AREA 1 FIELD SAMPLING PLAN
ADDENDUM TO REMEDIAL INVESTIGATION WORK PLAN
FOR PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS)

FORMER FORT DEVENS ARMY INSTALLATION, DEVENS, MA

SEPTEMBER 2018

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New England District
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Area 1 Field Sampling Plan
Addendum to the Remedial Investigation Work Plan
for Per- and Polyfluoroalkyl Substances (PFAS)
Former Fort Devens Army Installation
Devens, Massachusetts

September 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:

9/18/18

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
DPT	direct push technology
FSP	Field Sampling Plan
ft	feet/foot
IDW	investigation derived waste
J	estimated value
KGS	KOMAN Government Solutions
LHA	lifetime health advisory
LTM	long-term monitoring
MassDEP	Massachusetts Department of Environmental Protection
ng/L	nanograms per liter
PA	Preliminary Assessment
PFAS	per-and polyfluoroalkyl substances
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
RI	Remedial Investigation
SI	Site Inspection
SOP	standard operating procedure
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
µg/KG	micrograms per kilogram

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1.0 INTRODUCTION AND BACKGROUND

This Field Sampling Plan (FSP) for Area 1 at Former Fort Devens Army Installation (Devens) located in Devens, Massachusetts has been prepared by KOMAN Government Solutions (KGS) on behalf of the United States Army Corps of Engineers, New England District (USACE) and has been generated as an addendum to the *Remedial Investigation Work Plan for Per- and Polyfluoroalkyl Substances (PFAS)* (KGS, 2018a). Area 1 consists of Areas of Contamination (AOC) 57, 74, and 75 at Devens as well as the Town of Ayer Grove Pond municipal well field investigation area (Figure 1). The other AOCs and areas of investigation for the RI will be addressed as part of Area 2 and Area 3 FSPs. The three areas 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) were subsequently completed and concluded that PFAS are present in groundwater, soil, and surface water at several AOCs in Area 1. In addition, PFAS have been detected in public water supply wells associated with the Town of Ayer Grove Pond municipal well field, which is located adjacent to Devens (Figure 1). Therefore, the Army is conducting a Remedial Investigation (RI) under CERCLA to determine the nature and extent of PFAS in groundwater, soil, surface water, and sediment at AOCs 57, 74, or 75 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 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 1 and is intended to be used 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. All of the PFAS UFP-QAPP worksheets referenced in this FSP are provided in Appendix A of this FSP. 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) of the UFP-QAPP. Communication pathways are provided in Worksheet #6 (Communication Pathways) of the UFP-QAPP (Appendix A).

4.0 GENERAL REMEDIAL INVESTIGATION APPROACH

This section provides a general overview of the RI approach at Area 1. A detailed description of sampling activities for 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 1 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 1 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 initial 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 1 (Appendix A).

Groundwater vertical profile sampling ("profiling") involving direct push technology (DPT) and/or possibly sonic drilling technology, both utilizing proven groundwater sample tooling, will be conducted. These technologies provide for continuous soil logging and sampling, as needed during borehole advancement. The vertical profiling will be conducted in conjunction with sampling of existing monitoring wells to delineate PFAS contamination vertically and laterally in the aquifer. Surface and subsurface soil samples will be collected from the unsaturated zone to delineate the extent of PFAS contamination in soil at AOCs 57, 74, and 75.

To investigate PFAS contamination at the Grove Pond wellfield, an initial set of groundwater vertical profiling will be completed to delineate the vertical and lateral extent of PFAS in the aquifer near the Town of Ayer municipal water supply wells. Additional groundwater vertical profiling locations are anticipated to be advanced at Devens at locations to the south and upgradient of the PFAS contamination identified at the Grove Pond Wellfield in an effort to trace PFAS groundwater contamination back to a known or unknown source area on Devens. If the results of groundwater vertical profiling at Grove Pond Area identify a potential source area for PFAS groundwater contamination at Devens, soil borings will be advanced to evaluate soils. If the results of groundwater vertical profiling identify a potential source area for PFAS groundwater contamination not associated with Devens, no further investigation of the potential source area will be conducted.

The results from groundwater vertical profiling, soil sampling, and sampling of existing monitoring wells at Area 1, will be evaluated in coordination with USEPA and MassDEP to determine if the vertical and lateral extent of PFAS in groundwater and soil have been adequately delineated. If significant data gaps in the extent of PFAS in groundwater and/or soil are identified, then additional groundwater vertical profiling and/or soil sampling 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.

In addition, up to 26 permanent glacial overburden monitoring wells are planned to be installed in Area 1. The location and screen settings of the permanent monitoring wells will be determined based on a review of the PFAS data obtained from groundwater vertical profiling, soil sampling, and existing monitoring wells. The PFAS groundwater monitoring network will be designed to monitor PFAS concentrations within and bounding potential plumes identified through the groundwater vertical profiling effort.

During advancement of borings for permanent monitoring well installations, continuous soil cores 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 and sampling for PFAS analysis, samples will be collected for grain-size analysis and TOC. These borings and well installations will be conducted using DPT and/or possibly sonic drilling technology. These technologies provide for continuous soil logging and sampling, as needed during borehole advancement.

Up to four bedrock wells are tentatively planned at key locations, including one at AOC 57 Area 2, one at AOC 74 and two upgradient of the Grove Pond wellfield, to evaluate shallow bedrock physical properties (type and fracturing) and the presence of PFAS. The location of the wells will be determined based on a review of the PFAS data obtained from groundwater vertical profiling, soil sampling, and existing monitoring wells. The wells will be installed through drive and wash drilling. These wells will be cased in overburden and grouted into bedrock and 20 feet of coring advanced to establish an open well bore in rock. Rock cores will be described to evaluate fracturing and establish rock quality designations. Cores will be archived at Devens.

After new monitoring wells are installed, a synoptic water level measurement event will be conducted for Area 1 to evaluate groundwater flow within and between each AOC. In addition, one round of groundwater samples will be collected from the new monitoring wells and analyzed for PFAS. Samples from select wells in areas of high PFAS concentrations will also be sampled for dissolved organic carbon and TOP assay analysis to evaluate the fate and transport of PFAS and assess potential for total PFOS and PFOA mass in each sample through evaluation of the presence of PFOS and PFOA along with other PFAS compounds that biotransform into fully fluorinated PFAS compounds including PFOS and PFOA.

Initial review of PFAS concentrations in unsaturated soil, may result in additional analyses involving total organic carbon (TOC) and total oxidizable precursor (TOP) assay to evaluate the fate and transport of PFAS and assess potential for total PFOS and PFOA mass in each sample through evaluation of the presence of PFOS and PFOA along with other PFAS compounds that biotransform into fully fluorinated PFAS compounds including PFOS and PFOA. These data will be used to assess the potential for continuing sources.

Surface water and sediment will also be sampled at the Area 1 AOCs to assess whether PFAS are present in surface water and sediment at Cold Spring Brook and Grove Pond. The results of the sampling will be reviewed and additional samples may be collected to further characterize PFAS concentrations in Cold Spring Brook or Grove Pond.

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

5.0 FIELD ACTIVITIES BY AREAS OF INTEREST/ AREAS OF CONCERN

5.1 AOCs 57, 74, and 75

5.1.1 Introduction/ Conceptual Site Model Discussion

AOC 57 Area 1, 2, and 3

AOC 57 was not identified during the PA (KGS, 2017) as an area of known AFFF use or releases and was not sampled for PFAS during the SI (BERS-Weston, 2018). However, select monitoring wells at this AOC were sampled in early 2018 at the request of the USEPA in order to help delineate PFAS concentrations across Devens. Four LTM groundwater monitoring wells that were sampled for PFAS at AOC 57 had sum of perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS) concentrations that exceeded the lifetime health advisory (LHA) for drinking water of 70 nanograms per liter (ng/L) for the combined concentrations of PFOS and PFOA (KGS, 2018b) (Figures 3 and 4). No soil sampling for PFAS analysis has been conducted at AOC 57. Based on LTM activities at AOC 57, groundwater flow at AOC 57 Areas 2 and 3 is to the east/southeast, toward Cold Spring Brook (Figures 3 and 4). The general groundwater flow at AOC 57 Area 1 (Figure 2) is also toward Cold Spring Brook, based on the general understanding of regional hydrogeology.

No information is available regarding potential sources of PFAS in groundwater AOC 57. It is assumed, based on site history, that the presence of PFAS at AOC 57 is related to historic activities at this site and were released to the environment through similar methods of conveyance (storm drains and/or overland flow from paved areas) as the historic petroleum releases at AOC 57. AOC 57 Area 1 pertains to a storm water drain that collected rainfall from the paved areas around former Building 3713. A fuel spill that occurred from an overfilled underground storage tank at former Building 3713 flowed into a nearby storm drain and exited the storm drain at Area 1. AOC 57 Area 2 is located 800 feet northeast of Area l, and is adjacent to a vehicle storage yard associated with the former motor repair shops located in former Buildings 3757 and 3758. This area formerly consisted of an eroded drainage ditch created by periodic rain runoff. AOC 57 Area 3 is located approximately 600 feet to the northeast of Area 2, south of former vehicle maintenance motor pools. The site is characterized by a historic garage and vehicle waste disposal area (HLA, 2000). AOC 57 Area 3 was identified where historical photographs indicated soil staining (Harding, 2001).

The groundwater sampling locations at AOC 57 Areas 2 and 3 were chosen to evaluate the vertical and lateral extent of PFAS in groundwater within, upgradient, downgradient, and cross gradient of areas of PFAS groundwater contamination detected at LTM wells and to determine whether there is potential for discharge of PFAS contaminated groundwater to Cold Spring Brook.

Groundwater at AOC 57 Area 1 has not been sampled for PFAS. Therefore, the groundwater sampling locations at Area 1 were chosen to determine the presence or absence of PFAS in this area. Soil sampling locations at AOC 57 Areas 1, 2, and 3 were selected to characterize soils within and immediately upgradient of known areas of groundwater contamination and in the vicinity of historic petroleum soil contamination. Area 2 has been tentatively identified for location of a bedrock well. The usefulness of a bedrock well and the potential placement of the well will be reviewed and finalized with USEPA and MassDEP input upon collective review of soil and groundwater data collected during initial RI field work.

PFAS was detected in Cold Spring Brook at AOC 57 Area 3 during the LTM sampling (KGS, 2018b) (Figure 4). Therefore, surface water and sediment samples will be collected where AOC 57 Areas 1, 2, and 3 are presumed to discharge to Cold Spring Brook. Results from this brook sampling and other upgradient work will be evaluated to determine if further sampling beneath the brook or on the opposite bank are necessary. Scope for this additional work, should it be needed would be developed with USEPA and MassDEP input.

AOC 74

Reportedly, firefighting equipment was stored at this location during the closure of the former Moore Army Airfield and past firefighting training exercises with firefighting foam were conducted behind former Building 3773 (KGS, 2017). Shallow soil [0-5 feet (ft) below ground surface(bgs)] and water table groundwater samples were collected at locations behind former Building 3773 during the SI (BERS-Weston, 2018). Relatively low concentrations of PFOS [non-detect to 0.36 estimated value (J) micrograms per kilogram (µg/kg)] and PFOA (0.21 µg/kg to 0.77 µg/kg) were detected in the shallow soil sampled behind former Building 3773. PFOS and PFOA were also detected in groundwater at concentrations that exceed the LHA of 70 ng/L (Figure 5). A maximum sum of PFOS and PFOA concentration of 490 ng/L was detected in shallow groundwater at AOC 74 (BERS-Weston, 2018).

Cold Spring Brook is located adjacent to AOC 74. Knowledge of the regional groundwater flow field indicates that there is the potential for a divergent flow field in this area. Groundwater that originates behind the former Building 3773 where the AFFF was reportedly used during firefighting training, likely migrates to the southeast toward Cold Spring Brook. But groundwater northwest of the former Building 3773 is likely flowing northeast, toward Grove Pond (Figures 1 and 5).

The groundwater and soil sampling locations for AOC 74 were selected to further evaluate the nature and extent of PFAS in soil and groundwater behind former Building 3773 and determine whether there is potential for discharge of PFAS contaminated groundwater to Cold Spring Brook. Groundwater sampling will also be conducted at locations to the northeast of former Building 3773 to evaluate whether PFAS contaminated groundwater that originates at AOC 74 may also be migrating to the north, toward the Grove Pond municipal well field. AOC 74 has been tentatively identified for location of a bedrock well. The usefulness of a bedrock well and the potential placement of the well will be finalized with USEPA and MassDEP input upon collective review of soil and groundwater data collected during initial RI field work.

Due to the proximity of AOC 74 to Cold Spring Brook there is potential that PFAS contaminated groundwater may be discharging to this surface water body system. Surface water and sediment samples were not collected from Cold Spring Brook during the SI. Surface water and sediment samples will be collected where AOC 74 is presumed to discharge to Cold Spring Brook. Results from this brook sampling and other upgradient work will be evaluated to determine if further sampling beneath the brook or on the opposite bank are necessary. Scope for this additional work, should it be needed, would be developed with USEPA and MassDEP input.

AOC 75

The reported use of AFFF in response to a large warehouse fire at Building T-1445 in late 1980/early 1990s may have resulted in the discharge of AFFF directly to the ground surface at AOC 75 (KGS, 2017). The detections of PFOS and PFOA in groundwater at AOC 75 were below the LHA during sampling completed at four temporary water table wells for the SI (BERS-Weston, 2018) (Figure 6). PFOS and PFOA were detected in shallow soils at AOC 75 at concentrations ranging from 0.17 µg/kg to 1.2 µg/kg for PFOA and non-detect to 0.25 µg/kg for PFOS.

Soil sampling locations at AOC 75 were chosen to evaluate the surface and subsurface soils in the immediate vicinity of former building T-1445 and in the drainage ditch to the east of the former Building T-1445. Groundwater sampling locations were chosen to evaluate the vertical and lateral extent of PFAS in groundwater within, upgradient, downgradient and cross gradient of areas of known PFAS detections in groundwater at this AOC and of the presumed source. Based on knowledge of the regional flow field, groundwater flow at AOC 75 is likely to the east; however, groundwater sampling will also be completed to the north/northeast to account for a northerly component of groundwater flow toward the Grove Pond municipal well field.

No surface water or sediment sampling is planned for AOC 75, due to the relative distance of the AOC from known surface water body systems.

Details regarding the sampling plan for AOCs 57, 74, and 75 are provided below.

5.1.2 AOC 57, 74, and 75 Sampling Plan

Groundwater Vertical Profiling

Eighteen groundwater vertical profile borings are planned at AOC 57 (Figures 2 through 4), 11 groundwater vertical profile borings are planned at AOC 74 (Figure 5), and nine groundwater vertical profile borings are planned for AOC 75 (Figure 6). The proposed groundwater vertical profile locations are generally located within, downgradient, upgradient, and cross gradient to areas of known PFAS groundwater contamination. The groundwater vertical profile borings will be conducted using DPT. Groundwater samples will be collected at 10-ft intervals from the water table to rig refusal or the bedrock surface. The depth to bedrock will be estimated based on the results of previous investigations at Devens. If refusal is encountered significantly shallower than anticipated one 10-ft step out will be conducted. The samples will be analyzed for PFAS by isotope dilution (analyte list in QAPP Worksheet #15) (Appendix A). The rationale for each groundwater vertical profile is provided in Table 1 and the sampling nomenclature, anticipated depths, and analytical scope are summarized in Table 2. Additional groundwater vertical profiles may be conducted after review of the groundwater and soil data to further define the nature and extent of PFAS contamination in groundwater.

Existing Monitoring Well Sampling

Existing monitoring wells at AOC 57 will be sampled to provide additional PFAS data to augment the groundwater vertical profiling results. The samples will be analyzed for PFAS by isotope dilution (analyte list in QAPP Worksheet #15) (Appendix A). The existing monitoring wells to be sampled at AOC 57 along with the sampling nomenclature and analytical scope are provided in Table 3 and well construction information is provided in Table 4. There are no existing monitoring wells at AOCs 74 and 75.

Irrigation Well Sampling

An irrigation well is located at AOC 74 and will be sampled for PFAS analysis, if possible. Well construction information for this irrigation well is included Table 4. The sample will be analyzed for PFAS by isotope dilution (analyte list in QAPP Worksheet #15) (Appendix A). Sampling nomenclature and analytical scope for this irrigation well is provided in Table 3.

Soil Borings

Twelve soil borings will be advanced at AOC 57 (Figures 2 through 4), seven soil borings will be advanced at AOC 74 (Figure 5), and seven soil borings will be advanced at AOC 75 (Figure 6). Soil borings will be advanced to determine the vertical and lateral extent of PFAS contamination in unsaturated soil at each AOC. Limited information regarding the exact location of AFFF releases at each AOC is available. Therefore, soil borings are located within, immediately downgradient, and upgradient of highest groundwater PFAS concentrations reported in the SI. These locations may be adjusted based on the groundwater vertical profile results from samples collected during the RI. The soil borings will be conducted using DPT. Where possible, a soil boring is collocated with a groundwater vertical profile boring. However, because the extent of PFAS contaminated soil is anticipated to be smaller than the extent of groundwater contamination, not all groundwater vertical profile borings will have a collocated soil sample.

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) (Appendix A).

- 0-0.5 ft bgs
- 0.5 – 3 ft bgs
- 3-7 ft bgs
- 7-15 ft bgs
- Within 2 ft of the water table

The PFAS results from the 0-0.5 ft and 0.5–3 ft samples will be used to support a qualitative ecological risk evaluation, the PFAS results from the 0-15 ft intervals will be used to provide data to evaluate risks to human health through residential exposure to accessible soils (0-3 ft) and construction worker exposure scenario to potentially accessible soils (3-15 ft). Soil samples will also be collected within 2 ft of the water table to provide additional data for evaluating a potential leaching threat to groundwater. 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. The final depth of soil sampling intervals will end at the water table at borings where the water table is less than 15 ft. The sampling nomenclature, anticipated depths, and analytical scope for each soil boring planned at AOCs 57, 74, and 75 are provided in Table 5.
Additional soil borings may be conducted 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 conducted after review of the soil data in area of high PFAS concentrations in soil to assist in assessment of potential continuing source of PFAS to groundwater. These soil samples will be analyzed for TOC and TOP assay. The location of the soil borings and target depth of sample collection will be determined after review of the soil data.

Installation of New Monitoring Wells

Installation of up to 20 new overburden and two bedrock monitoring wells are planned at AOCs 57, 74, and 75. The rationale for installing new monitoring wells at each AOC is provided in Table 6. The number of wells, locations, and screen settings of the new groundwater monitoring wells, and the need for soil coring and confirmation of bedrock will be based on a review of the PFAS data obtained from groundwater vertical profiling, soil sampling, and existing monitoring wells. Final locations and depths will be reviewed with USEPA and MassDEP. The monitoring well network will be designed to monitor PFAS contamination in groundwater at AOCs 57, 74, and 75 as well as provide bounding locations to demonstrate the limits of PFAS contamination in groundwater. Monitoring well couplets will be installed adjacent to Cold Spring Brook at AOCs 74 and 57 (Areas 2 and 3) to evaluate the potential for vertical gradients on the northwestern side of Cold Spring Brook. Continuous logging of overburden soils will be conducted at select monitoring well locations. Field lithologic classification will be performed and select samples may be collected for grain size analysis and total organic carbon (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. If bedrock wells are agreed upon, the wells will be cased in overburden and grouted into bedrock and 20 feet of coring advanced to establish an open well bore in rock. Rock cores will be described to evaluate fracturing and establish rock quality designations. The bedrock wells would be installed through drive and wash drilling.

New Monitoring Well Sampling

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

5.2 Grove Pond Municipal Well Field

5.2.1 Introduction/Conceptual Site Model Discussion

At the Town of Ayer Grove Pond municipal well field, PFAS have been detected in the influent to municipal wells # 6, 7, and 8. The sum of PFOS and PFOA at Ayer municipal well #8 has been detected at concentrations greater than the LHA.

PFOS and PFOA have also been detected in groundwater at concentrations greater than the LHA at Devens at AOCs 74 and 75, which are located potentially upgradient of the Grove Pond municipal well field. Additional investigation is needed to determine if the PFAS at the Grove Pond municipal well field is originating from sources associated with Devens and if there are other sources contributing to PFAS at the wellfield. Upgradient of the Grove Pond wellfield is an area that has been tentatively identified for location of two bedrock wells. The usefulness of a bedrock wells and the potential placement of the wells will be finalized with USEPA and MassDEP input upon collective review of soil and groundwater data collected during initial RI field work.

5.2.2 Grove Pond Investigation Area Sampling Plan

Groundwater Vertical Profiling

An initial transect of 12 groundwater vertical profile borings will be completed to delineate the vertical and lateral extent of PFAS in the aquifer near the Town of Ayer municipal water supply wells (Figure 7). The groundwater vertical profiles will be conducted using DPT. Groundwater samples will be collected at 10-ft intervals from the water table to drilling refusal or bedrock. The samples will be analyzed for PFAS by isotope dilution (analyte list in QAPP Worksheet #15) (Appendix A). The rationale for each groundwater vertical profile is provided in Table 1 and the sampling nomenclature, anticipated depths, and analytical scope are summarized in Table 2.

Additional groundwater vertical profiling locations are anticipated to be advanced at Devens along subsequent transects located to the south and upgradient of the PFAS contamination identified at the Grove Pond municipal wellfield in an effort to trace PFAS groundwater contamination back to a known or unknown source at Devens (Figure 7). The final location of additional groundwater vertical profile borings will be based on a review of the groundwater vertical profile results obtained from the initial transect of vertical profiles, but for planning purposes are anticipated to be in the vicinity of the subsequent transects shown Figure 7.

Existing Monitoring Well Sampling

Existing monitoring wells in the vicinity of the Grove Pond municipal well field will be sampled to provide additional PFAS data to augment the groundwater vertical profiling results. Samples from the wells will be analyzed for PFAS by isotope dilution (analyte list in QAPP Worksheet #15) (Appendix A). A listing of existing monitoring wells to be sampled at Grove Pond along with the sampling nomenclature and analytical scope are summarized in Table 3 and well construction information is provided in Table 4.

Soil Sampling

The presence of PFAS in groundwater at the Grove Pond municipal well field vertical profiling locations is assumed to be distal from the PFAS sources. Therefore, PFAS near the Grove Pond wellfield likely exists only as dissolved phase in this area of the aquifer. Therefore, collection of soil samples at these locations is not planned at the initial set of 12 groundwater vertical profiles. However, if a potential soil source area, other than a known AOC, is identified during the groundwater vertical profiling effort (higher PFAS concentrations at the water table), up to nine soil borings may be advanced within the potential source area (Table 5). The soil borings will be conducted using DPT and the samples would be analyzed for PFAS by isotope dilution (analyte list in QAPP Worksheet #15) (Appendix A).

Additional soil borings may be conducted after review of the groundwater and soil data to further define the nature and extent of PFAS contamination in the soil. Additional soil borings may also be conducted after review of the soil data in area of high PFAS concentrations in soil to assist in assessment of potential continuing source of PFAS to groundwater. These soil samples will be analyzed for TOC and TOP assay. The location of the soil borings and the target depth of sample collection will be determined after review of the soil data.

Installation of New Monitoring Wells

Installation of up to eight new overburden monitoring wells and two bedrock monitoring wells, either installed as couplets or single wells, are planned at the Grove Pond investigation area. The rationale for installing new monitoring wells at Grove Pond is provided in Table 6. The locations and screen settings of the new groundwater monitoring wells will be based on a review of the PFAS data obtained from groundwater vertical profiling, soil sampling, and existing monitoring wells. Final locations and depths will be reviewed with USEPA and MassDEP. The monitoring well network will be designed to monitor PFAS contamination in groundwater at the Grove Pond investigation area as well as provide bounding locations (spatially and vertically) to demonstrate the limits of PFAS contamination in groundwater.

Continuous logging of overburden soils will be conducted at select monitoring well locations. Field lithologic classification will be performed and select samples may be collected for grain size analysis and total organic carbon for locations where additional data on hydrogeology and fate and transport of PFAS is needed (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. If bedrock wells are agreed upon, the wells will be cased in overburden and grouted into bedrock and 20 feet of coring advanced to establish an open well bore in rock. Rock cores will be described to evaluate fracturing and establish rock quality designations. The bedrock wells would be installed through drive and wash drilling.

New Monitoring Well Sampling

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

5.3 Surface Water and Sediment Sampling Plan

5.3.1 Introduction

Surface water and sediment samples were not collected from Cold Spring Brook or Grove Pond during the SI (BERS-Weston, 2018). One surface water sample was collected from Cold Spring Brook at AOC 57 Area 3 as part of the LTM sampling (KGS, 2018b) (Figure 8). Cold Spring Brook is located adjacent to AOCs 57 and 74, and Grove Pond receives surface water from Cold Spring Brook (BERS-Weston, 2018). Grove Pond has received the effluent from Ayer municipal well #8 since 26 February 2018 when the well was taken off-line by the Town of Ayer, which has a sum of PFOS and PFOA concentrations that exceeds the LHA of 70 ng/L (Section 1.2.13 of the RI Work Plan).

PFAS have been detected in shallow groundwater at AOCs 57 and 74, which may potentially discharge to Cold Spring Brook, which then discharges to Grove Pond. In addition, there is potential for PFAS impacted surface soils at AOC 74 to have been carried to Cold Spring Brook via overland flow during storm events. Given the potential for PFAS to have impacted sediments and surface water of Cold Spring Brook and Grove Pond, sampling of sediment and surface water at Cold Spring Brook and Grove Pond is needed to determine if PFAS are present in these wetland systems.

5.3.2 Surface Water and Sediment Sampling Plan

Surface water and shallow sediment samples, involving cores (0 to 6 inches), will be collected from eight locations along a transect of Cold Spring Brook that is adjacent to AOCs 57 and 74 at Devens (Figure 8), from five locations at Grove Pond, and one location at the outlet to Balch Pond, which flows to Grove Pond (Figure 8). The locations were selected to assess if PFAS are present in surface water and sediment at Cold Spring Brook and Grove Pond.

The location at Balch Pond will be sampled to determine if PFAS are present in surface water entering Grove Pond from the north. The tentative sampling locations along Cold Spring Brook are shown on Figures 3 through 5 and will be at locations near the western shoreline. The final locations may be adjusted to where there is potential for the greatest impact from overland flow or based on the groundwater vertical profiling results conducted during the RI. If a potential for human health and/or ecological risks are identified, additional surface water and sediment sampling may be needed to identify which AOC is contributing the greatest risk.

The surface water samples will be analyzed for PFAS by isotope dilution (analyte list in QAPP Worksheet #15) (Appendix A). The sediment samples will be analyzed for PFAS by isotope dilution (analyte list in QAPP Worksheet #15) (Appendix A), TOC, and grain size. The sampling nomenclature for each surface water and sediment location and the quality controls samples are provided in Table 9.

6.0 FIELD QUALITY CONTROL SAMPLES

Collection of field QC 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 of the UFP-QAPP and SOP-F014 (Direct Push Technology).
- 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 and provided in Attachment A 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

BERS-Weston Services, JVA, LLC (BERS-Weston), 2018. *Final Site Inspection Report for Per- and Polyfluoroalkyl Substances (PFAS) at Former Fort Devens Army Installation, Devens, Massachusetts*. Prepared by BERS-Weston Services, JVA, LLC. For U.S. Army Corps of Engineers, New England District, Concord, Massachusetts. May.

Harding Environmental, Science & Engineering (Harding), 2001. *Record of Decision, Area of Contamination 57, Devens Reserve Forces Training Area, Devens, Massachusetts*. September.

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KGS (KOMAN Government Solutions, LLC), 2017. *Final Base-wide Preliminary Assessment for Evaluation of Perfluoroalkyl Substances, Former Fort Devens Army Installation*. May.

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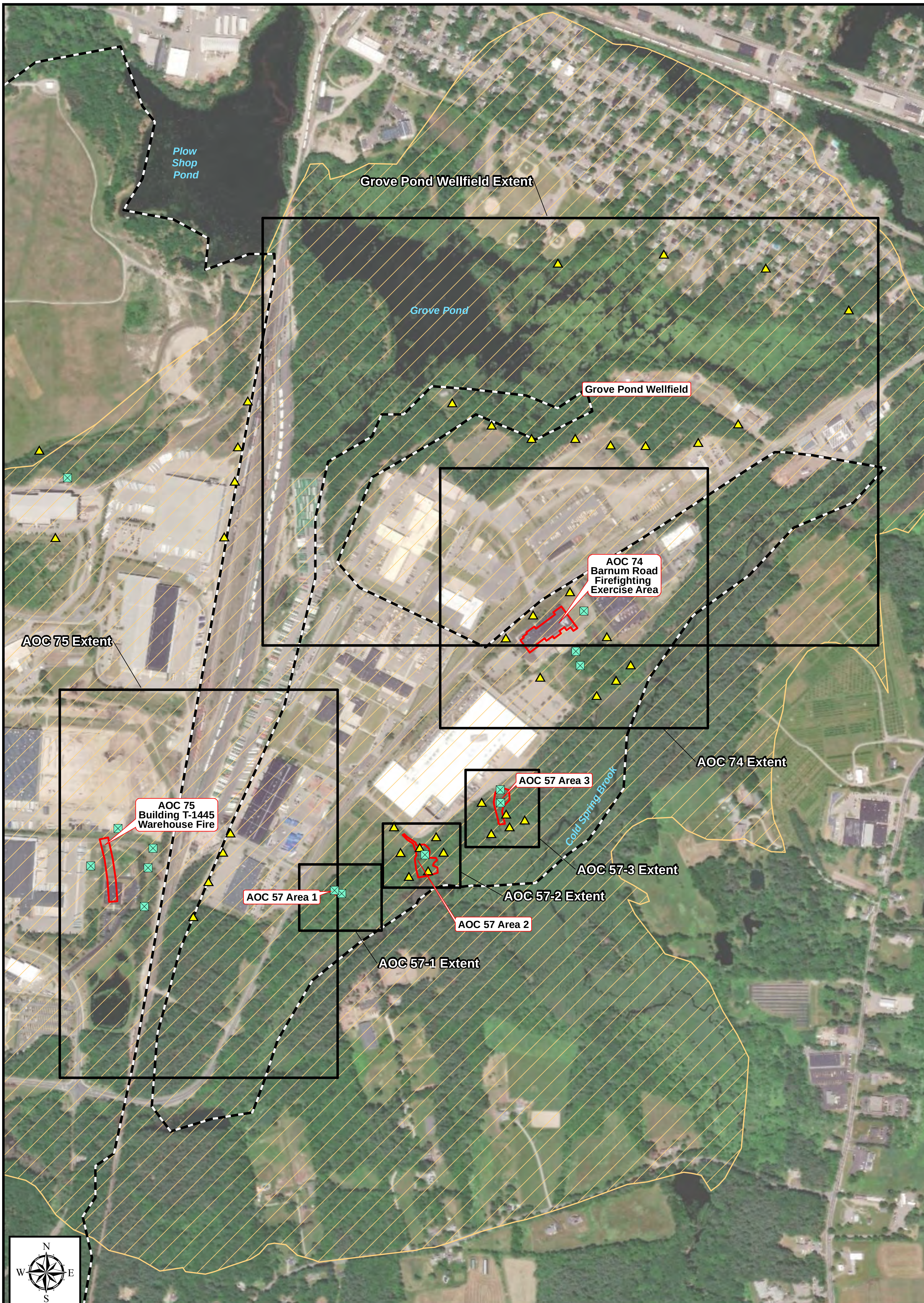
KGS, 2018b. *Memorandum: Additional PFAS Sampling to Support the Development of the Remedial Investigation Work Plan, Former Fort Devens Army Installation, Devens, Massachusetts*. April.

Harding Lawson Associates (HLA), 2000. *Final Remedial Investigation Report Area of Contamination (AOC) 57*. June.

FIGURES



Legend

- Proposed Soil Boring and Vertical Profiling Location
- Proposed Vertical Profiling Location
- MassDEP Zone II Wellhead Protection Area
- Area of Contamination (AOC)
- Former Fort Devens Boundary

Area 1 Figure Extents
Devens PFAS RI WP - Area 1 FSP Addendum

Former Fort Devens Army Installation
Devens, Massachusetts

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

0 325 650
Feet

Date: 06/28/2018

Figure 1

File: PFAS2018_A1FSP_F1_Extents_VPL.mxd

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

Legend

- Tentative Monitoring Well
- Proposed Soil Boring and Vertical Profiling Location
- Appoximate Groundwater Flow Direction
- Approximate Extent of Excavation (1994)
- Topographic Contour (feet above sea level)
- Stream
- Area of Contamination (AOC)
- Former Fort Devens Boundary

Note:

AOC 57 Area 1 lies within the MassDEP Zone II wellhead protection area.

Topographic Contour Source: MassGIS, Elevation Contours (1:5,000) - North American Vertical Datum of 1988.

Aerial Sources: 2013, USGS, MassGIS

AOC 57 Area 1 Vertical Profiling and Soil Boring Locations
Devens PFAS RI WP - Area 1 FSP Addendum

Former Fort Devens Army Installation
Devens, Massachusetts

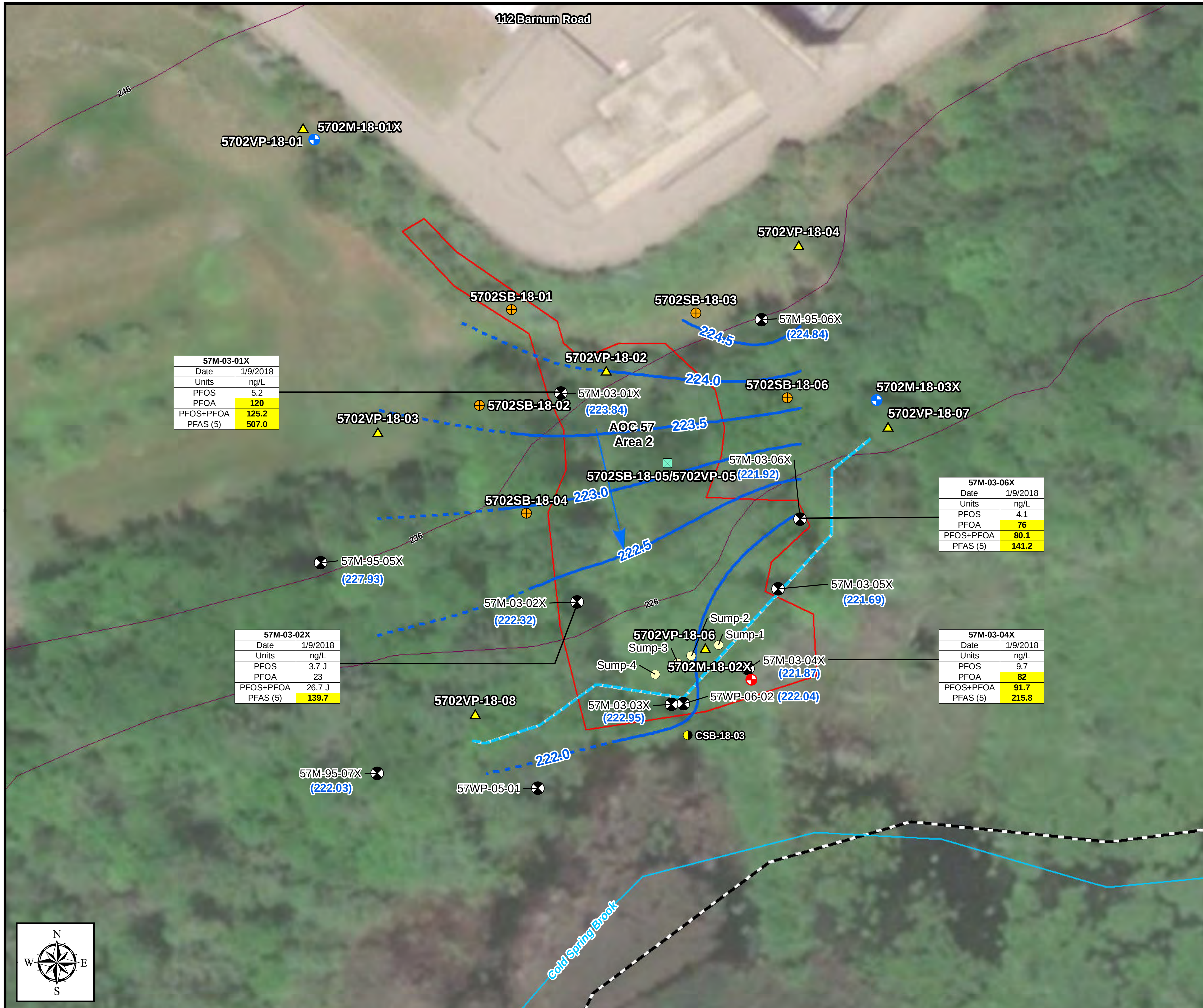
KOMAN Government Solutions, LLC
293 Boston Post Road West, Suite 100, Marlborough, MA 01752

0 30 60
Feet

Date: 06/28/2018

Figure 2

File: PFAS2018_A1FSP_F2_AOC57-1_VPL_SB.mxd



57M-03-01X	
Date	1/9/2018
Units	ng/L
PFOS	5.2
PFOA	**120**
PFOS+PFOA	**125.2**
PFAS (5)	**507.0**

57M-03-06X	
Date	1/9/2018
Units	ng/L
PFOS	4.1
PFOA	**76**
PFOS+PFOA	**80.1**
PFAS (5)	**141.2**

57M-03-02X	
Date	1/9/2018
Units	ng/L
PFOS	3.7 J
PFOA	23
PFOS+PFOA	26.7 J
PFAS (5)	**139.7**

57M-03-04X	
Date	1/9/2018
Units	ng/L
PFOS	9.7
PFOA	**82**
PFOS+PFOA	**91.7**
PFAS (5)	**215.8**

Legend

- Tentative Monitoring Well
- Tentative Bedrock Well
- Proposed Soil Boring and Vertical Profiling Location
- Proposed Vertical Profiling Location
- Proposed Soil Boring Location
- Proposed Surface Water and Sediment Sampling Location
- Monitoring Well
- Sump
- (222.03) Groundwater Elevation (ft NGVD) (June 2017)
- Groundwater Elevation Contour (ft NGVD) (Contour Interval = 0.5 ft) (June 2017)
- Inferred Groundwater Elevation Contour
- Groundwater Flow Direction
- 57M-03-06X Well/Piezometer/Sump/Sample Location Identification
- Flagged Wetland Limits
- Stream
- Topographic Contour (feet above sea level)
- Area of Contamination (AOC)
- Former Fort Devens Boundary

Notes:
Site is within a MassDEP Approved Wellhead Protection Area (Zone II)
ft AMSL = Feet Above Mean Sea Level
57M-95-05X and 57M-03-03X were not used in generating groundwater contours
NGVD = National Geodetic Vertical Datum (1929)
LTM = Long-Term Monitoring

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

Topographic Contour Source: MassGIS, Elevation Contours (1:5,000) - North American Vertical Datum of 1988.

Aerial Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

AOC 57 Area 2 Vertical Profiling and Soil Boring Locations
Devens PFAS RI WP - Area 1 FSP Addendum

Former Fort Devens Army Installation
Devens, Massachusetts

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

0 30 60
Feet

Date: 09/18/2018

Figure 3

File: PFAS2018_A1FSP_F3_AOC57-2_VPL_SB.mxd

57M-95-03X	
Date	1/10/2018
Units	ng/L
PFOS	20 U
PFOA	**82**
PFOS+PFOA	**82**
PFAS (5)	**153.7**

57M-96-11X	
Date	1/10/2018
Units	ng/L
PFOS	2.0 U
PFOA	5.2
PFOS+PFOA	5.2
PFAS (5)	44.5

Area 3 SW-1	
Date	1/10/2018
Units	ng/L
PFOS	0.59 J
PFOA	24
PFOS+PFOA	24.6 J

Legend

- Proposed Surface Water and Sediment Sampling Location
- Tentative Monitoring Well
- Proposed Soil Boring and Vertical Profiling Location
- Proposed Vertical Profiling Location
- Proposed Soil Boring Location
- Monitoring Well
- Well Point
- LTM Piezometer
- Surface Water Sample Location
- Monitoring Well - Abandoned (2012)
- Monitoring Well - Destroyed
- (220.10) Groundwater Elevation (ft NGVD) (June 2017)
- Groundwater Elevation Contour (ft NGVD) (Contour Interval = 0.5 ft) (June 2017)
- Inferred Groundwater Elevation Contour
- Groundwater Flow Direction
- 57M-95-03X Well/Piezometer/Sample Location Identification
- Stream
- Topographic Contour (feet above sea level)
- Area of Contamination (AOC)/ 1999 Excavation Area
- Alternate III-2a Estimated Soil Excavation Area (approximate location)

Notes:
Site is within a MassDEP Approved Wellhead Protection Area (Zone II)
Well 57M-96-09X buried by construction.
ft AMSL = Feet Above Mean Sea Level
NGVD = National Geodetic Vertical Datum (1929)
LTM = Long-Term Monitoring

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

Topographic Contour Source: MassGIS, Elevation Contours (1:5,000) - North American Vertical Datum of 1988.

Aerial Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, SGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

AOC 57 Area 3 Vertical Profiling and Soil Boring Locations
Devens PFAS RI WP - Area 1 FSP AddendUM

Former Fort Devens Army Installation
Devens, Massachusetts

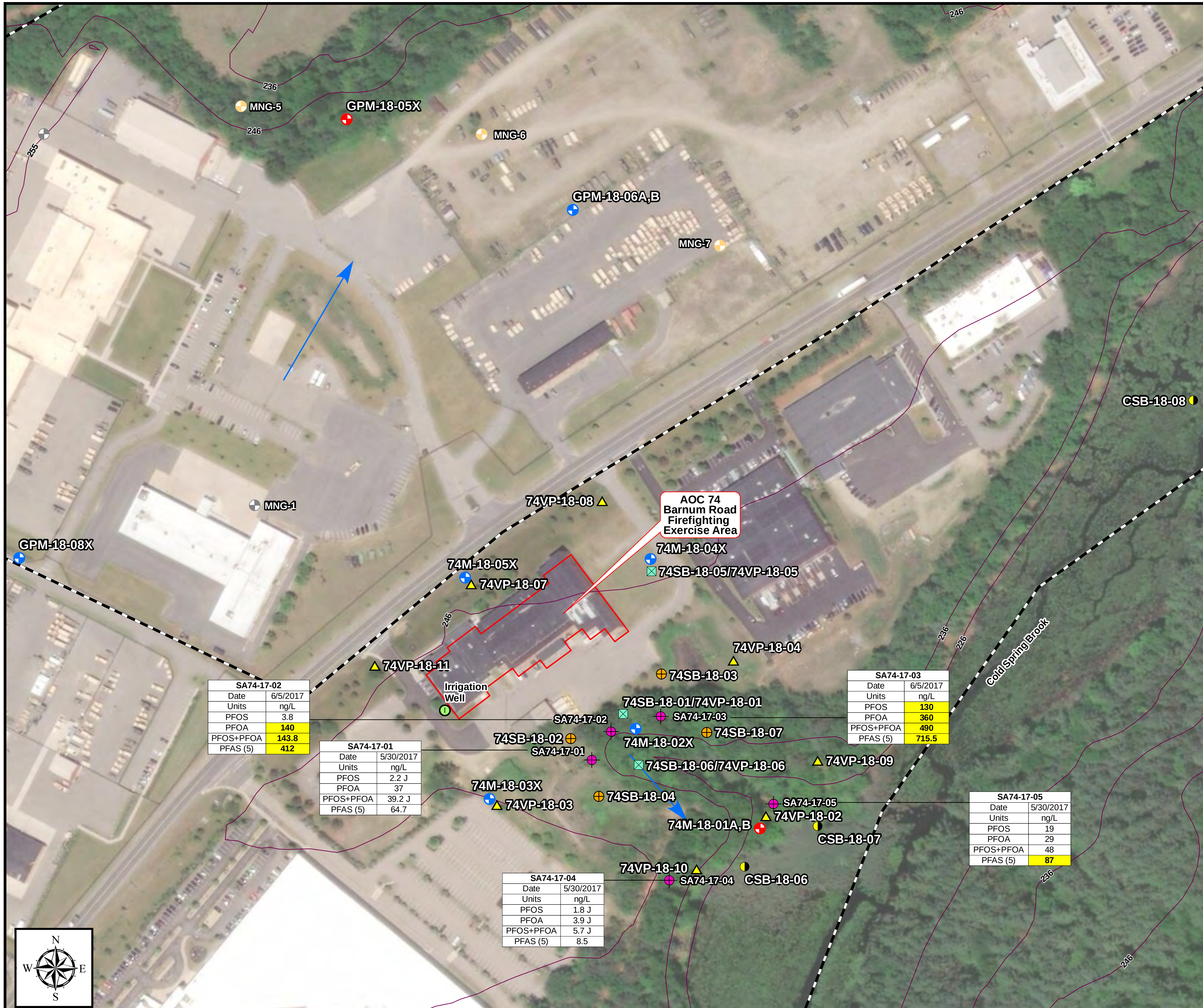
KOMAN Government Solutions, LLC
293 Boston Post Road West, Suite 100, Marlborough, MA 01752

0 30 60
Feet

Date: 06/28/2018

Figure 4

File: PFAS2018_A1FSP_F4_AOC57-3_VPL_SB.mxd



SA74-17-02	
Date	6/5/2017
Units	ng/L
PFOS	3.8
PFOA	**140**
PFOS+PFOA	**143.8**
PFAS (5)	**412**

SA74-17-01	
Date	5/30/2017
Units	ng/L
PFOS	2.2 J
PFOA	37
PFOS+PFOA	39.2 J
PFAS (5)	64.7

SA74-17-04	
Date	5/30/2017
Units	ng/L
PFOS	1.8 J
PFOA	3.9 J
PFOS+PFOA	5.7 J
PFAS (5)	8.5

SA74-17-03	
Date	6/5/2017
Units	ng/L
PFOS	**130**
PFOA	**360**
PFOS+PFOA	**490**
PFAS (5)	**715.5**

SA74-17-05	
Date	5/30/2017
Units	ng/L
PFOS	19
PFOA	29
PFOS+PFOA	48
PFAS (5)	**87**

Legend

- Tentative Monitoring Well
- Tentative Bedrock Well
- Proposed Surface Water and Sediment Sampling Location
- Proposed Soil Boring and Vertical Profiling Location
- Proposed Vertical Profiling Location
- Proposed Soil Boring Location
- Monitoring Well (Damaged)
- Monitoring Well (Destroyed)
- Temporary Well Location from SI
- Irrigation Well (Approximate Location)
- Approximate Groundwater Flow Direction
- Topographic Contour (feet above sea level)
- Area of Contamination (AOC)
- Former Fort Devens Boundary

Notes:

AOC 74 lies within the MassDEP Zone II wellhead protection area

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

Topographic Contour Source: MassGIS, Elevation Contours (1:5,000) - North American Vertical Datum of 1988.

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

AOC 74 Vertical Profiling and Soil Boring Locations
Devens PFAS RI WP - Area 1 FSP Addendum

Former Fort Devens Army Installation
Devens, Massachusetts

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

0 100 200
Feet

Date: 06/28/2018

Figure 5

File: PFAS2018_A1FSP_F5_AOC74_VPL_SB.mxd

SA75-17-01	
Date	6/5/2017
Units	ng/L
PFOS	3.5 J
PFOA	2.3 J
PFOS+PFOA	5.8 J
PFAS (5)	10.2

SA75-17-02	
Date	6/5/2017
Units	ng/L
PFOS	49
PFOA	18
PFOS+PFOA	67
PFAS (5)	**89.8**

SA75-17-03	
Date	5/30/2017
Units	ng/L
PFOS	6.9
PFOA	22
PFOS+PFOA	28.9
PFAS (5)	**83.7**

SA75-17-04	
Date	5/30/2017
Units	ng/L
PFOS	2.8 U
PFOA	1.2 J
PFOS+PFOA	1.2 J
PFAS (5)	2.8

Notes:

AOC 75 lies within the MassDEP Zone II wellhead protection area

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

Topographic Contour Source: MassGIS, Elevation Contours (1:5,000) - North American Vertical Datum of 1988.

Legend

- Tentative Monitoring Well
- Proposed Soil Boring and Vertical Profiling Location
- Proposed Vertical Profiling Location
- Proposed Soil Boring Location
- Temporary Well Location from SI
- Estimated Groundwater Flow Direction
- Area of Contamination (AOC)
- Topographic Contour (feet above sea level)
- Former Fort Devens Boundary

AOC 75 Vertical Profiling and Soil Boring Locations
Devens PFAS RI WP - Area 1 FSP Addendum

Former Fort Devens Army Installation
Devens, Massachusetts

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

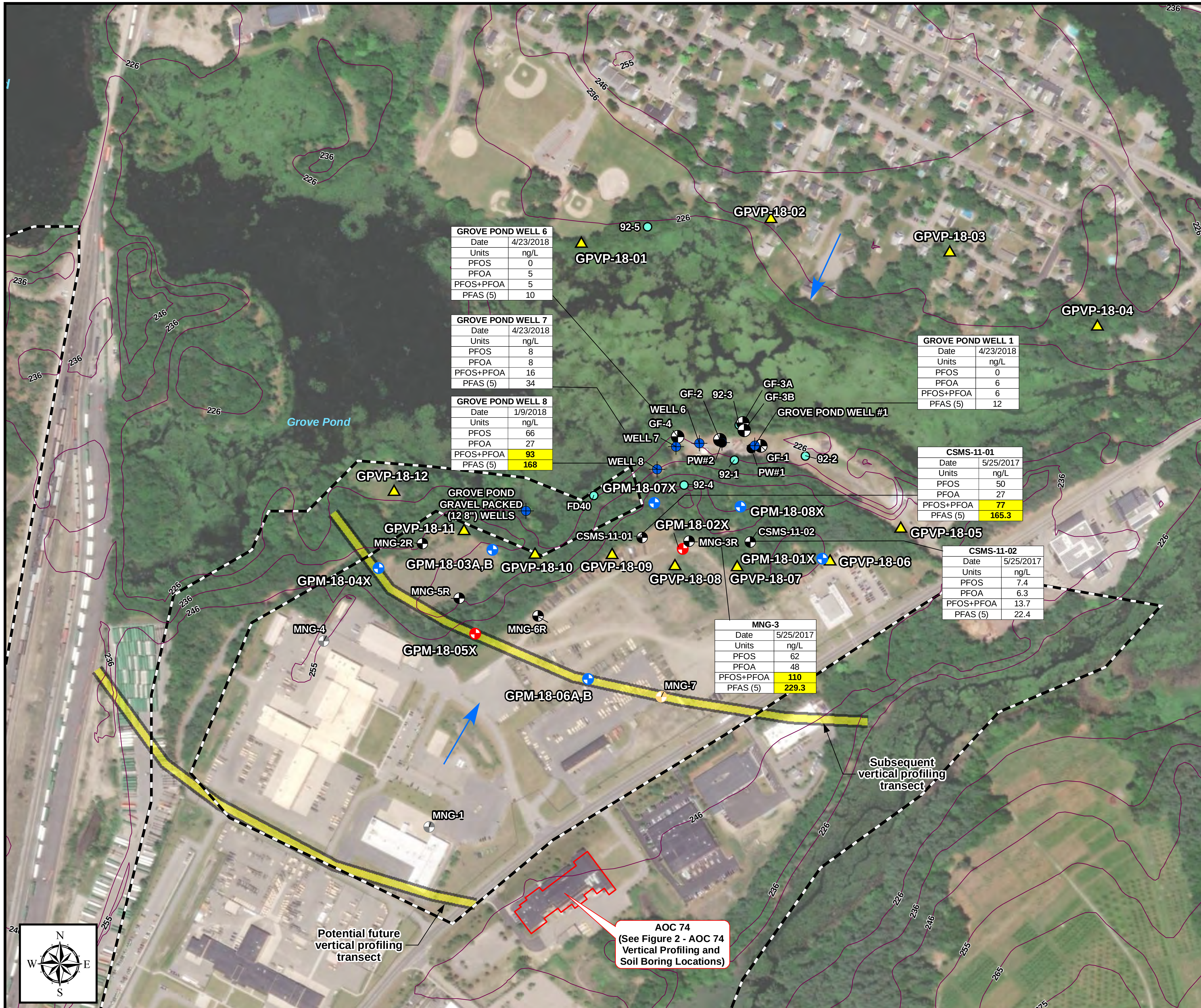
0 100 200
Feet

Date:
06/28/2018

Figure
6

File: PFAS2018_A1FSP_F6_AOC75_VPL_SB.mxd

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



GROVE POND WELL 6	
Date	4/23/2018
Units	ng/L
PFOS	0
PFOA	5
PFOS+PFOA	5
PFAS (5)	10

GROVE POND WELL 7	
Date	4/23/2018
Units	ng/L
PFOS	8
PFOA	8
PFOS+PFOA	16
PFAS (5)	34

GROVE POND WELL 8	
Date	1/9/2018
Units	ng/L
PFOS	66
PFOA	27
PFOS+PFOA	**93**
PFAS (5)	**168**

GROVE POND WELL 1	
Date	4/23/2018
Units	ng/L
PFOS	0
PFOA	6
PFOS+PFOA	6
PFAS (5)	12

CSMS-11-01	
Date	5/25/2017
Units	ng/L
PFOS	50
PFOA	27
PFOS+PFOA	**77**
PFAS (5)	**165.3**

CSMS-11-02	
Date	5/25/2017
Units	ng/L
PFOS	7.4
PFOA	6.3
PFOS+PFOA	13.7
PFAS (5)	22.4

MNG-3	
Date	5/25/2017
Units	ng/L
PFOS	62
PFOA	48
PFOS+PFOA	**110**
PFAS (5)	**229.3**

Legend

- Tentative Monitoring Well
- Tentative Bedrock Well
- Proposed Vertical Profiling Location
- Monitoring Well
- Monitoring Well (Damaged)
- Monitoring Well (Destroyed)
- Public/Sentry Well
- Historical Supply Well
- Public Water Supply Well
- Approximate Groundwater Flow Direction
- Topographic Contour (feet above sea level)
- Area of Contamination (AOC)
- Former Fort Devens Boundary

Notes:

Grove Pond Wetland lies within the MassDEP Zone II wellhead protection area.

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

Topographic Contour Source: MassGIS, Elevation Contours (1:5,000) - North American Vertical Datum of 1988.

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

Grove Pond Wellfield Vertical Profiling Locations
Devens PFAS RI WP - Area 1 FSP Addendum

Former Fort Devens Army Installation
Devens, Massachusetts

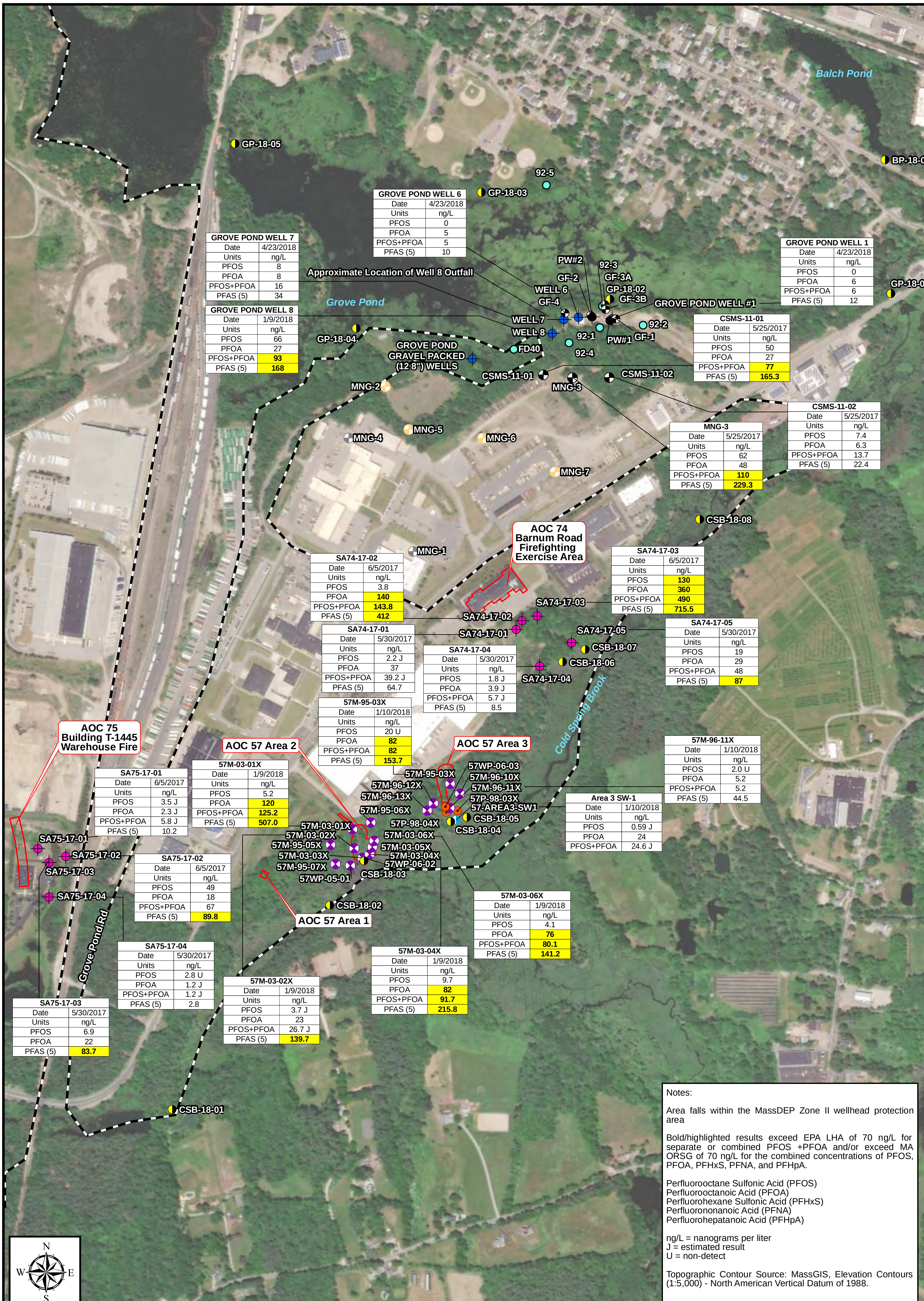
KOMAN Government Solutions, LLC
293 Boston Post Road West, Suite 100, Marlborough, MA 01752

0 200 400
Feet

Date: 09/17/2018

Figure 7

File: PFAS2018_A1FSP_F7_GrovePond_VPL.mxd



GROVE POND WELL 6	
Date	4/23/2018
Units	ng/L
PFOS	0
PFOA	5
PFOS+PFOA	5
PFAS (5)	10

GROVE POND WELL 7	
Date	4/23/2018
Units	ng/L
PFOS	8
PFOA	8
PFOS+PFOA	16
PFAS (5)	34

GROVE POND WELL 8	
Date	1/9/2018
Units	ng/L
PFOS	66
PFOA	27
PFOS+PFOA	**93**
PFAS (5)	**168**

GROVE POND WELL 1	
Date	4/23/2018
Units	ng/L
PFOS	0
PFOA	6
PFOS+PFOA	6
PFAS (5)	12

CSMS-11-01	
Date	5/25/2017
Units	ng/L
PFOS	50
PFOA	27
PFOS+PFOA	**77**
PFAS (5)	**165.3**

CSMS-11-02	
Date	5/25/2017
Units	ng/L
PFOS	7.4
PFOA	6.3
PFOS+PFOA	13.7
PFAS (5)	22.4

MNG-3	
Date	5/25/2017
Units	ng/L
PFOS	62
PFOA	48
PFOS+PFOA	**110**
PFAS (5)	**229.3**

SA74-17-02	
Date	6/5/2017
Units	ng/L
PFOS	3.8
PFOA	**140**
PFOS+PFOA	**143.8**
PFAS (5)	**412**

SA74-17-03	
Date	6/5/2017
Units	ng/L
PFOS	**130**
PFOA	**360**
PFOS+PFOA	**490**
PFAS (5)	**715.5**

SA74-17-01	
Date	5/30/2017
Units	ng/L
PFOS	2.2 J
PFOA	37
PFOS+PFOA	39.2 J
PFAS (5)	64.7

SA74-17-04	
Date	5/30/2017
Units	ng/L
PFOS	1.8 J
PFOA	3.9 J
PFOS+PFOA	5.7 J
PFAS (5)	8.5

SA74-17-05	
Date	5/30/2017
Units	ng/L
PFOS	19
PFOA	29
PFOS+PFOA	48
PFAS (5)	**87**

57M-95-03X	
Date	1/10/2018
Units	ng/L
PFOS	20 U
PFOA	**82**
PFOS+PFOA	**82**
PFAS (5)	**153.7**

57M-96-11X	
Date	1/10/2018
Units	ng/L
PFOS	2.0 U
PFOA	5.2
PFOS+PFOA	5.2
PFAS (5)	44.5

Area 3 SW-1	
Date	1/10/2018
Units	ng/L
PFOS	0.59 J
PFOA	24
PFOS+PFOA	24.6 J

57M-03-01X	
Date	1/9/2018
Units	ng/L
PFOS	5.2
PFOA	**120**
PFOS+PFOA	**125.2**
PFAS (5)	**507.0**

SA75-17-01	
Date	6/5/2017
Units	ng/L
PFOS	3.5 J
PFOA	2.3 J
PFOS+PFOA	5.8 J
PFAS (5)	10.2

SA75-17-02	
Date	6/5/2017
Units	ng/L
PFOS	49
PFOA	18
PFOS+PFOA	67
PFAS (5)	**89.8**

SA75-17-04	
Date	5/30/2017
Units	ng/L
PFOS	2.8 U
PFOA	1.2 J
PFOS+PFOA	1.2 J
PFAS (5)	2.8

SA75-17-03	
Date	5/30/2017
Units	ng/L
PFOS	6.9
PFOA	22
PFAS (5)	**83.7**

57M-03-06X	
Date	1/9/2018
Units	ng/L
PFOS	4.1
PFOA	**76**
PFOS+PFOA	**80.1**
PFAS (5)	**141.2**

57M-03-04X	
Date	1/9/2018
Units	ng/L
PFOS	9.7
PFOA	**82**
PFOS+PFOA	**91.7**
PFAS (5)	**215.8**

57M-03-02X	
Date	1/9/2018
Units	ng/L
PFOS	3.7 J
PFOA	23
PFOS+PFOA	26.7 J
PFAS (5)	**139.7**

Notes:

Area falls within the MassDEP Zone II wellhead protection area

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

Topographic Contour Source: MassGIS, Elevation Contours (1:5,000) - North American Vertical Datum of 1988.

Legend

- Proposed Surface Water and Sediment Sampling Location
- LTM Well
- LTM Well Point or Piezometer
- Surface Water Sample Location
- Monitoring Well (Damaged)
- Monitoring Well (Destroyed)
- Public/Sentry Well
- Historical Supply Well
- Monitoring Well
- Temporary Well Location from SI
- Public Water Supply Well
- Area of Contamination (AOC)
- Former Fort Devens Boundary

Area 1 Surface Water and Sediment Sampling Locations
Devens PFAS RI WP - Area 1 FSP Addendum

Former Fort Devens Army Installation
Devens, Massachusetts

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

0 300 600
Feet

Date: 09/18/2018

Figure 8

File: PFAS2018_A1FSP_F8_PropSW_Sed_Area1.mxd

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

TABLES

Table 1
Area 1 Groundwater Vertical Profiling Locations and Rationale
Area 1 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Proposed Location	Rationale	Path Forward If PFAS is Detected in Groundwater[1]
Area of Contamination 57, Area 1		
5701VP-18-01	Determine if PFAS is present in groundwater at Area 1. Directly downgradient of storm drain outfall.	• Evaluate need for vertical profile location further upgradient, northwest of this location, based on a review of the magnitude and depth of the borings advanced at this area. • Evaluate need for vertical profile location further cross gradient, north and south of this location, based on a review of the magnitude and depth of the borings advanced at this area.
5701VP-18-02	Determine if PFAS is present in groundwater at Area 1. Directly downgradient of storm drain outfall.	• Evaluate need for vertical profile location further downgradient, southeast of this location, based on a review of the magnitude and depth of the borings advanced at this area. • Evaluate need for vertical profile location further cross gradient, north and south of this location, based on a review of the magnitude and depth of the borings advanced at this area.
Area of Contamination 57, Area 2		
5702VP-18-01	Determine if PFAS is present in groundwater upgradient of Area 2.	• Evaluate need for a vertical profile location further upgradient, northwest of this location, based on a review of the magnitude and depth of detections at this profile. • Evaluate need for a vertical profile location further cross gradient, northeast and west of this location, based on a review of the magnitude and depth of detections at this profile.
5702VP-18-02	Characterize vertical extent of PFAS in groundwater within area of known PFAS contamination in groundwater.	• Evaluate data from surrounding locations.
5702VP-18-03	Determine if PFAS is present at Area 2 groundwater cross gradient to upgradient portion of Area 2.	• Evaluate need for a vertical profile location further upgradient and cross gradient, to the northwest of this location based on a review of the magnitude and depth of detections at this profile.
5702VP-18-04	Determine if PFAS is present at Area 2 groundwater cross gradient to upgradient portion of Area 2.	• Evaluate need for a vertical profile location further upgradient and cross gradient, to the northeast of this location based on a review of the magnitude and depth of detections at this profile.
5702VP-18-05	Characterize vertical extent of PFAS in groundwater within area of known PFAS contamination in groundwater.	• Evaluate data from surrounding locations.
5702VP-18-06	Characterize vertical extent of PFAS in groundwater within area of known PFAS contamination in groundwater, adjacent to Cold Spring Brook.	• Evaluate potential for underflow of Cold Spring brook, by reviewing elevation of observed PFAS and measuring vertical hydraulic gradients with installation of nested piezometers or monitoring wells at this location.
5702VP-18-07	Determine if PFAS is present at Area 2 groundwater cross gradient to downgradient portion of Area 2, adjacent to Cold Spring Brook.	• Evaluate need for a vertical profile location cross gradient further to the northeast based on a review of magnitude and depth of detections at this profile. • Evaluate potential for underflow of Cold Spring Brook, by reviewing elevation of observed PFAS in groundwater at this location and considering vertical hydraulic gradients measured at nearby nested piezometers or monitoring wells at this AOC.
5702VP-18-08	Determine if PFAS is present at Area 2 groundwater cross gradient to downgradient portion of Area 2, adjacent to Cold Spring Brook.	• Evaluate need for a vertical profile location cross gradient further to the west based on a review of magnitude and depth of detections at this profile. • Evaluate potential for underflow of Cold Spring Brook, by reviewing elevation of observed PFAS in groundwater at this location and considering vertical hydraulic gradients measured at nearby nested piezometers or monitoring wells at this AOC.
Area of Contamination 57, Area 3		
5703VP-18-01	Determine if PFAS is present in groundwater upgradient and cross gradient of known groundwater contamination at Area 3.	• Evaluate need for a vertical profile location further upgradient cross gradient, to the northwest of this location. Distance to be dependent on magnitude and depth of detections.
5703VP-18-02	Determine if PFAS is present in groundwater upgradient of known groundwater contamination at Area 3.	• Evaluate need for a vertical profile location further upgradient, to the north of this location. Distance to be dependent on magnitude and depth of detections.
5703VP-18-03	Determine if PFAS is present in groundwater upgradient and cross gradient of known groundwater contamination at Area 3.	• Evaluate need for a vertical profile location further upgradient and cross gradient, to the northeast of this location. Distance to be dependent on magnitude and depth of detections.
5703VP-18-04	Characterize vertical extent of PFAS in groundwater at an area of known PFAS contamination in groundwater.	• Evaluate data from surrounding locations.
5703VP-18-05	Determine if PFAS is present at Area 3 groundwater cross gradient to downgradient portion of Area 3, adjacent to Cold Spring Brook.	• Evaluate need for a vertical profile location cross gradient, southwest of this location, based on a review of magnitude and depth of detections at this profile. • Evaluate potential for underflow of Cold Spring Brook, by reviewing elevation of observed PFAS in groundwater at this location and considering vertical hydraulic gradients measured at nearby nested piezometers or monitoring wells at this AOC.
5703VP-18-06	Characterize vertical extent of PFAS in groundwater at an area of known PFAS contamination in groundwater.	• Evaluate potential for underflow of Cold Spring brook, by reviewing elevation of observed PFAS and measuring vertical hydraulic gradients with installation of nested piezometers or monitoring wells at this location.

Table 1
Area 1 Groundwater Vertical Profiling Locations and Rationale
Area 1 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Proposed Location	Rationale	Path Forward If PFAS is Detected in Groundwater(1)
5703VP-18-07	Determine if PFAS is present at Area 3 groundwater cross gradient to downgradient portion of Area 3, adjacent to Cold Spring Brook.	• Evaluate need for a vertical profile location cross gradient further to the northeast based on a review of magnitude and depth of detections at this profile. • Evaluate potential for underflow of Cold Spring Brook, by reviewing elevation of observed PFAS in groundwater at this location and considering vertical hydraulic gradients measured at nearby nested piezometers or monitoring wells at this AOC.
5703VP-18-08	Characterize vertical extent of PFAS in groundwater within area of known PFAS contamination in groundwater.	• Evaluate data from surrounding locations.
Area of Contamination 74		
74VP-18-01	Characterize vertical extent of PFAS contamination in groundwater in area of known PFAS contamination.	• Evaluate data from surrounding locations.
74VP-18-02	Characterize vertical extent of PFAS contamination in groundwater in aquifer downgradient of known PFAS contamination and adjacent to Cold Spring Brook.	• Evaluate data from surrounding locations. • Evaluate potential for underflow of Cold Spring Brook, by reviewing elevation of observed PFAS in groundwater and measuring vertical hydraulic gradients with installation of nested piezometers or monitoring wells at this location.
74VP-18-03	Bound extent of PFAS contamination in groundwater to the southwest.	• Evaluate need for a vertical profile location cross gradient further to the southwest based on a review of magnitude and depth of detections at this profile.
74VP-18-04	Bound extent of PFAS contamination in groundwater to the northeast.	• Evaluate need for a vertical profile location cross gradient further to the northeast based on a review of magnitude and depth of detections at this profile.
74VP-18-05	Determine if PFAS contamination is present in groundwater to the east of Bldg. 3773 at AOC 74.	• Evaluate need for a vertical profile location cross gradient further to the northeast based on a review of magnitude and depth of detections at this profile.
74VP-18-06	Characterize vertical extent of PFAS contamination in groundwater in aquifer downgradient of known PFAS contamination.	• Evaluate data from surrounding locations.
74VP-18-07	Determine if PFAS contamination is present in groundwater to the north of Bldg. 3773 at AOC 74.	• Evaluate need for a vertical profile locations to the north based on a review of magnitude and depth of detections at this profile.
74VP-18-08	Determine if PFAS contamination is present in groundwater to the north of Bldg. 3773 at AOC 74.	• Evaluate vertical profile data in conjunction with vertical profile results obtained from Grove Pond investigation area.
74VP-18-09	Determine if PFAS contamination is present in groundwater adjacent to Cold Spring Brook.	• Evaluate need for a vertical profile location cross gradient further to the northeast based on a review of magnitude and depth of detections at this profile.
74VP-18-10	Determine if PFAS contamination is present in groundwater adjacent to Cold Spring Brook.	• Evaluate need for a vertical profile location cross gradient further to the southwest based on a review of magnitude and depth of detections at this profile.
74VP-18-11	Determine if PFAS contamination is present in groundwater to the north of Bldg. 3773 at AOC 74.	• Evaluate need for a vertical profile locations to the southwest based on a review of magnitude and depth of detections at this profile.
Area of Contamination 75		
75VP-18-01	Determine if PFAS is present in groundwater upgradient of AOC-75.	• Evaluate need for a vertical profile that is further upgradient of this location based on a review of the magnitude and depth of detections at this profile.
75VP-18-02	Determine if PFAS is present in groundwater cross gradient, to the north of known PFAS detections at AOC-75.	• Evaluate need for a vertical profile location that is further cross gradient, to the north of this location based on a review of the magnitude and depth of detections at this profile.
75VP-18-03	Determine if PFAS is present in groundwater that is downgradient of known PFAS detections in AOC-75 groundwater.	• Evaluate need for a profile location that is further downgradient, to the east, of this location based on a review of the magnitude and depth of detections at AOC-75 and AOC 57 Area 1 (located to the east and downgradient).
75VP-18-04	Determine if PFAS is present in groundwater downgradient, to the southeast of known PFAS detections at AOC-75.	• Evaluate need for a vertical profile location that is further cross gradient, to the south of this location based on a review of the magnitude and depth of detections at this profile. • Evaluate need for a vertical profile location further downgradient, to the east of this location based on a review of the magnitude and depth of detections at this profile.
75VP-18-05	Determine if PFAS is present in groundwater cross gradient, to the north of known PFAS detections at AOC-75.	• Evaluate need for a vertical profile location that is further cross gradient, to the north of this location based on a review of the magnitude and depth of detections at this profile.
75VP-18-06	Characterize vertical extent of PFAS in an area of known groundwater contamination at AOC 75.	• Evaluate data from surrounding locations.
75VP-18-07	Determine if PFAS is present in groundwater cross gradient, to the south of known PFAS detections at AOC-75.	• Evaluate need for a vertical profile location that is further cross gradient, to the south of this location based on a review of the magnitude and depth of detections at this profile.
75VP-18-08	Determine if PFAS is present in groundwater downgradient, to the northeast of known PFAS detections in groundwater at AOC-75.	• Evaluate need for a vertical profile location that is further cross gradient, to the north of this location based on a review of the magnitude and depth of detections at this profile. • Evaluate need for a vertical profile location further downgradient, to the east of this location based on a review of the magnitude and depth of detections at this profile.

Table 1
Area 1 Groundwater Vertical Profiling Locations and Rationale
Area 1 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Proposed Location	Rationale	Path Forward If PFAS is Detected in Groundwater[1]
75VP-18-09	Determine if PFAS is present in groundwater downgradient, to the northeast of known PFAS detections in groundwater at AOC-75.	• Evaluate need for a vertical profile location that is further cross gradient, to the north of this location based on a review of the magnitude and depth of detections at this profile. • Evaluate need for a vertical profile location further downgradient, to the east of this location based on a review of the magnitude and depth of detections at this profile.
Grove Pond Municipal Well Field		
GPVP-18-01	Determine if PFAS is present in groundwater to the northwest of Grove Pond Wellfield.	• Inform stakeholders of PFAS contamination at this off-base location.
GPVP-18-02	Determine if PFAS is present in groundwater to the north of Grove Pond Wellfield.	• Inform stakeholders of PFAS contamination at this off-base location.
GPVP-18-03	Determine if PFAS is present in groundwater to the northeast of Grove Pond Wellfield.	• Inform stakeholders of PFAS contamination at this off-base location.
GPVP-18-04	Determine if PFAS is present in groundwater to the east of Grove Pond Wellfield.	• Inform stakeholders of PFAS contamination at this off-base location.
GPVP-18-05	Determine if PFAS is present in groundwater to the east of Grove Pond Wellfield.	• Evaluate flow direction for additional vertical profile borings located upgradient or cross gradient.
GPVP-18-06	Characterize vertical extent of PFAS contamination in an area of known groundwater contamination to the southeast of Grove Pond Wellfield.	• Establish a vertical profile location further upgradient, to the south of this location. Distance is anticipated to be along a transect that passes through MNG-2 through MNG-7.
GPVP-18-07	Characterize vertical extent of PFAS contamination in an area of known groundwater contamination to the south of Grove Pond Wellfield.	• Establish a vertical profile location further upgradient, to the south of this location. Distance is anticipated to be along a transect that passes through MNG-2 through MNG-7.
GPVP-18-08	Characterize vertical extent of PFAS contamination in an area of known groundwater contamination to the south of Grove Pond Wellfield.	• Establish a vertical profile location further upgradient, to the south of this location. Distance is anticipated to be along a transect that passes through MNG-2 through MNG-7.
GPVP-18-09	Characterize vertical extent of PFAS contamination in an area of known groundwater contamination to the south of Grove Pond Wellfield.	• Establish a vertical profile location further upgradient, to the south and west of this location. Distance is anticipated to be along a transect that passes through MNG-2 through MNG-7.
GPVP-18-10	Characterize vertical extent of PFAS contamination in an area southwest of known groundwater contamination at Grove Pond Wellfield.	• Establish a vertical profile location further upgradient, to the south and west of this location. Distance is anticipated to be along a transect that passes through MNG-2 through MNG-7.
GPVP-18-11	Characterize vertical extent of PFAS contamination in an area west of Grove Pond Wellfield.	• Establish a vertical profile location further upgradient, to the south and west of this location. Distance is anticipated to be along a transect that passes through MNG-2 through MNG-7.
GPVP-18-12	Characterize vertical extent of PFAS contamination in an area west of Grove Pond Wellfield.	• Establish a vertical profile location further upgradient, to the south and west of this location. Distance is anticipated to be along a transect that passes through MNG-2 through MNG-7.

Notes:
AOC = Area of Contamination
PFAS = per- and poly-fluoroalkyl substances
1. Evaluation of need for additional vertical profiling locations will be based on a review of PFAS data from this and nearby vertical profiles to determine if data gaps regarding the extent of PFAS contamination in groundwater exist.

Table 2
Area 1 Groundwater Vertical Profiling Sampling Summary
Area 1 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name**	Estimated Maximum Target Depth (ft bgs) *	Ground Surface Elevation (ft msl)	Water Table Elevation from the SI or LTM (ft msl)	Approximate Depth to Groundwater (ft bgs)**	Proposed Sample Depth (ft bgs)**	Sample Type
AOC-57 Area 1	5701VP-18-01	5701VP-18-01-XX-XX	100	230	223	7	7-9	Native Sample
		5701VP-18-01-XX-XX	100	230	223	7	17-19	Native Sample
		5701VP-18-01-XX-XX	100	230	223	7	27-29	Native Sample
		5701VP-18-01-XX-XX	100	230	223	7	37-39	Native Sample
		5701VP-18-01-XX-XX	100	230	223	7	47-49	Native Sample
		5701VP-18-01-XX-XX	100	230	223	7	57-59	Native Sample
		5701VP-18-01-XX-XX	100	230	223	7	67-69	Native Sample
		5701VP-18-01-XX-XX	100	230	223	7	77-79	Native Sample
		5701VP-18-01-XX-XX	100	230	223	7	87-89	Native Sample
	5701VP-18-02	5701VP-18-02-XX-XX	100	228	223	5	5-7	Native Sample
		5701VP-18-02-XX-XX	100	228	223	5	15-17	Native Sample
		5701VP-18-02-XX-XX	100	228	223	5	25-27	Native Sample
		5701VP-18-02-XX-XX	100	228	223	5	35-37	Native Sample
		5701VP-18-02-XX-XX	100	228	223	5	45-47	Native Sample
		5701VP-18-02-XX-XX	100	228	223	5	55-57	Native Sample
		5701VP-18-02-XX-XX	100	228	223	5	65-67	Native Sample
		5701VP-18-02-XX-XX	100	228	223	5	75-77	Native Sample
		5701VP-18-02-XX-XX	100	228	223	5	85-87	Native Sample
		5701VP-18-02-XX-XX	100	228	223	5	95-97	Native Sample
AOC-57 Area 2	5702VP-18-01	5702VP-18-01-XX-XX	100	244	224	20	20-22	Native Sample
		5702VP-18-01-XX-XX	100	244	224	20	30-32	Native Sample
		5702VP-18-01-XX-XX	100	244	224	20	40-42	Native Sample
		5702VP-18-01-XX-XX	100	244	224	20	50-52	Native Sample
		5702VP-18-01-XX-XX	100	244	224	20	60-62	Native Sample
		5702VP-18-01-XX-XX	100	244	224	20	70-72	Native Sample
		5702VP-18-01-XX-XX	100	244	224	20	80-82	Native Sample
		5702VP-18-01-XX-XX	100	244	224	20	90-92	Native Sample
	5702VP-18-02	5702VP-18-02-XX-XX	100	236	224	12	12-14	Native Sample
		5702VP-18-02-XX-XX	100	236	224	12	22-24	Native Sample
		5702VP-18-02-XX-XX	100	236	224	12	32-34	Native Sample
		5702VP-18-02-XX-XX	100	236	224	12	42-44	Native Sample
		5702VP-18-02-XX-XX	100	236	224	12	52-54	Native Sample
		5702VP-18-02-XX-XX	100	236	224	12	62-64	Native Sample
		5702VP-18-02-XX-XX	100	236	224	12	72-74	Native Sample
		5702VP-18-02-XX-XX	100	236	224	12	82-84	Native Sample
		5702VP-18-02-XX-XX	100	236	224	12	92-94	Native Sample
	5702VP-18-03	5702VP-18-03-XX-XX	100	236	224	12	12-14	Native Sample
		5702VP-18-03-XX-XX	100	236	224	12	22-24	Native Sample
		5702VP-18-03-XX-XX	100	236	224	12	32-34	Native Sample
		5702VP-18-03-XX-XX	100	236	224	12	42-44	Native Sample
		5702VP-18-03-XX-XX	100	236	224	12	52-54	Native Sample
		5702VP-18-03-XX-XX	100	236	224	12	62-64	Native Sample
		5702VP-18-03-XX-XX	100	236	224	12	72-74	Native Sample
		5702VP-18-03-XX-XX	100	236	224	12	82-84	Native Sample
		5702VP-18-03-XX-XX	100	236	224	12	92-94	Native Sample
	5702VP-18-04	5702VP-18-04-XX-XX	100	236	224	12	12-14	Native Sample
		5702VP-18-04-XX-XX	100	236	224	12	22-24	Native Sample
		5702VP-18-04-XX-XX	100	236	224	12	32-34	Native Sample
		5702VP-18-04-XX-XX	100	236	224	12	42-44	Native Sample
		5702VP-18-04-XX-XX	100	236	224	12	52-54	Native Sample
		5702VP-18-04-XX-XX	100	236	224	12	62-64	Native Sample
		5702VP-18-04-XX-XX	100	236	224	12	72-74	Native Sample
		5702VP-18-04-XX-XX	100	236	224	12	82-84	Native Sample
		5702VP-18-04-XX-XX	100	236	224	12	92-94	Native Sample
	5702VP-18-05	5702VP-18-05-XX-XX	100	230	223	7	7-9	Native Sample
		5702VP-18-05-XX-XX	100	230	223	7	17-19	Native Sample
		5702VP-18-05-XX-XX	100	230	223	7	27-29	Native Sample
		5702VP-18-05-XX-XX	100	230	223	7	37-39	Native Sample
		5702VP-18-05-XX-XX	100	230	223	7	47-49	Native Sample
		5702VP-18-05-XX-XX	100	230	223	7	57-59	Native Sample
		5702VP-18-05-XX-XX	100	230	223	7	67-69	Native Sample
		5702VP-18-05-XX-XX	100	230	223	7	77-79	Native Sample
		5702VP-18-05-XX-XX	100	230	223	7	87-89	Native Sample
	5702VP-18-06	5702VP-18-06-XX-XX	100	225	222	3	3-5	Native Sample
		5702VP-18-06-XX-XX	100	225	222	3	13-15	Native Sample
		5702VP-18-06-XX-XX	100	225	222	3	23-25	Native Sample
		5702VP-18-06-XX-XX	100	225	222	3	33-35	Native Sample

Table 2
Area 1 Groundwater Vertical Profiling Sampling Summary
Area 1 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name**	Estimated Maximum Target Depth (ft bgs) *	Ground Surface Elevation (ft msl)	Water Table Elevation from the SI or LTM (ft msl)	Approximate Depth to Groundwater (ft bgs)**	Proposed Sample Depth (ft bgs)**	Sample Type
		5702VP-18-06-XX-XX	100	225	222	3	43-45	Native Sample
		5702VP-18-06-XX-XX	100	225	222	3	53-55	Native Sample
		5702VP-18-06-XX-XX	100	225	222	3	63-65	Native Sample
		5702VP-18-06-XX-XX	100	225	222	3	73-75	Native Sample
		5702VP-18-06-XX-XX	100	225	222	3	83-85	Native Sample
		5702VP-18-06-XX-XX	100	225	222	3	93-95	Native Sample
	5702VP-18-07	5702VP-18-07-XX-XX	100	225	222	3	3-5	Native Sample
		5702VP-18-07-XX-XX	100	225	222	3	13-15	Native Sample
		5702VP-18-07-XX-XX	100	225	222	3	23-25	Native Sample
		5702VP-18-07-XX-XX	100	225	222	3	33-35	Native Sample
		5702VP-18-07-XX-XX	100	225	222	3	43-45	Native Sample
		5702VP-18-07-XX-XX	100	225	222	3	53-55	Native Sample
		5702VP-18-07-XX-XX	100	225	222	3	63-65	Native Sample
		5702VP-18-07-XX-XX	100	225	222	3	73-75	Native Sample
		5702VP-18-07-XX-XX	100	225	222	3	83-85	Native Sample
		5702VP-18-07-XX-XX	100	225	222	3	93-95	Native Sample
	5702VP-18-08	5702VP-18-08-XX-XX	100	225	222	3	3-5	Native Sample
		5702VP-18-08-XX-XX	100	225	222	3	13-15	Native Sample
		5702VP-18-08-XX-XX	100	225	222	3	23-25	Native Sample
		5702VP-18-08-XX-XX	100	225	222	3	33-35	Native Sample
		5702VP-18-08-XX-XX	100	225	222	3	43-45	Native Sample
		5702VP-18-08-XX-XX	100	225	222	3	53-55	Native Sample
		5702VP-18-08-XX-XX	100	225	222	3	63-65	Native Sample
		5702VP-18-08-XX-XX	100	225	222	3	73-75	Native Sample
		5702VP-18-08-XX-XX	100	225	222	3	83-85	Native Sample
		5702VP-18-08-XX-XX	100	225	222	3	93-95	Native Sample
AOC-57 Area 3	5703VP-18-01	5703VP-18-01-XX-XX	100	236	225	11	11-13	Native Sample
		5703VP-18-01-XX-XX	100	236	225	11	21-23	Native Sample
		5703VP-18-01-XX-XX	100	236	225	11	31-33	Native Sample
		5703VP-18-01-XX-XX	100	236	225	11	41-43	Native Sample
		5703VP-18-01-XX-XX	100	236	225	11	51-53	Native Sample
		5703VP-18-01-XX-XX	100	236	225	11	61-63	Native Sample
		5703VP-18-01-XX-XX	100	236	225	11	71-73	Native Sample
		5703VP-18-01-XX-XX	100	236	225	11	81-83	Native Sample
		5703VP-18-01-XX-XX	100	236	225	11	91-93	Native Sample
	5703VP-18-02	5703VP-18-02-XX-XX	100	236	225	11	11-13	Native Sample
		5703VP-18-02-XX-XX	100	236	225	11	21-23	Native Sample
		5703VP-18-02-XX-XX	100	236	225	11	31-33	Native Sample
		5703VP-18-02-XX-XX	100	236	225	11	41-43	Native Sample
		5703VP-18-02-XX-XX	100	236	225	11	51-53	Native Sample
		5703VP-18-02-XX-XX	100	236	225	11	61-63	Native Sample
		5703VP-18-02-XX-XX	100	236	225	11	71-73	Native Sample
		5703VP-18-02-XX-XX	100	236	225	11	81-83	Native Sample
		5703VP-18-02-XX-XX	100	236	225	11	91-93	Native Sample
	5703VP-18-03	5703VP-18-03-XX-XX	100	236	225	11	11-13	Native Sample
		5703VP-18-03-XX-XX	100	236	225	11	21-23	Native Sample
		5703VP-18-03-XX-XX	100	236	225	11	31-33	Native Sample
		5703VP-18-03-XX-XX	100	236	225	11	41-43	Native Sample
		5703VP-18-03-XX-XX	100	236	225	11	51-53	Native Sample
		5703VP-18-03-XX-XX	100	236	225	11	61-63	Native Sample
		5703VP-18-03-XX-XX	100	236	225	11	71-73	Native Sample
		5703VP-18-03-XX-XX	100	236	225	11	81-83	Native Sample
		5703VP-18-03-XX-XX	100	236	225	11	91-93	Native Sample
	5703VP-18-04	5703VP-18-04-XX-XX	100	230	224	6	6-8	Native Sample
		5703VP-18-04-XX-XX	100	230	224	6	16-18	Native Sample
		5703VP-18-04-XX-XX	100	230	224	6	26-28	Native Sample
		5703VP-18-04-XX-XX	100	230	224	6	36-38	Native Sample
		5703VP-18-04-XX-XX	100	230	224	6	46-48	Native Sample
		5703VP-18-04-XX-XX	100	230	224	6	56-58	Native Sample
		5703VP-18-04-XX-XX	100	230	224	6	66-68	Native Sample
		5703VP-18-04-XX-XX	100	230	224	6	76-78	Native Sample
		5703VP-18-04-XX-XX	100	230	224	6	86-88	Native Sample
		5703VP-18-04-XX-XX	100	226	223	6	96-98	Native Sample
	5703VP-18-05	5703VP-18-05-XX-XX	100	226	221	5	5-7	Native Sample
		5703VP-18-05-XX-XX	100	226	221	5	15-17	Native Sample
		5703VP-18-05-XX-XX	100	226	221	5	25-27	Native Sample
		5703VP-18-05-XX-XX	100	226	221	5	35-37	Native Sample

Table 2
Area 1 Groundwater Vertical Profiling Sampling Summary
Area 1 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name**	Estimated Maximum Target Depth (ft bgs) *	Ground Surface Elevation (ft msl)	Water Table Elevation from the SI or LTM (ft msl)	Approximate Depth to Groundwater (ft bgs)**	Proposed Sample Depth (ft bgs)**	Sample Type
		5703VP-18-05-XX-XX	100	226	221	5	45-47	Native Sample
		5703VP-18-05-XX-XX	100	226	221	5	55-57	Native Sample
		5703VP-18-05-XX-XX	100	226	221	5	65-67	Native Sample
		5703VP-18-05-XX-XX	100	226	221	5	75-77	Native Sample
		5703VP-18-05-XX-XX	100	226	221	5	85-87	Native Sample
		5703VP-18-05-XX-XX	100	226	221	5	95-97	Native Sample
	5703VP-18-06	5703VP-18-06-XX-XX	100	224	222	2	2-4	Native Sample
		5703VP-18-06-XX-XX	100	224	222	2	12-14	Native Sample
		5703VP-18-06-XX-XX	100	224	222	2	22-24	Native Sample
		5703VP-18-06-XX-XX	100	224	222	2	32-34	Native Sample
		5703VP-18-06-XX-XX	100	224	222	2	42-44	Native Sample
		5703VP-18-06-XX-XX	100	224	222	2	52-54	Native Sample
		5703VP-18-06-XX-XX	100	224	222	2	62-64	Native Sample
		5703VP-18-06-XX-XX	100	224	222	2	72-74	Native Sample
		5703VP-18-06-XX-XX	100	224	222	2	82-84	Native Sample
		5703VP-18-06-XX-XX	100	224	222	2	92-94	Native Sample
	5703VP-18-07	5703VP-18-07-XX-XX	100	224	222	2	2-4	Native Sample
		5703VP-18-07-XX-XX	100	224	222	2	12-14	Native Sample
		5703VP-18-07-XX-XX	100	224	222	2	22-24	Native Sample
		5703VP-18-07-XX-XX	100	224	222	2	32-34	Native Sample
		5703VP-18-07-XX-XX	100	224	222	2	42-44	Native Sample
		5703VP-18-07-XX-XX	100	224	222	2	52-54	Native Sample
		5703VP-18-07-XX-XX	100	224	222	2	62-64	Native Sample
		5703VP-18-07-XX-XX	100	224	222	2	72-74	Native Sample
		5703VP-18-07-XX-XX	100	224	222	2	82-84	Native Sample
		5703VP-18-07-XX-XX	100	224	222	2	92-94	Native Sample
	5703VP-18-08	5703VP-18-08-XX-XX	100	226	223	3	3-5	Native Sample
		5703VP-18-08-XX-XX	100	226	223	3	13-15	Native Sample
		5703VP-18-08-XX-XX	100	226	223	3	23-25	Native Sample
		5703VP-18-08-XX-XX	100	226	223	3	33-35	Native Sample
		5703VP-18-08-XX-XX	100	226	223	3	43-45	Native Sample
		5703VP-18-08-XX-XX	100	226	223	3	53-55	Native Sample
		5703VP-18-08-XX-XX	100	226	223	3	63-65	Native Sample
		5703VP-18-08-XX-XX	100	226	223	3	73-75	Native Sample
		5703VP-18-08-XX-XX	100	226	223	3	83-85	Native Sample
		5703VP-18-08-XX-XX	100	226	223	3	93-95	Native Sample
AOC-74	74VP-18-01	74VP-18-01-XX-XX	100	236	223	13	13-15	Native Sample
		74VP-18-01-XX-XX	100	236	223	13	23-25	Native Sample
		74VP-18-01-XX-XX	100	236	223	13	33-35	Native Sample
		74VP-18-01-XX-XX	100	236	223	13	43-45	Native Sample
		74VP-18-01-XX-XX	100	236	223	13	53-55	Native Sample
		74VP-18-01-XX-XX	100	236	223	13	63-65	Native Sample
		74VP-18-01-XX-XX	100	236	223	13	73-75	Native Sample
		74VP-18-01-XX-XX	100	236	223	13	83-85	Native Sample
		74VP-18-01-XX-XX	100	236	223	13	93-95	Native Sample
	74VP-18-02	74VP-18-02-XX-XX	100	226	223	3	3-5	Native Sample
		74VP-18-02-XX-XX	100	226	223	3	13-15	Native Sample
		74VP-18-02-XX-XX	100	236	223	3	23-25	Native Sample
		74VP-18-02-XX-XX	100	236	223	3	33-35	Native Sample
		74VP-18-02-XX-XX	100	236	223	3	43-45	Native Sample
		74VP-18-02-XX-XX	100	236	223	3	53-55	Native Sample
		74VP-18-02-XX-XX	100	236	223	3	63-65	Native Sample
		74VP-18-02-XX-XX	100	236	223	3	73-75	Native Sample
		74VP-18-02-XX-XX	100	236	223	3	83-85	Native Sample
		74VP-18-02-XX-XX	100	236	223	3	93-95	Native Sample
	74VP-18-03	74VP-18-03-XX-XX	100	246	223	23	23-25	Native Sample
		74VP-18-03-XX-XX	100	246	223	23	33-35	Native Sample
		74VP-18-03-XX-XX	100	246	223	23	43-45	Native Sample
		74VP-18-03-XX-XX	100	246	223	23	53-55	Native Sample
		74VP-18-03-XX-XX	100	246	223	23	63-65	Native Sample
		74VP-18-03-XX-XX	100	246	223	23	73-75	Native Sample
		74VP-18-03-XX-XX	100	246	223	23	83-85	Native Sample
		74VP-18-03-XX-XX	100	246	223	23	93-95	Native Sample

Table 2
Area 1 Groundwater Vertical Profiling Sampling Summary
Area 1 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name**	Estimated Maximum Target Depth (ft bgs) *	Ground Surface Elevation (ft msl)	Water Table Elevation from the SI or LTM (ft msl)	Approximate Depth to Groundwater (ft bgs)**	Proposed Sample Depth (ft bgs)**	Sample Type
	74VP-18-04	74VP-18-04-XX-XX	100	236	223	13	13-15	Native Sample
		74VP-18-04-XX-XX	100	236	223	13	23-25	Native Sample
		74VP-18-04-XX-XX	100	236	223	13	33-35	Native Sample
		74VP-18-04-XX-XX	100	236	223	13	43-45	Native Sample
		74VP-18-04-XX-XX	100	236	223	13	53-55	Native Sample
		74VP-18-04-XX-XX	100	236	223	13	63-65	Native Sample
		74VP-18-04-XX-XX	100	236	223	13	73-75	Native Sample
		74VP-18-04-XX-XX	100	236	223	13	83-85	Native Sample
		74VP-18-04-XX-XX	100	236	223	13	93-95	Native Sample
	74VP-18-05	74VP-18-05-XX-XX	200	246	223	23	23-25	Native Sample
		74VP-18-05-XX-XX	200	246	223	23	33-35	Native Sample
		74VP-18-05-XX-XX	200	246	223	23	43-45	Native Sample
		74VP-18-05-XX-XX	200	246	223	23	53-55	Native Sample
		74VP-18-05-XX-XX	200	246	223	23	63-65	Native Sample
		74VP-18-05-XX-XX	200	246	223	23	83-85	Native Sample
		74VP-18-05-XX-XX	200	246	223	23	93-95	Native Sample
		74VP-18-05-XX-XX	200	246	223	23	103-105	Native Sample
		74VP-18-05-XX-XX	200	246	223	23	113-115	Native Sample
		74VP-18-05-XX-XX	200	246	223	23	123-125	Native Sample
		74VP-18-05-XX-XX	200	246	223	23	133-135	Native Sample
		74VP-18-05-XX-XX	200	246	223	23	143-145	Native Sample
		74VP-18-05-XX-XX	200	246	223	23	153-155	Native Sample
		74VP-18-05-XX-XX	200	246	223	23	163-165	Native Sample
		74VP-18-05-XX-XX	200	246	223	23	173-175	Native Sample
		74VP-18-05-XX-XX	200	246	223	23	183-185	Native Sample
		74VP-18-05-XX-XX	200	246	223	23	193-195	Native Sample
	74VP-18-06	74VP-18-06-XX-XX	100	226	223	13	13-15	Native Sample
		74VP-18-06-XX-XX	100	226	223	13	23-25	Native Sample
		74VP-18-06-XX-XX	100	226	223	13	33-35	Native Sample
		74VP-18-06-XX-XX	100	226	223	13	43-45	Native Sample
		74VP-18-06-XX-XX	100	226	223	13	53-55	Native Sample
		74VP-18-06-XX-XX	100	226	223	13	63-65	Native Sample
		74VP-18-06-XX-XX	100	226	223	13	73-75	Native Sample
		74VP-18-06-XX-XX	100	226	223	13	83-85	Native Sample
		74VP-18-06-XX-XX	100	226	223	13	93-95	Native Sample
	74VP-18-07	74VP-18-07-XX-XX	200	246	223	23	23-25	Native Sample
		74VP-18-07-XX-XX	200	246	223	23	33-35	Native Sample
		74VP-18-07-XX-XX	200	246	223	23	43-45	Native Sample
		74VP-18-07-XX-XX	200	246	223	23	53-55	Native Sample
		74VP-18-07-XX-XX	200	246	223	23	63-65	Native Sample
		74VP-18-07-XX-XX	200	246	223	23	73-75	Native Sample
		74VP-18-07-XX-XX	200	246	223	23	83-85	Native Sample
		74VP-18-07-XX-XX	200	246	223	23	93-95	Native Sample
		74VP-18-07-XX-XX	200	246	223	23	103-105	Native Sample
		74VP-18-07-XX-XX	200	246	223	23	113-115	Native Sample
		74VP-18-07-XX-XX	200	246	223	23	123-125	Native Sample
		74VP-18-07-XX-XX	200	246	223	23	133-135	Native Sample
		74VP-18-07-XX-XX	200	246	223	23	143-145	Native Sample
		74VP-18-07-XX-XX	200	246	223	23	153-155	Native Sample
		74VP-18-07-XX-XX	200	246	223	23	163-165	Native Sample
		74VP-18-07-XX-XX	200	246	223	23	173-175	Native Sample
		74VP-18-07-XX-XX	200	246	223	23	183-185	Native Sample
		74VP-18-07-XX-XX	200	246	223	23	193-195	Native Sample
	74VP-18-08	74VP-18-08-XX-XX	200	246	223	23	23-25	Native Sample
		74VP-18-08-XX-XX	200	246	223	23	33-35	Native Sample
		74VP-18-08-XX-XX	200	246	223	23	43-45	Native Sample
		74VP-18-08-XX-XX	200	246	223	23	53-55	Native Sample
		74VP-18-08-XX-XX	200	246	223	23	63-65	Native Sample
		74VP-18-08-XX-XX	200	246	223	23	73-75	Native Sample
		74VP-18-08-XX-XX	200	246	223	23	83-85	Native Sample
		74VP-18-08-XX-XX	200	246	223	23	93-95	Native Sample
		74VP-18-08-XX-XX	200	246	223	23	103-105	Native Sample
		74VP-18-08-XX-XX	200	246	223	23	113-115	Native Sample
		74VP-18-08-XX-XX	200	246	223	23	123-125	Native Sample
		74VP-18-08-XX-XX	200	246	223	23	133-135	Native Sample
		74VP-18-08-XX-XX	200	246	223	23	143-145	Native Sample
		74VP-18-08-XX-XX	200	246	223	23	153-155	Native Sample

Table 2
Area 1 Groundwater Vertical Profiling Sampling Summary
Area 1 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name**	Estimated Maximum Target Depth (ft bgs) *	Ground Surface Elevation (ft msl)	Water Table Elevation from the SI or LTM (ft msl)	Approximate Depth to Groundwater (ft bgs)**	Proposed Sample Depth (ft bgs)**	Sample Type
		74VP-18-08-XX-XX	200	246	223	23	163-165	Native Sample
		74VP-18-08-XX-XX	200	246	223	23	173-175	Native Sample
		74VP-18-08-XX-XX	200	246	223	23	183-185	Native Sample
		74VP-18-08-XX-XX	200	246	223	23	193-195	Native Sample
	74VP-18-09	74VP-18-09-XX-XX	100	236	223	13	13-15	Native Sample
		74VP-18-09-XX-XX	100	236	223	13	23-25	Native Sample
		74VP-18-09-XX-XX	100	236	223	13	33-35	Native Sample
		74VP-18-09-XX-XX	100	236	223	13	43-45	Native Sample
		74VP-18-09-XX-XX	100	236	223	13	53-55	Native Sample
		74VP-18-09-XX-XX	100	236	223	13	63-65	Native Sample
		74VP-18-09-XX-XX	100	236	223	13	73-75	Native Sample
		74VP-18-09-XX-XX	100	236	223	13	83-85	Native Sample
		74VP-18-09-XX-XX	100	236	223	13	93-95	Native Sample
	74VP-18-10	74VP-18-10-XX-XX	100	230	223	7	7-9	Native Sample
		74VP-18-10-XX-XX	100	230	223	7	17-19	Native Sample
		74VP-18-10-XX-XX	100	230	223	7	27-29	Native Sample
		74VP-18-10-XX-XX	100	230	223	7	37-39	Native Sample
		74VP-18-10-XX-XX	100	230	223	7	47-49	Native Sample
		74VP-18-10-XX-XX	100	230	223	7	57-59	Native Sample
		74VP-18-10-XX-XX	100	230	223	7	67-69	Native Sample
		74VP-18-10-XX-XX	100	230	223	7	77-79	Native Sample
		74VP-18-10-XX-XX	100	230	223	7	87-89	Native Sample
		74VP-18-10-XX-XX	100	230	223	7	97-99	Native Sample
	74VP-18-11	74VP-18-11-XX-XX	200	246	223	23	23-25	Native Sample
		74VP-18-11-XX-XX	200	246	223	23	33-35	Native Sample
		74VP-18-11-XX-XX	200	246	223	23	43-45	Native Sample
		74VP-18-11-XX-XX	200	246	223	23	53-55	Native Sample
		74VP-18-11-XX-XX	200	246	223	23	63-65	Native Sample
		74VP-18-11-XX-XX	200	246	223	23	73-75	Native Sample
		74VP-18-11-XX-XX	200	246	223	23	83-85	Native Sample
		74VP-18-11-XX-XX	200	246	223	23	93-95	Native Sample
		74VP-18-11-XX-XX	200	246	223	23	103-105	Native Sample
		74VP-18-11-XX-XX	200	246	223	23	113-115	Native Sample
		74VP-18-11-XX-XX	200	246	223	23	123-125	Native Sample
		74VP-18-11-XX-XX	200	246	223	23	133-135	Native Sample
		74VP-18-11-XX-XX	200	246	223	23	143-145	Native Sample
		74VP-18-11-XX-XX	200	246	223	23	153-155	Native Sample
		74VP-18-11-XX-XX	200	246	223	23	163-165	Native Sample
		74VP-18-11-XX-XX	200	246	223	23	173-175	Native Sample
		74VP-18-11-XX-XX	200	230	223	23	183-185	Native Sample
		74VP-18-11-XX-XX	200	230	223	23	193-195	Native Sample
AOC-75	75VP-18-01	75VP-18-01-XX-XX	100	250	230	20	20-22	Native Sample
		75VP-18-01-XX-XX	100	250	230	20	30-32	Native Sample
		75VP-18-01-XX-XX	100	250	230	20	40-42	Native Sample
		75VP-18-01-XX-XX	100	250	230	20	50-52	Native Sample
		75VP-18-01-XX-XX	100	250	230	20	60-62	Native Sample
		75VP-18-01-XX-XX	100	250	230	20	70-72	Native Sample
		75VP-18-01-XX-XX	100	250	230	20	80-82	Native Sample
		75VP-18-01-XX-XX	100	250	230	20	90-92	Native Sample
	75VP-18-02	75VP-18-02-XX-XX	100	250	230	20	20-22	Native Sample
		75VP-18-02-XX-XX	100	250	230	20	30-32	Native Sample
		75VP-18-02-XX-XX	100	250	230	20	40-42	Native Sample
		75VP-18-02-XX-XX	100	250	230	20	50-52	Native Sample
		75VP-18-02-XX-XX	100	250	230	20	60-62	Native Sample
		75VP-18-02-XX-XX	100	250	230	20	70-72	Native Sample
		75VP-18-02-XX-XX	100	250	230	20	80-82	Native Sample
		75VP-18-02-XX-XX	100	250	230	20	90-92	Native Sample
	75VP-18-03	75VP-18-03-XX-XX	100	246	230	16	16-18	Native Sample
		75VP-18-03-XX-XX	100	246	230	16	26-28	Native Sample
		75VP-18-03-XX-XX	100	246	230	16	36-38	Native Sample
		75VP-18-03-XX-XX	100	246	230	16	46-48	Native Sample
		75VP-18-03-XX-XX	100	246	230	16	56-58	Native Sample
		75VP-18-03-XX-XX	100	246	230	16	66-68	Native Sample

Table 2
Area 1 Groundwater Vertical Profiling Sampling Summary
Area 1 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name**	Estimated Maximum Target Depth (ft bgs) *	Ground Surface Elevation (ft msl)	Water Table Elevation from the SI or LTM (ft msl)	Approximate Depth to Groundwater (ft bgs)**	Proposed Sample Depth (ft bgs)**	Sample Type
		75VP-18-03-XX-XX	100	246	230	16	76-78	Native Sample
		75VP-18-03-XX-XX	100	246	230	16	86-88	Native Sample
	75VP-18-04	75VP-18-04-XX-XX	100	246	230	16	16-18	Native Sample
		75VP-18-04-XX-XX	100	246	230	16	26-28	Native Sample
		75VP-18-04-XX-XX	100	246	230	16	36-38	Native Sample
		75VP-18-04-XX-XX	100	246	230	16	46-48	Native Sample
		75VP-18-04-XX-XX	100	246	230	16	56-58	Native Sample
		75VP-18-04-XX-XX	100	246	230	16	66-68	Native Sample
		75VP-18-04-XX-XX	100	246	230	16	76-78	Native Sample
		75VP-18-04-XX-XX	100	246	230	16	86-88	Native Sample
	75VP-18-05	75VP-18-05-XX-XX	100	243	230	13	13-15	Native Sample
		75VP-18-05-XX-XX	100	243	230	13	23-25	Native Sample
		75VP-18-05-XX-XX	100	243	230	13	33-35	Native Sample
		75VP-18-05-XX-XX	100	243	230	13	43-45	Native Sample
		75VP-18-05-XX-XX	100	243	230	13	53-55	Native Sample
		75VP-18-05-XX-XX	100	243	230	13	63-65	Native Sample
		75VP-18-05-XX-XX	100	243	230	13	73-75	Native Sample
		75VP-18-05-XX-XX	100	243	230	13	83-85	Native Sample
		75VP-18-05-XX-XX	100	243	230	13	93-95	Native Sample
	75VP-18-06	75VP-18-06-XX-XX	100	243	230	13	13-15	Native Sample
		75VP-18-06-XX-XX	100	243	230	13	23-25	Native Sample
		75VP-18-06-XX-XX	100	243	230	13	33-35	Native Sample
		75VP-18-06-XX-XX	100	243	230	13	43-45	Native Sample
		75VP-18-06-XX-XX	100	243	230	13	53-55	Native Sample
		75VP-18-06-XX-XX	100	243	230	13	63-65	Native Sample
		75VP-18-06-XX-XX	100	243	230	13	73-75	Native Sample
		75VP-18-06-XX-XX	100	243	230	13	83-85	Native Sample
		75VP-18-06-XX-XX	100	243	230	13	93-95	Native Sample
	75VP-18-07	75VP-18-07-XX-XX	100	247	231	16	16-18	Native Sample
		75VP-18-07-XX-XX	100	247	231	16	26-28	Native Sample
		75VP-18-07-XX-XX	100	247	231	16	36-38	Native Sample
		75VP-18-07-XX-XX	100	247	231	16	46-48	Native Sample
		75VP-18-07-XX-XX	100	247	231	16	56-58	Native Sample
		75VP-18-07-XX-XX	100	247	231	16	66-68	Native Sample
		75VP-18-07-XX-XX	100	247	231	16	76-78	Native Sample
		75VP-18-07-XX-XX	100	247	231	16	86-88	Native Sample
	75VP-18-08	75VP-18-08-XX-XX	100	246	230	16	16-18	Native Sample
		75VP-18-08-XX-XX	100	246	230	16	26-28	Native Sample
		75VP-18-08-XX-XX	100	246	230	16	36-38	Native Sample
		75VP-18-08-XX-XX	100	246	230	16	46-48	Native Sample
		75VP-18-08-XX-XX	100	246	230	16	56-58	Native Sample
		75VP-18-08-XX-XX	100	246	230	16	66-68	Native Sample
		75VP-18-08-XX-XX	100	246	230	16	76-78	Native Sample
		75VP-18-08-XX-XX	100	246	230	16	86-88	Native Sample
	75VP-18-09	75VP-18-09-XX-XX	100	246	230	16	16-18	Native Sample
		75VP-18-09-XX-XX	100	246	230	16	26-28	Native Sample
		75VP-18-09-XX-XX	100	246	230	16	36-38	Native Sample
		75VP-18-09-XX-XX	100	246	230	16	46-48	Native Sample
		75VP-18-09-XX-XX	100	246	230	16	56-58	Native Sample
		75VP-18-09-XX-XX	100	246	230	16	66-68	Native Sample
		75VP-18-09-XX-XX	100	246	230	16	76-78	Native Sample
		75VP-18-09-XX-XX	100	246	230	16	86-88	Native Sample
Grove Pond	GPVP-18-01	GPVP-18-01-XX-XX	50	220	215	5	5-7	Native Sample
		GPVP-18-01-XX-XX	50	220	215	5	15-17	Native Sample
		GPVP-18-01-XX-XX	50	220	215	5	25-27	Native Sample
		GPVP-18-01-XX-XX	50	220	215	5	35-37	Native Sample
		GPVP-18-01-XX-XX	50	220	215	5	45-47	Native Sample
	GPVP-18-02	GPVP-18-02-XX-XX	50	236	216	20	20-22	Native Sample
		GPVP-18-02-XX-XX	50	236	216	20	30-32	Native Sample
		GPVP-18-02-XX-XX	50	236	216	20	40-42	Native Sample
	GPVP-18-03	GPVP-18-03-XX-XX	50	240	215	25	25-27	Native Sample
		GPVP-18-03-XX-XX	50	240	215	25	35-37	Native Sample
		GPVP-18-03-XX-XX	50	240	215	25	45-47	Native Sample

Table 2
Area 1 Groundwater Vertical Profiling Sampling Summary
Area 1 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name**	Estimated Maximum Target Depth (ft bgs) *	Ground Surface Elevation (ft msl)	Water Table Elevation from the SI or LTM (ft msl)	Approximate Depth to Groundwater (ft bgs)**	Proposed Sample Depth (ft bgs)**	Sample Type
	GPVP-18-04	GPVP-18-04-XX-XX	50	230	215	15	15-17	Native Sample
		GPVP-18-04-XX-XX	50	230	215	15	25-27	Native Sample
		GPVP-18-04-XX-XX	50	230	215	15	35-37	Native Sample
		GPVP-18-04-XX-XX	50	230	215	15	45-47	Native Sample
	GPVP-18-05	GPVP-18-05-XX-XX	100	245	215	30	30-32	Native Sample
		GPVP-18-05-XX-XX	100	245	215	30	40-42	Native Sample
		GPVP-18-05-XX-XX	100	245	215	30	50-52	Native Sample
		GPVP-18-05-XX-XX	100	245	215	30	60-62	Native Sample
		GPVP-18-05-XX-XX	100	245	215	30	70-72	Native Sample
		GPVP-18-05-XX-XX	100	245	215	30	80-82	Native Sample
		GPVP-18-05-XX-XX	100	245	215	30	90-92	Native Sample
	GPVP-18-06	GPVP-18-06-XX-XX	100	255	215	40	40-42	Native Sample
		GPVP-18-06-XX-XX	100	255	215	40	50-52	Native Sample
		GPVP-18-06-XX-XX	100	255	215	40	60-62	Native Sample
		GPVP-18-06-XX-XX	100	255	215	40	70-72	Native Sample
		GPVP-18-06-XX-XX	100	255	215	40	80-82	Native Sample
		GPVP-18-06-XX-XX	100	255	215	40	90-92	Native Sample
	GPVP-18-07	GPVP-18-07-XX-XX	100	255	215	40	40-42	Native Sample
		GPVP-18-07-XX-XX	100	255	215	40	50-52	Native Sample
		GPVP-18-07-XX-XX	100	255	215	40	60-62	Native Sample
		GPVP-18-07-XX-XX	100	255	215	40	70-72	Native Sample
		GPVP-18-07-XX-XX	100	255	215	40	80-82	Native Sample
		GPVP-18-07-XX-XX	100	255	215	40	90-92	Native Sample
	GPVP-18-08	GPVP-18-08-XX-XX	100	255	215	40	40-42	Native Sample
		GPVP-18-08-XX-XX	100	255	215	40	50-52	Native Sample
		GPVP-18-08-XX-XX	100	255	215	40	60-62	Native Sample
		GPVP-18-08-XX-XX	100	255	215	40	70-72	Native Sample
		GPVP-18-08-XX-XX	100	255	215	40	80-82	Native Sample
		GPVP-18-08-XX-XX	100	255	215	40	90-92	Native Sample
	GPVP-18-09	GPVP-18-09-XX-XX	100	250	215	35	35-37	Native Sample
		GPVP-18-09-XX-XX	100	250	215	35	45-47	Native Sample
		GPVP-18-09-XX-XX	100	250	215	35	55-57	Native Sample
		GPVP-18-09-XX-XX	100	250	215	35	65-67	Native Sample
		GPVP-18-09-XX-XX	100	250	215	35	75-77	Native Sample
		GPVP-18-09-XX-XX	100	250	215	35	85-87	Native Sample
		GPVP-18-09-XX-XX	100	250	215	35	95-97	Native Sample
	GPVP-18-10	GPVP-18-10-XX-XX	100	235	215	20	20-22	Native Sample
		GPVP-18-10-XX-XX	100	235	215	20	30-32	Native Sample
		GPVP-18-10-XX-XX	100	235	215	20	40-42	Native Sample
		GPVP-18-10-XX-XX	100	235	215	20	50-52	Native Sample
		GPVP-18-10-XX-XX	100	235	215	20	60-62	Native Sample
		GPVP-18-10-XX-XX	100	235	215	20	70-72	Native Sample
		GPVP-18-10-XX-XX	100	235	215	20	80-82	Native Sample
		GPVP-18-10-XX-XX	100	235	215	20	90-92	Native Sample
	GPVP-18-11	GPVP-18-11-XX-XX	100	237	215	22	22-24	Native Sample
		GPVP-18-11-XX-XX	100	237	215	22	32-34	Native Sample
		GPVP-18-11-XX-XX	100	237	215	22	42-44	Native Sample
		GPVP-18-11-XX-XX	100	237	215	22	52-54	Native Sample
		GPVP-18-11-XX-XX	100	237	215	22	62-64	Native Sample
		GPVP-18-11-XX-XX	100	237	215	22	72-74	Native Sample
		GPVP-18-11-XX-XX	100	237	215	22	82-84	Native Sample
		GPVP-18-11-XX-XX	100	237	215	22	92-94	Native Sample
	GPVP-18-12	GPVP-18-12-XX-XX	100	225	215	10	10-12	Native Sample
		GPVP-18-12-XX-XX	100	225	215	10	20-22	Native Sample
		GPVP-18-12-XX-XX	100	225	215	10	30-32	Native Sample
		GPVP-18-12-XX-XX	100	225	215	10	40-42	Native Sample
		GPVP-18-12-XX-XX	100	225	215	10	50-52	Native Sample
		GPVP-18-12-XX-XX	100	225	215	10	60-62	Native Sample
		GPVP-18-12-XX-XX	100	225	215	10	70-72	Native Sample
		GPVP-18-12-XX-XX	100	225	215	10	80-82	Native Sample
		GPVP-18-12-XX-XX	100	225	215	10	90-92	Native Sample
QC samples***	TBD	57VP-DUP18-XX	NA	NA	NA	NA	NA	Field Duplicate
	TBD	74VP-18-XX-XX-XX	NA	NA	NA	NA	NA	MS/MSD
		75VP-EB-XX	NA	NA	NA	NA	NA	Equipment Blank

Table 2
Area 1 Groundwater Vertical Profiling Sampling Summary
Area 1 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name**	Estimated Maximum Target Depth (ft bgs) *	Ground Surface Elevation (ft msl)	Water Table Elevation from the SI or LTM (ft msl)	Approximate Depth to Groundwater (ft bgs)**	Proposed Sample Depth (ft bgs)**	Sample Type
		GPVP-FRB-XX	NA	NA	NA	NA	NA	Field Reagent Blank

Notes:

All samples will be analyzed for PFAS analysis via isotope dilution.

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.

* Estimated maximum target depth is anticipated depth to bedrock based on a review of the Surficial Geology overlay from MassGIS (https://maps.massgis.state.ma.us/map_ol/oliver.php). 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. Depth to bedrock may be confirmed at select locations during installation of long-term monitoring wells.

** Approximate depth to groundwater and proposed sample depths are for planning purposes and are estimated from water table elevations observed at nearby temporary wells or long-term monitoring wells sampled during the SI or LTM activities. 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 per week. The frequency will be applied to all of Area 1. Equipment blanks only collected if non-disposal equipment is used.

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
QC = quality control
LTM = long-term monitoring program
MS/MSD = matrix spike/matrix spike duplicate
MSL = mean sea level
NA = not applicable
ft bgs = feet below ground surface
SI = site inspection

Table 3
Area 1 Existing Monitoring Well Sampling Summary
Area 1 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Well Identifier	Sample Name*	Sample Type
AOC 57 Area 2	57M-03-01X	57M-03-01X-MONYY	Native Sample
	57M-03-02X	57M-03-02X-MONYY	Native Sample
	57M-03-03X	57M-03-03X-MONYY	Native Sample
	57M-03-04X	57M-03-04X-MONYY	Native Sample
	57M-03-05X	57M-03-05X-MONYY	Native Sample
	57M-03-06X	57M-03-06X-MONYY	Native Sample
	57M-95-05X	57M-95-05X-MONYY	Native Sample
	57M-95-06X	57M-95-06X-MONYY	Native Sample
	57M-95-07X	57M-95-07X-MONYY	Native Sample
	57WP-05-01	57WP-05-01-MONYY	Native Sample
	57WP-06-02	57WP-06-02-MONYY	Native Sample
AOC 57 Area 3	57M-95-03X	57M95-03X-MONYY	Native Sample
	57M-96-10X	57M96-10X-MONYY	Native Sample
	57M-96-11X	57M96-11X-MONYY	Native Sample
	57M-96-12X	57M-96-12X-MONYY	Native Sample
	57M-96-13X	57M96-13X-MONYY	Native Sample
	57P-98-03X	57P-98-03X-MONYY	Native Sample
	57P-98-04X	57P-98-04X-MONYY	Native Sample
	57WP-06-03	57WP-06-03-MONYY	Native Sample
AOC 57 QC Samples**	57M-03-06X	57M-FD-01	Field Duplicate
	57M-96-12X	57M-FD-02	Field Duplicate
	57M96-11X	57M96-11X-MONYY	MS/MSD
		57M-EB-01	Equipment Blank
		57M-FRB-01	Field Reagant Blank
AOC 74 Irrigation Well	74-IG01	74-IG01-MONYY	Native Sample
Grove Pond Area	92-5	92-5-MONYY	Native Sample
	92-4	92-4-MONYY	Native Sample
	92-3	92-3-MONYY	Native Sample
	92-2	92-2-MONYY	Native Sample
	92-1	92-1-MONYY	Native Sample
	CSMS-11-01	CSMS-11-01-MONYY	Native Sample
	CSMS-11-02	CSMS-11-02-MONYY	Native Sample
	GF-1	GF-1-MONYY	Native Sample
	GF-2	GF-2-MONYY	Native Sample
	GF-3A	GF-3A-MONYY	Native Sample
	GF-3B	GF-3B-MONYY	Native Sample
	GF-4	GF-4-MONYY	Native Sample
	MNG-2R	MNG-2R-MONYY	Native Sample
	MNG-3R	MNG-3R-MONYY	Native Sample
	MNG-5R	MNG-5R-MONYY	Native Sample
	MNG-6R	MNG-6R-MONYY	Native Sample

Table 3
Area 1 Existing Monitoring Well Sampling Summary
Area 1 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Well Identifier	Sample Name*	Sample Type
QC Samples**	57M-03-06X	57M-FD-01	Field Duplicate
	57M-96-12X	57M-FD-02	Field Duplicate
	57M96-11X	57M96-11X-MONYY	MS/MSD
	NA	57M-EB-01	Equipment Blank
	NA	57M-FRB-01	Field Reagant Blank
	MNG-3R	GPM-FD01	Field Duplicate
	CSMS-11-02	GPM-FD02	Field Duplicate
	CSMS-11-01	CSMS-11-01-MONYY	MS/MSD
	NA	GPM-EB-01	Equipment Blank
	NA	GPM-FRB-01	Field Reagant Blank

Notes:
All samples will be analzyed for PFAS via isotope dilution. Analyte list is specified in UFP-QAPP Worksheet #15.
* = The sample name for native samples 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 1. Equipment blanks only collected if non-disposal equipment is used.

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 4
Area 1 Existing Monitoring Well Construction Information
Area 1 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Monitoring Well	Well Screen Interval (ft NGVD)	Well Screen Interval (ft BTOC)	Well Screen Interval (ft bgs)	Top of Casing Elevation (ft NGVD)	Ground Surface Elevation (ft NGVD)
AOC-57 Area 2					
57M-03-01X	215.50 – 225.50	12.40 - 22.40	10.00 - 20.40	237.90	235.50
57M-03-02X	213.30 – 223.30	3.80 - 13.80	2.00 - 12.00	227.10	225.30
57M-03-03X	210.34 – 220.34	3.30 - 13.30	2.00 - 12.00	223.64	222.34
57M-03-04X	210.22 – 220.22	3.80 - 13.80	2.00 - 12.00	224.02	222.22
57M-03-05X	214.87 – 224.87	3.90 - 13.90	2.00 - 12.00	224.33	222.43
57M-03-06X	212.34 – 222.34	3.50 - 13.50	2.00 - 12.00	224.56	223.06
57M-95-05X	215.48 - 225.48	12.44 - 22.44	10.00 - 20.00	237.31	234.87
57M-95-06X	214.87 – 224.87	14.22 - 24.22	12.08- 22.08	236.56	234.42
57M-95-07X	212.34 – 222.34	4.21 - 14.21	3.00 - 13.00	224.57	223.36
57WP-05-01	--	2.00 - 4.00	0.00 - 2.00	--	--
57WP-06-02	202.91 - 197.91	20.00 - 25.00	19.00 - 24.00	222.91	--
AOC-57 Area 3					
57M-95-03X	215.48 - 225.48	9.49 - 19.49	7.00 - 17.00	234.97	232.48
57M-96-10X	214.09 - 224.09	5.46 - 15.46	3.00 - 13.00	229.55	227.09
57M-96-11X	210.18 - 220.18	4.20 - 14.20	2.00 - 12.00	224.38	222.18
57M-96-12X	212.82 - 222.82	5.05 - 15.05	2.00 - 12.00	227.87	224.82
57M-96-13X	213.06 - 223.06	4.67 - 14.67	2.00 - 12.00	227.73	225.06
57P-98-03X	--	4.50 - 7.50	2.50 - 5.50	222.58	--
57P-98-04X	--	4.81 -7.81	2.00 - 5.00	223.72	--
57WP-06-03	202.69 - 207.69	15.00 - 20.00	--	222.69	--
AOC-74					
74IG-01**	--	505**	--	--	--
Grove Pond Well Field					
92-5	182.16 - 188.16	36.00 - 42.00	35.00 - 41.00	223.64	221.74
92-4	180.84 - 184.84	70.01 - 74.01	67.00 - 71.00	254.85	251.84
92-3	162.67 - 168.67	51.01 - 57.01	49.00 - 55.00	219.68	217.67
92-2	210.84 - 216.84	38.01 - 44.01	35.00 - 41.00	254.85	251.84
92-1	166.74 172.74	50.90 - 56.90	49.00 - 55.00	224.16	223.16
CSMS-11-01	214.3 - 224.3	33.02 - 43.02	30.00 - 40.00	253.60*	250.70*
CSMS-11-02	212.7 - 222.7	33.19 - 43.19	30.00 - 40.00	252.04*	248.90*
GF-1	100.33 - 105.33	118.61 - 123.61	116.00 - 121.00	223.94	221.33

Table 4
Area 1 Existing Monitoring Well Construction Information
Area 1 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Monitoring Well	Well Screen Interval	Well Screen Interval	Well Screen Interval	Top of Casing Elevation	Ground Surface Elevation
	(ft NGVD)	(ft BTOC)	(ft bgs)	(ft NGVD)	(ft NGVD)
GF-2	100.87 - 107.87	115.69 - 122.69	114.00 - 121.00	223.56	221.87
GF-3A	116.81 - 121.81	99.15 - 104.15	97.00 - 102.00	220.96	218.81
GF-3B	205.90 - 210.90	10.02 - 15.02	8.00 - 13.00	220.92	218.9
GF-4	140.58 145.58	80.64 - 85.64	79.00 - 84.00	226.22	224.58
MNG-2R				236.08*	233.50*
MNG-3R				254.36*	251.50*
MNG-4R				235.91*	233.50*
MNG-5R				252.39*	249.70*

Notes:
* = Elevations are feet in NAVD88
** = Landscape irrigation well that is located at AOC 74 with a reported total depth of 505 feet below ground surface.
-- = Information is not available

AOC = area of contamination
bgs = below ground surface
BTOC = below top to casing
ft = feet
NGVD = National Geodetic Vertical Datum 1929

Table 5
Area 1 Soil Boring Sampling Summary
Area 1 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
AOC57 Area 1	5701SB-18-01	5701SB-18-01-0-0.5	0-0.5	7	Native Sample
		5701SB-18-01-0.5-3	0.5-3	7	Native Sample
		5701SB-18-01-3-5	3-5	7	Native Sample
		5701SB-18-01-5-7	5-7	7	Native Sample
	5701SB-18-02	5701SB-18-02-0-0.5	0-0.5	5	Native Sample
		5701SB-18-02-0.5-3	0.5-3	5	Native Sample
		5701SB-18-02-3-5	3-5	5	Native Sample
AOC 57 Area 2	5702SB-18-01	5702SB-18-01-0-0.5	0-0.5	12	Native Sample
		5702SB-18-01-0.5-3	0.5-3	12	Native Sample
		5702SB-18-01-3-7	3-7	12	Native Sample
		5702SB-18-01-7-10	7-10	12	Native Sample
		5702SB-18-01-10-12	10-12	12	Native Sample
	5702SB-18-02	5702SB-18-02-0-0.5	0-0.5	12	Native Sample
		5702SB-18-02-0.5-3	0.5-3	12	Native Sample
		5702SB-18-02-3-7	3-7	12	Native Sample
		5702SB-18-02-7-10	7-10	12	Native Sample
		5702SB-18-02-10-12	10-12	12	Native Sample
	5702SB-18-03	5702SB-18-03-0-0.5	0-0.5	12	Native Sample
		5702SB-18-03-0.5-3	0.5-3	12	Native Sample
		5702SB-18-03-3-7	3-7	12	Native Sample
		5702SB-18-03-7-10	7-10	12	Native Sample
		5702SB-18-03-10-12	10-12	12	Native Sample
	5702SB-18-04	5702SB-18-04-0-0.5	0-0.5	10	Native Sample
		5702SB-18-04-0.5-3	0.5-3	10	Native Sample
		5702SB-18-04-3-7	3-7	10	Native Sample
		5702SB-18-04-7-8	7-8	10	Native Sample
		5702SB-18-04-8-10	8-10	10	Native Sample
	5702SB-18-05	5702SB-18-05-0-0.5	0-0.5	10	Native Sample
		5702SB-18-05-0.5-3	0.5-3	10	Native Sample
		5702SB-18-05-3-7	3-7	10	Native Sample
		5702SB-18-05-7-8	7-8	10	Native Sample
		5702SB-18-05-8-10	8-10	10	Native Sample
	5702SB-18-06	5702SB-18-06-0-0.5	0-0.5	10	Native Sample
		5702SB-18-06-0.5-3	0.5-3	10	Native Sample
		5702SB-18-06-3-7	3-7	10	Native Sample
		5702SB-18-06-7-8	7-8	10	Native Sample
		5702SB-18-06-8-10	8-10	10	Native Sample
AOC 57 Area 3	5703SB-18-01	5703SB-18-01-0-0.5	0-0.5	11	Native Sample
		5703SB-18-01-0.5-3	0.5-3	11	Native Sample
		5703SB-18-01-3-7	3-7	11	Native Sample
		5703SB-18-01-7-9	7-9	11	Native Sample
		5703SB-18-01-9-11	9-11	11	Native Sample

Table 5
Area 1 Soil Boring Sampling Summary
Area 1 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
	5703SB-18-02	5703SB-18-02-0-0.5	0-0.5	11	Native Sample
		5703SB-18-02-0.5-3	0.5-3	11	Native Sample
		5703SB-18-02-3-7	3-7	11	Native Sample
		5703SB-18-02-7-9	7-9	11	Native Sample
		5703SB-18-02-9-11	9-11	11	Native Sample
	5703SB-18-03	5703SB-18-03-0-0.5	0-0.5	11	Native Sample
		5703SB-18-03-0.5-3	0.5-3	11	Native Sample
		5703SB-18-03-3-7	3-7	11	Native Sample
		5703SB-18-03-7-9	7-9	11	Native Sample
		5703SB-18-03-9-11	9-11	11	Native Sample
	5703SB-18-04	5703SB-18-04-0-0.5	0-0.5	5	Native Sample
		5703SB-18-04-0.5-3	0.5-3	5	Native Sample
		5703SB-18-04-3-7	3-5	5	Native Sample
AOC 74	74SB-18-01	74SB-18-01-0-0.5	0-0.5	13	Native Sample
		74SB-18-01-0.5-3	0.5-3	13	Native Sample
		74SB-18-01-3-7	3-7	13	Native Sample
		74SB-18-01-7-11	7-11	13	Native Sample
		74SB-18-01-11-13	11-13	13	Native Sample
	74SB-18-02	74SB-18-02-0-0.5	0-0.5	13	Native Sample
		74SB-18-02-0.5-3	0.5-3	13	Native Sample
		74SB-18-02-3-7	3-7	13	Native Sample
		74SB-18-02-7-11	7-11	13	Native Sample
		74SB-18-02-11-13	11-13	13	Native Sample
	74SB-18-03	74SB-18-03-0-0.5	0-0.5	13	Native Sample
		74SB-18-03-0.5-3	0.5-3	13	Native Sample
		74SB-18-03-3-7	3-7	13	Native Sample
		74SB-18-03-7-11	7-11	13	Native Sample
		74SB-18-03-11-13	11-13	13	Native Sample
	74SB-18-04	74SB-18-04-0-0.5	0-0.5	13	Native Sample
		74SB-18-04-0.5-3	0.5-3	13	Native Sample
		74SB-18-04-3-7	3-7	13	Native Sample
		74SB-18-04-7-11	7-11	13	Native Sample
		74SB-18-04-11-13	11-13	13	Native Sample
	74SB-18-05	74SB-18-05-0-0.5	0-0.5	23	Native Sample
		74SB-18-05-0.5-3	0.5-3	23	Native Sample
		74SB-18-05-3-7	3-7	23	Native Sample
		74SB-18-05-7-13	7-15	23	Native Sample
		74SB-18-05-21-23	21-23	23	Native Sample
	74SB-18-06	74SB-18-06-0-0.5	0-0.5	7	Native Sample
		74SB-18-06-0.5-3	0.5-3	7	Native Sample
		74SB-18-06-3-5	3-5	7	Native Sample
		74SB-18-06-5-7	5-7	7	Native Sample

Table 5
Area 1 Soil Boring Sampling Summary
Area 1 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
	74SB-18-07	74SB-18-07-0-0.5	0-0.5	23	Native Sample
		74SB-18-07-0.5-3	0.5-3	23	Native Sample
		74SB-18-07-3-7	3-7	23	Native Sample
		74SB-18-07-7-13	7-15	23	Native Sample
		74SB-18-07-21-23	21-23	23	Native Sample
AOC 75	75SB-18-01	75SB-18-01-0-0.5	0-0.5	20	Native Sample
		75SB-18-01-0.5-3	0.5-3	20	Native Sample
		75SB-18-01-3-7	3-7	20	Native Sample
		75SB-18-01-7-15	7-15	20	Native Sample
		75SB-18-01-18-20	18-20	20	Native Sample
	75SB-18-02	75SB-18-02-0-0.5	0-0.5	20	Native Sample
		75SB-18-02-0.5-3	0.5-3	20	Native Sample
		75SB-18-02-3-7	3-7	20	Native Sample
		75SB-18-02-7-15	7-15	20	Native Sample
		75SB-18-02-18-20	18-20	20	Native Sample
	75SB-18-03	75SB-18-03-0-0.5	0-0.5	20	Native Sample
		75SB-18-03-0.5-3	0.5-3	20	Native Sample
		75SB-18-03-3-7	3-7	20	Native Sample
		75SB-18-03-7-15	7-15	20	Native Sample
		75SB-18-03-18-20	18-20	20	Native Sample
	75SB-18-04	75SB-18-04-0-0.5	0-0.5	20	Native Sample
		75SB-18-04-0.5-3	0.5-3	20	Native Sample
		75SB-18-04-3-7	3-7	20	Native Sample
		75SB-18-04-7-15	7-15	20	Native Sample
		75SB-18-04-18-20	18-20	20	Native Sample
	75SB-18-05	75SB-18-05-0-0.5	0-0.5	20	Native Sample
		75SB-18-05-0.5-3	0.5-3	20	Native Sample
		75SB-18-05-3-7	3-7	20	Native Sample
		75SB-18-05-7-15	7-15	20	Native Sample
		75SB-18-05-18-20	18-20	20	Native Sample
	75SB-18-06	75SB-18-06-0-0.5	0-0.5	20	Native Sample
		75SB-18-06-0.5-3	0.5-3	20	Native Sample
		75SB-18-06-3-7	3-7	20	Native Sample
		75SB-18-06-7-15	7-15	20	Native Sample
		75SB-18-06-18-20	18-20	20	Native Sample
	75SB-18-07	75SB-18-07-0-0.5	0-0.5	20	Native Sample
		75SB-18-07-0.5-3	0.5-3	20	Native Sample
		75SB-18-07-3-7	3-7	20	Native Sample
		75SB-18-07-7-15	7-15	20	Native Sample
		75SB-18-07-18-20	18-20	20	Native Sample

Table 5
Area 1 Soil Boring Sampling Summary
Area 1 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
Grove Pond Contingency Borings	Up to 9 are planned (GPSB-18-01 through -18-09)	to be determined	0-0.5	to be determined	Native Sample
			0.5-3		Native Sample
			3-7		Native Sample
			7-15		Native Sample
			21-23		Native Sample
QC Samples****		57SB-DUP-18-XX	NA	NA	Field Duplicate
		74SB-18-01-XX-XX	NA	NA	MS/MSD
		74SB-EB-XX	NA	NA	Equipment Blank
		75SB-FRB-XX	NA	NA	Field Reagent 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.

** Soil samples will be collected from the following intervals: 0-0.5 ft bgs, 0.5 – 3 ft bgs, 3-7 ft bgs, 7-15 ft bgs, and within 2 ft of the water table.

*** 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.

**** 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 1. 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 1 New Monitoring Well Rationale
Area 1 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
Area of Contamination 57, Area 1					
3	If PFAS contamination is determined to exist in AOC 57 Area 1 though groundwater vertical profiling activities, installation of up to three new monitoring wells is estimated. Locations will be based on a review of vertical profile data. The groundwater monitoring well network will be designed to monitor groundwater within the area of PFAS impacted groundwater as well as provide bounding wells upgradient, cross gradient and downgradient.	Yes, at select locations for the length 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.
Area of Contamination 57, Area 2					
3	Installation of up to three new monitoring wells is estimated. Locations will be based on a review of vertical profile data and will augment existing monitoring wells. The PFAS groundwater monitoring well network will be designed to monitor groundwater within the area of PFAS impacted groundwater as well as provide bounding wells upgradient, cross gradient and downgradient. A nested monitoring well cluster will be installed at a location adjacent to Cold Spring Brook to measure potential for vertical gradients on the northern side of Cold Spring Brook.	Yes, at select locations for the length of the boring.	TBD	A soil sample collected from the screen setting interval at each monitoring well will be submitted for TOC analysis	Soil samples collected from select intervals at select locations will be submitted for grain-size analysis.

Table 6
Area 1 New Monitoring Well Rationale
Area 1 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
Area of Contamination 57, Area 3					
3	Installation of up to three new monitoring wells is estimated. Locations will be based on a review of vertical profile data and will augment existing monitoring wells. The PFAS groundwater monitoring well network will be designed to monitor groundwater within the area of PFAS impacted groundwater as well as provide bounding wells upgradient, cross gradient and downgradient. A nested monitoring well cluster will be installed at a location adjacent to Cold Spring Brook to measure potential for vertical gradients on the northern side of Cold Spring Brook.	Yes, at select locations for the length 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.
Area of Contamination 74					
6	Installation of up to six new monitoring wells at five locations is estimated. Locations will be based on a review of vertical profile data. The groundwater monitoring well network will be designed to monitor groundwater within the area of PFAS impacted groundwater as well as provide bounding wells upgradient, cross gradient and downgradient. A nested monitoring well cluster will be installed at the location adjacent to Cold Spring Brook, to measure potential for vertical gradients on the northern side of Cold Spring Brook.	Yes, at select locations for the length 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.

Table 6
Area 1 New Monitoring Well Rationale
Area 1 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
Area of Contamination 75					
5	Installation of up to five new monitoring wells is estimated. Locations will be based on a review of vertical profile data. The groundwater monitoring well network will be designed to monitor groundwater within the area of PFAS impacted groundwater as well as provide bounding wells upgradient, cross gradient and downgradient.	Yes, at select locations for the length 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.
Grove Pond Municipal Well Field					
10	Installation of up to 10 new monitoring wells is estimated. Locations will be based on a review of vertical profile data. The groundwater monitoring well network will be designed to monitor groundwater within the area of PFAS impacted groundwater as well as provide bounding wells upgradient, cross gradient and downgradient.	Yes, at select locations for the length 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 1 Soil Sampling During New Monitoring Well Installation Sampling Summary
Area 1 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier*	Sample Name**	Proposed Sample Depth (ft bgs)**	Sample Type
AOC 57 Area 1	5701M-18-01X	5701M-18-01X-SO-XX-XX	TBD	Native Sample
	5701M-18-02X	5701M-18-02X-SO-XX-XX	TBD	Native Sample
AOC 57 Area 2	5702M-18-01X	5702M-18-01X-SO-XX-XX	TBD	Native Sample
	5702M-18-02X	5702M-18-02X-SO-XX-XX	TBD	Native Sample
AOC 57 Area 3	5703M-18-01X	5703M-18-01X-SO-XX-XX	TBD	Native Sample
	5703M-18-02X	5703M-18-02X-SO-XX-XX	TBD	Native Sample
AOC 74	74M-18-01X	74M-18-01X-SO-XX-XX	TBD	Native Sample
	74M-18-02X	74M-18-02X-SO-XX-XX	TBD	Native Sample
AOC 75	75M-18-01X	75M-18-01X-SO-XX-XX	TBD	Native Sample
	75M-18-02X	75M-18-02X-SO-XX-XX	TBD	Native Sample
Grove Pond Area	GPM-18-01X	GPM-18-01X-SO-XX-XX	TBD	Native Sample
	GPM-18-02X	GPM-18-02X-SO-XX-XX	TBD	Native Sample
QC Samples***	75M-18-01X	75M-SO-FD-01		Field Duplicate
	74M-18-01X	74M-SO-FD-01		Field Duplicate
	74M-18-02X	74M-18-XXX-SO-XX-XX		MS/MSD
		74M-SO-EB-01		Equipment Blank
		74M-SO-FRB-01		Field Reagant Blank

Notes:

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

* It is estimated two locations at each area of investigation will be drilled during monitoring well installation and soil samples will 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 1. 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 1 New Monitoring Well Sampling Summary
Area 1 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name*	Sample Type
AOC 57 Area 1	5701M-18-01X	5701M-18-01X-MONYY	Native Sample
	5701M-18-02X	5701M-18-02X-MONYY	Native Sample
	5701M-18-03X	5701M-18-03X-MONYY	Native Sample
AOC 57 Area 2	5702M-18-01X	5702M-18-01X-MONYY	Native Sample
	5702M-18-02X	5702M-18-02X-MONYY	Native Sample
	5702M-18-03X	5702M-18-03X-MONYY	Native Sample
AOC 57 Area 3	5703M-18-01X	5703M-18-01X-MONYY	Native Sample
	5703M-18-02X	5703M-18-02X-MONYY	Native Sample
	5703M-18-03X	5703M-18-03X-MONYY	Native Sample
AOC 74	74M-18-01A	74M-18-01A-MONYY	Native Sample
	74M-18-01B	74M-18-01B-MONYY	Native Sample
	74M-18-02X	74M-18-02X-MONYY	Native Sample
	74M-18-03X	74M-18-03X-MONYY	Native Sample
	74M-18-04X	74M-18-04X-MONYY	Native Sample
	74M-18-05X	74M-18-05X-MONYY	Native Sample
AOC 75	75M-18-01A	75M-18-01X-MONYY	Native Sample
	75M-18-02X	75M-18-02X-MONYY	Native Sample
	75M-18-03X	75M-18-03X-MONYY	Native Sample
	75M-18-04X	75M-18-04X-MONYY	Native Sample
	75M-18-05X	75M-18-05X-MONYY	Native Sample
Grove Pond Area	GPM-18-01X	GPM-18-01X-MONYY	Native Sample
	GPM-18-02X	GPM-18-02X-MONYY	Native Sample
	GPM-18-03A	GPM-18-03A-MONYY	Native Sample
	GPM-18-03B	GPM-18-03B-MONYY	Native Sample
	GPM-18-04X	GPM-18-04X-MONYY	Native Sample
	GPM-18-05X	GPM-18-05X-MONYY	Native Sample
	GPM-18-06A	GPM-18-06A-MONYY	Native Sample
	GPM-18-06B	GPM-18-06B-MONYY	Native Sample
	GPM-18-07X	GPM-18-07X-MONYY	Native Sample
	GPM-18-08X	GPM-18-08X-MONYY	Native Sample

Table 8
Area 1 New Monitoring Well Sampling Summary
Area 1 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name*	Sample Type
QC Samples**	5701M-18-02X	57M-FD-01	Field Duplicate
	74M-18-02X	74M-FD-01	Field Duplicate
	GPM-18-04X	GPM-FD-01	Field Duplicate
	74M-18-03X	74M-18-03X-MONYY	MS/MSD
	75M-18-04X	75M-18-04X-MONYY	MS/MSD
		74M-EB-01	Equipment Blank
		75M-EB-01	Equipment Blank
		75M-FRB-01	Field Reagent Blank

Notes:
All samples will be analyzed for PFAS via isotope dilution. Select samples will be analyzed for total oxidazable precussor 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. The frequency will be applied to all of Area 1. 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 reagent blank
MS/MSD = matrix spike/matrix spike duplicate
QC = quality control

Table 9
Area 1 Surface Water and Sediment Sampling Summary
Area 1 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name*	Sample Matrix	Sample Type	Sample Location
Cold Spring Brook	CSB-18-01	CSB-18-01-SW-MONYY	surface water	Native Sample	Channel
		CSB-18-01-SED-MONYY	sediment	Native Sample	
	CSB-18-02	CSB-SW-18-02-SW-MONYY	surface water	Native Sample	West Shoreline
		CSB-SED-18-02-SED-MONYY	sediment	Native Sample	
	CSB-18-03	CSB-SW-18-03-SW-MONYY	surface water	Native Sample	West Shoreline
		CSB-SED-18-03-SED-MONYY	sediment	Native Sample	
	CSB-18-04	CSB-SW-18-04-SW-MONYY	surface water	Native Sample	West Shoreline
		CSB-SED-18-04-SED-MONYY	sediment	Native Sample	
	CSB-18-05	CSB-SW-18-05-SW-MONYY	surface water	Native Sample	West Shoreline
		CSB-SED-18-05-SED-MONYY	sediment	Native Sample	
	CSB-18-06	CSB-SW-18-06-SW-MONYY	surface water	Native Sample	West Shoreline
		CSB-SED-18-06-SED-MONYY	sediment	Native Sample	
	CSB-18-07	CSB-SW-18-07-SW-MONYY	surface water	Native Sample	West Shoreline
		CSB-SED-18-07-SED-MONYY	sediment	Native Sample	
	CSB-18-08	CSB-SW-18-08-SW-MONYY	surface water	Native Sample	Channel
		CSB-SED-18-08-SED-MONYY	sediment	Native Sample	
Grove Pond	GP-18-01	GP-SW-18-01-SW-MONYY	surface water	Native Sample	West Shoreline
		GP-SED-18-01-SED-MONYY	sediment	Native Sample	
	GP-18-02	GP-SW-18-02-SW-MONYY	surface water	Native Sample	West Shoreline
		GP-SED-18-02-SED-MONYY	sediment	Native Sample	
	GP-18-03	GP-SW-18-03-SW-MONYY	surface water	Native Sample	West Shoreline
		GP-SED-18-03-SED-MONYY	sediment	Native Sample	
	GP-18-4	GP-SW-18-04-SW-MONYY	surface water	Native Sample	West Shoreline
		GP-SED-18-04-SED-MONYY	sediment	Native Sample	
	GP-18-05	GP-SW-18-05-SW-MONYY	surface water	Native Sample	West Shoreline
		GP-SED-18-05-SED-MONYY	sediment	Native Sample	
Balch Pond	BP-18-01	BP-SW-18-01-SW-MONYY	surface water	Native Sample	Channel
		BP-SED-18-01-SED-MONYY	sediment	Native Sample	
Surface Water and Sediment** QC Samples	CSB-18-05	CSB-SW-FD01	surface water	Field Duplicate	NA
		CSB-SED-FD01	sediment	Field Duplicate	
	GP-18-03	GP-SW-FD02	surface water	Field Duplicate	NA
		GP-SED-FD02	sediment	Field Duplicate	
	CSB-02	GP-18-02-SW-MONYY	surface water	MS/MSD	NA
		GP-18-02-SED-MONYY	sediment	MS/MSD	
	NA	GP-SW-MONYY-EB1	NA	Equipment Blank	NA
	NA	GP-SED-MONYY-EB1	NA	Equipment Blank	NA
	NA	GP-SW-MONYY-FRB1	NA	Field Reagant Blank	NA

Notes:

All samples analyzed for PFAS via isotope dilution. Sediment samples analyzed for total oragnic 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.

** 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 AOC per piece of equipment, the FRB will be collected is at least once during the sampling event. Equipment blanks only collected if non-disposal equipment is used.

EB = equipment blank FRB = field reagant blank QC = quality control
FD = field duplicate MS/MSD = matrix spike/matrix spike duplicate

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

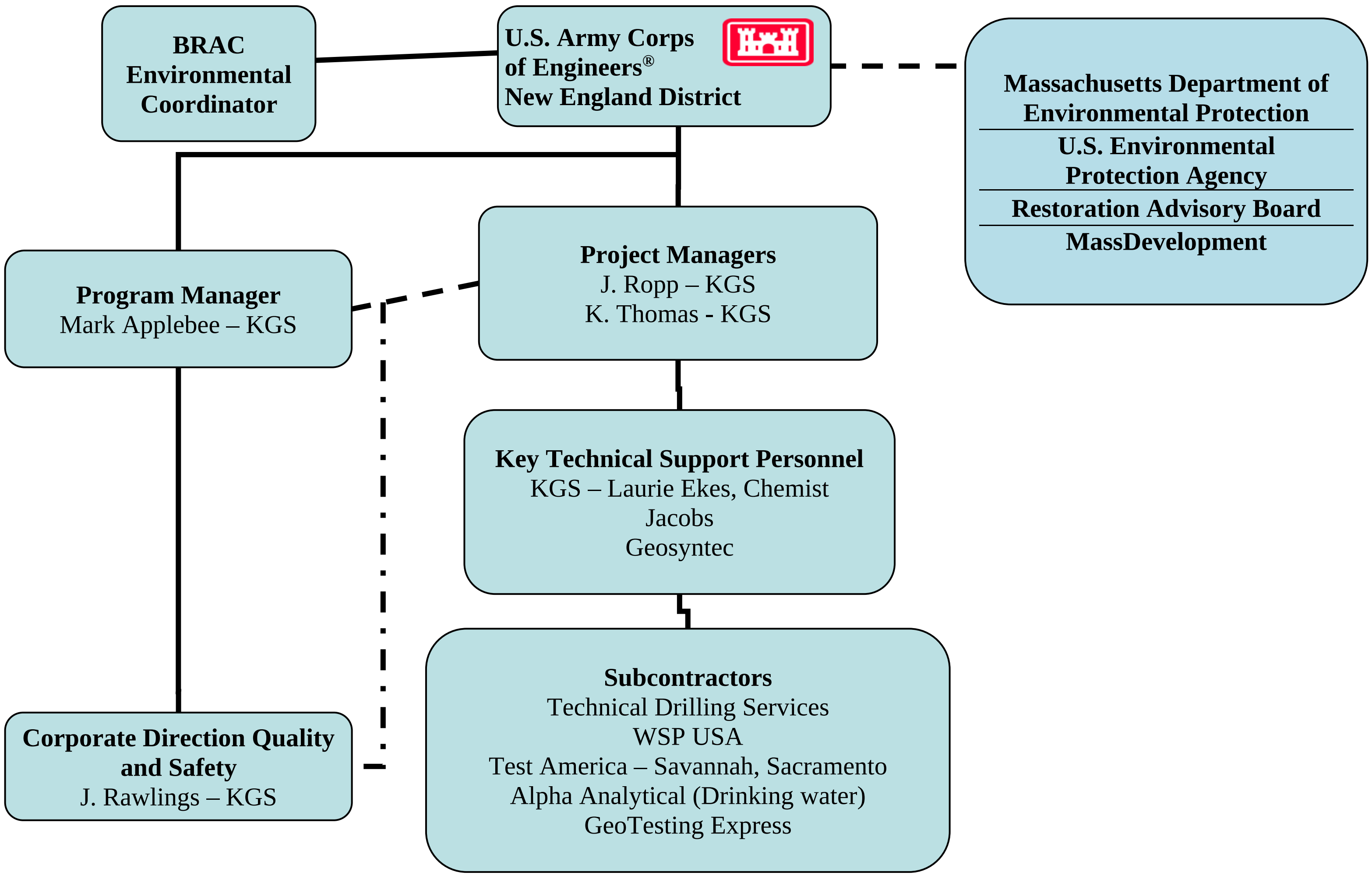
Name	Project Title	Specialized Training/Certifications	Responsibilities	Signature/Date
Jim Occhialini		Not applicable	Manages client services for Alpha Analytical.	

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 #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

QAPP Worksheets #26 & 27 – Continued

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

QAPP Worksheets #26 & 27 – Continued

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

U.S. ARMY RESPONSES TO U.S. EPA COMMENTS ON THE DRAFT AREA 1 FIELD SAMPLING PLAN ADDENDUM TO REMEDIAL INVESTIGATION WORK PLAN FOR PFAS
Former Fort Devens Army Installation, Devens, Massachusetts
8 August 2018

The following Army responses pertain to the U.S. Environmental Protection Agency (EPA) comments, dated 1 August 2018, on the draft *Area 1 Field Sampling Plan, Addendum to Remedial Investigation Work Plan for Per- and Polyfluoroalkyl Substances (PFAS), Former Fort Devens Army Installation, Devens, MA*, dated June 2018.

General Comments

Comment #1: Per EPA's (Ginny Lombardo) April 30, 2018 email to Army (Andy Van dyke), Army was required to submit a CERCLA RI Work Plan for the base-wide investigation of PFAS and area- specific Sampling and Analysis Plans (SAPs) for each phase of proposed field work (i.e. Areas 1, 2 and 3). Although Army had originally planned to prepare the RI Work Plan in accordance with 2012 UFP QAPP guidance, given the significance of this field effort and level of scrutiny that it will undoubtedly receive, EPA determined that the UFP-QAPP as a stand-along document would not satisfy the CERCLA requirements of an RI Work Plan. To ensure consistency with the CERCLA RI process and expedite commencement of field work, EPA informed Army that it must prepare and submit, for regulatory review and comment, a draft SAP (i.e. Field Sampling Plan (FSP) and QAPP) for Area 1. In addition, to ensure timely review and comment and implementation of the Area 1 field sampling program in accordance with Army's proposed schedule, EPA recommended that Army prepare the Area 1 SAP and the base-wide RI Work Plan on separate timelines. Follow-on SAPs for Areas 2 and 3 would then be provided over time as addendums to the Area 1 SAP. Ultimately, the Final RI Work Plan for the base-wide PFAS investigation would incorporate the initial SAP for Area 1, as amended for other areas, to form the completed RI Work Plan documentation.

On June 29, 2018, EPA received electronic copies of the draft PFAS RI Work Plan (and attached draft QAPP) and a draft Area 1 Field Sampling Plan (FSP) (hard (paper) copies of these documents were never received). Unfortunately, the documents do not follow the instructions laid out in EPA's April 30, 2018 email and, more importantly, do not comply with the process and requirements set forth in CERCLA for the preparation of site- specific SAPs and RI Work Plans. Despite these shortcomings, EPA provides the following comments and recommendations on the draft Area 1 FSP to allow for the timely collection of preliminary field data from Area 1. Comments on the draft base-wide RI Work Plan (and base-wide QAPP) will be provided upon receipt and review of the draft risk assessment portion of the draft work plan (which was unexpectedly removed from the June 29, 2018 submittal just prior to its release). To ensure the integrity of the CERCLA process moving forward and to ensure timely implementation of subsequent field efforts (for Areas 2 and 3), it is imperative that Army comply with the above-mentioned requirements and recommendations. Failure to do so may result in EPA's immediate disapproval of these submittals in accordance with the provisions set forth in the Devens FFA.

Response: The work plan schedule noted that draft documents would be provided in electronic format only. This was to expedite the delivery of the documents. The format of area-specific FSPs was created in order to expedite getting into the field to collect data. On June 29, 2018, the Army provided a PFAS RI work plan, a base-wide PFAS QAPP, and the Area 1 FSP. The Area 1 FSP combined with the base-wide PFAS QAPP serves as the Area 1 SAP. As the Area 2 and 3 FSPs are written, they will be provided to EPA for review. The Area 2 and 3 FSPs, combined with the base-wide PFAS QAPP serves as the Area 2 and Area 3 SAPs. This plan for the documents and outlines for the documents were discussed during the April 25, 2018 BCT meeting. The outlines were provided on May 2, 2018. EPA comments on the outlines received on May 4, 2018 were considered during development of the documents. The EPA comments did not indicate that the planned documents (i.e., PFAS RI work plan, a base-wide PFAS QAPP, and the Area 1 FSP) would not meet EPA's expectations. The Army believes delivery of the PFAS RI work plan, a base-wide PFAS QAPP, and the Area 1 FSP met the expectations of EPA as outlined in EPA's April 30, 2018 email.

Comment #2: As stated on page 22 of the May 2018, Final PFAS SI Report, based on results of the SI and presence of PFOA and PFOS in soil and groundwater at each of the SAs and AOCs sampled, Army recommended that a RI Work Plan be prepared to focus on the following:

- Delineation of the source and extent of PFAS contamination impacting the MacPherson and Grove Pond water supply wells;
- Evaluation of all areas and all media where PFAS was detected during the SI.
- Evaluation of potential off-site impacts within a one- and four-mile radius of detected PFAS concentrations in groundwater exceeding the EPA LHA (70 ppt).

While the field work proposed in the draft Area 1 FSP will expand the existing SI database for each of the 14 confirmed PFAS AOCs, the currently proposed sampling program is inadequate for purposes of meeting the objectives identified in the May 2018 SI Report and for complying with requirements for conducting a CERCLA RI.

As noted in EPA's June 25, 2018 comments on minutes of the May 24, 2018, Area 1 sampling design conference call, Army's decision to forego many of the data collection activities identified by EPA as critical to the successful performance of a CERCLA RI will undoubtedly extend the timeframe required to complete the Area 1 sampling program and delay completion of the base-wide PFAS RI. While Army has expressed a willingness to expand the proposed Area 1 sampling program as part of a subsequent field effort, this approach is contrary to discussions at the June 15, 2018 meeting between EPA, OSD, Army, MassDEP, MassDevelopment and representatives from Devens and Ayer and inconsistent with current DoD and EPA guidance for characterizing the nature and extent of contamination and evaluating risks to human and the environment posed by existing site conditions. Specific proposals and recommendations for expediting and enhancing the proposed sampling program are reiterated in the page-specific comments below.

Response: As discussed and agreed by EPA, Army, MassDEP, MassDevelopment, during BCT meetings on April 4, April 25, and May 24, 2018, the Army's work plan presents an adaptive/dynamic approach to determining the nature and extend of PFAS at Devens. The analytical data collected from the initial phase of sampling will be provided to the regulatory agencies as it is received so that it can quickly be reviewed and discussed, so that additional field activities can be adapted and conducted in a timely manner to accelerate the data collection in support of obtaining the objectives of the RI. The objectives include characterizing the nature and extent of contamination and evaluating risk to human health and the environment.

Within various sections of the FSP, there is text stating that data will be reviewed as it becomes available to guide additional field activities. The text will be revised to state that data from the laboratory will be shared with the stakeholders on a frequent (e.g., weekly) basis to expedite review of the data, which will allow additional field activities to be expedited.

The Army believes that using data to determine the appropriate investigation activities is the most efficient and expeditious way to achieve the objectives of the RI.

Comment #3: A limited number of soil and groundwater drive point samples were collected during the PFAS SI that provided useful data for confirming or denying the presence of PFAS at each of the SAs and AOCs studied. One of the primary objectives of a CERCLA RI is to obtain a quality dataset that accurately and thoroughly defines/evaluates the nature and extent of PFOS and PFOA concentrations in soil (surface and shallow/deep overburden), groundwater (overburden and bedrock aquifer), sediments and surface water. To accomplish this objective, intrusive investigation activities that go beyond the currently proposed vertical profiling / direct push technology must be included in the initial phase of the Area 1 data collection effort. While useful for defining the boundaries of a known contaminant plume, confirming the presence or absence of contamination at a site, and/or defining site-specific geologic units (i.e. fill (artificially placed), native overburden, and bedrock), vertical profile samplers are often limited in their ability to meet the rigorous DQOs typically required of a CERCLA RI. EPA recommends that the FSP be expanded to include the concurrent vertical profiling of soils and groundwater in areas with confirmed PFAS detections utilizing sampling techniques and technologies (i.e. hollow-stem auger drilling and continuous split- spoon soil samplers) that can more accurately (and more expeditiously) characterize existing site conditions. At a minimum, permanent monitoring wells should be installed during the initial phase of the PFAS RI to replace the non-viable MNG wells and complete the transect of groundwater monitoring wells in this critical portion of Area 1. At AOCs 57 and 74, additional soil borings/monitoring wells should be installed on the downgradient side of Cold Spring Brook to verify the downgradient extent of PFAS contamination in this area.

EPA also recommends that a limited number of well couplets be installed during the initial phase of investigation consisting of a well set in shallow overburden (screened across the inferred groundwater table) a well set at the top of the competent bedrock/overburden interface. This is of critical importance in areas with little or no available bedrock groundwater quality data, which is the case for the majority of PFAS AOCs being investigated. At locations where overburden couplets are installed the deep overburden well should be installed first such that appropriate screen intervals can be selected for both the deep and shallow overburden well. Bedrock wells should be advanced at least 12 feet into competent bedrock, with a 10’ screened interval installed at the base of the boring.

Response: The use of direct-push technology (DPT) is expected to meet the DQOs associated with this RI. DPT is a proven sampling technology that has been accepted and used at other Remedial Investigation sites in EPA Region 1 to collect representative soil and groundwater samples from both the unsaturated and saturated aquifer to the target depths anticipated to be required at Area 1 of Fort Devens. Furthermore, the advantages of DPT compared to hollow stem auger includes more efficient field characterization, reduced generation of investigation derived waste (IDW), and less susceptibility to heaving sands characteristic at depth within the glacial outwash deposits at Devens. In heaving sands, hollow-stem auger does not allow for accurate collection of soil samples at specific depth intervals. The dual-tube tooling used in DPT stabilizes (“cases”) the formation, enabling efficient advancement and removal of soil core barrels (typically 5 ft in length) for field lithologic descriptions/sub-sampling and deployment of groundwater profiling tools (e.g. Geoprobe SP 22 Groundwater Sampler) in undisturbed formation ahead of the drill string. These systems provide excellent recoveries for soil cores. Larger borehole HSA (e.g. 4.25”) are much less cost effective and are prone to problems with heaving sands requiring introduction of water to stabilize borehole as the drill string is advanced. As indicated in the Area 1 FSP (Section 4), sonic drilling technology may also be utilized. It is anticipated sonic drilling technology will be used for vertical profiling if DPT cannot reach the necessary depths.

As described in Section 5.2.2 of the Area 1 FSP, based on EPA's request, the Army has included the installation of up to eight new overburden wells and two bedrock wells, if needed (i.e., if vertical profiling data indicate that PFAS contamination in the overburden extends to bedrock) in the Grove Pond investigation area. As previously requested by EPA, the tentative locations for new monitoring wells were shown on Figure 7 of the Area 1 FSP and several of these wells are anticipated to be in the vicinity of the non-viable MNG wells. However, the final locations and screen settings of the new groundwater monitoring wells will be based on a review of the PFAS data obtained from groundwater vertical profiling, soil sampling and existing monitoring wells. The final locations and screen depths will be reviewed with EPA and MassDEP.

As stated in Section 5.1.2 – AOC 57, 74, and 75 Sampling Plan, paragraph 1 of page 8; the potential for vertical hydraulic gradients in groundwater adjacent to Cold Spring Brook will be evaluated through the installation of overburden monitoring well couplets at AOCs 74 and 57. If groundwater vertical gradients measured at the well couplets and groundwater vertical profiling data collected from borings advanced on Devens adjacent to Cold Spring Brook indicate that the potential exists for PFAS groundwater contamination to underflow Cold Spring Brook then, as stated in Section 5.1.2 – AOC 57, 74 and 75 Sampling Plan, Groundwater Vertical Profiling, additional investigation further downgradient of AOCs 74 and 57 (i.e., on private property located across Cold Spring Brook) will be completed.

The groundwater vertical profiling data at Area 1 AOCs will be used to determine if PFAS is migrating toward the bedrock. If the vertical profiling data do not indicate the presence of PFAS near the overburden/bedrock interface, then the need to install a bedrock wells would not be necessary. However, if the groundwater vertical profiling data indicate that installation of bedrock monitoring wells is warranted then, as stated in paragraph 8 of Section 4.0 – General Remedial Investigation Approach, up to four bedrock monitoring wells are planned for Area 1.

EPA's recommendation to advance bedrock wells at least 12 feet into competent bedrock, with a 10-foot screened interval installed at the base of the boring, or to install open boreholes as indicated in the FSP, will be further considered during the design of the wells during the RI field work phase, based upon the observed conditions at the desired monitoring interval.

Comment #4: Drive-point data collected during the SI should not be used to determine the location of soil borings in the RI. As discussed above, to accurately determine the location and extent of PFAS contamination in site surface and subsurface soils and groundwater, soil borings should be advanced (using a continuous split spoon sampler) at 5' intervals commencing at ground surface to within two feet of the water table. (Thereafter, groundwater samples should be collected at 5' intervals from two feet below the top of the water table to bedrock). While useful for determining permanent monitoring well locations and screen settings, drive point data collected during the SI should not be used to locate/identify potential "hot spots" of PFAS contamination or to make decisions regarding groundwater flow gradients and direction. Data collected during the profiling work should be used to determine permanent monitoring well locations and screen settings for purposes of defining the boundaries of PFAS contamination in these media and confirm groundwater elevation and flow gradients and direction. In addition, water level measurements from a limited number of temporary drive points should not be relied upon to accurately predict or support decisions regarding groundwater flow gradients and directions.

Response: The locations of proposed soil borings are shown on Figures 2 through 6 of the Area 1 FSP. These soil boring locations were chosen in consideration of the SI groundwater and soil results, as well as site history reported during the SI. The locations were also discussed with EPA during the Area 1 sampling rationale meeting on May 24, 2018. It is a reasonable approach to begin a sampling investigation by advancing soil borings at areas of reported AFFF application to the ground surface or, at AOCs with no known source of PFAS identified yet, at borings located upgradient, cross gradient and downgradient of known PFAS groundwater contamination. As stated on Page 2, paragraph 4 (General Remedial Approach) and page 7, paragraph 3 (AOC 57, 74 and 75 Sampling Plan) of the Area 1 FSP, if the groundwater vertical profiling and soil sampling results collected during this initial phase of RI investigation indicate that additional soil sampling and/or groundwater vertical profiling is warranted beyond the locations currently proposed for sampling, additional locations will be identified in consultation with EPA and MassDEP.

As presented on Page 7, Section 5.1.2, Soil Borings, characterization of the vadose zone aquifer materials will be completed during the initial phase of the Area 1 data collection effort through continuous coring of soil to the water table during advancement of each of the soil borings using DPT. As discussed in the response to EPA comment #3, DPT provides excellent recoveries for soil cores. Soil cores will be described in the field for field lithologic classification and soil samples from each boring to be collected for PFAS analysis.

Groundwater vertical profile samples will be collected at 10-foot intervals from the water table to bedrock in Area 1. A 10-foot sampling interval is expected to result in a reasonable number of samples needed to characterize the vertical extent of PFAS in the groundwater column associated with the approximately 100-foot think glacial overburden deposits in Area 1. This sampling interval has been used at similar groundwater investigations in glacial overburden deposits within EPA Region 1 and has been determined to provide data to adequately delineate the vertical distribution of contamination in groundwater.

The SI results were not used to make decisions regarding groundwater flow gradients and direction.

Data collected during the profiling work will be used to determine permanent monitoring well locations and screen settings for purposes of defining the boundaries of PFAS contamination in groundwater and confirm groundwater elevation and flow gradients and direction. This was described in Section 4.0 – General Remedial Investigation Approach and in Section 5.1.2 – AOC 57, 74, and 75 Sampling Plan of the Area 1 FSP.

The Area 1 FSP does not include utilizing water level measurements from temporary drive points.

Comment #5: The inclusion of field sampling activities that may or may not be conducted as part of the Area 1 RI is misleading and distorts the scope of the proposed sampling program for each of the PFAS AOCs. Consistent with EPA's comments on the draft slides for the June 19, 2018 RAB meeting, the FSP should be amended to clearly distinguish between the initial work to be performed (Phase 1) and the proposed work that may be performed (Phase 2), if deemed necessary based on data from the initial (Phase 1) work.

Response: The FSP will be clarified that the scope of some tasks (e.g., number, location, and design of permanent wells) will depend on the results of the initial sampling effort (e.g., vertical profiles). This is viewed as part of the adaptive/dynamic site characterization approach that is currently described in the FSP and is intended to meet the objectives of the CERCLA RI. This will be an iterative approach which can address data gaps in real time while field work is ongoing, whereas a "phased" approach may imply re-mobilizations for supplemental work in the future.

It is expected that permanent wells will need to be installed following the initial profile sampling, thus the field activities specified in the FSP are correct. As indicated in the Area 1 FSP, monitoring wells will be installed as part of the RI. The ultimate number, location, and screen placement of the wells will be determined based on review of the vertical profiling data. The vertical profiling data will be provided to the regulators on a frequent (e.g., weekly) basis to make decisions on well placement and is not intended to consist of a separate "Phase" of investigation. With frequent data reviews, decisions regarding adjustments/improvements to subsequent sampling locations will be made more quickly than a longer-term "phased" investigation.

Comment #6: Preferential pathways for possible PFAS migration should be explored during or concurrent with implementation of the initial phase of RI work. Former and current underground utility corridors, sewer lines, floor and trench drains (and associated piping), catch basins, oil/water separators, storm water drainage systems (exterior trench drains) should be identified and evaluated as potential sources and/or conduits of PFAS contamination. Several of these features have already been identified as potential sources and conduits of contamination at AOC 50. Recent PFAS detections in surface water and sediment samples from locations associated with the storm water management system at AOC 50 confirm the likelihood of PFAS impacts associated with these features where present at each of the PFAS AOCs.

Response: As indicated in the last paragraph of Section 4, utility maps will be reviewed and evaluated as potential preferential pathways. It is anticipated that most historic subsurface structures and utilities are located at relatively shallow depths within the vadose zone and have bedding composed of natural glacial outwash or similar materials and would have similar hydraulic properties to surrounding undisturbed natural deposits and would not be likely preferential pathways for infiltrating surface water. However, mapping and characteristics will be considered.

Comment #7: Additional discussions are warranted regarding Army's continued reliance on its "regional groundwater flow model" (as presented in Army's April 2, 2018 paper entitled "Regional Groundwater Flow and Hydrogeology and Potential PFAS Impacts to Water Supply wells in the Areas surrounding Devens, MA") to support assumptions regarding site-specific groundwater flow gradients and directions, identify/evaluate potential PFAS source areas (i.e. back particle tracking) or support decisions related to the PFAS RI. As noted in EPA's (C. Keating) April 3, 2018 email to Army (R. Simeone), Army developed the "regional groundwater flow model" independent of the ongoing work to update the Shepley's Hill Landfill (SHL) groundwater flow model and without regulator input or involvement. As you may recall, EPA was adamantly opposed to the use of Army's regional model when it was first discussed at a BCT meeting early this year as a tool to help scope the PFAS RI. EPA was clear that use of site-specific data, either from historic site investigations or the upcoming PFAS RI was the only acceptable means of determining/document groundwater flow in and around known or suspected PFAS source areas. EPA requests that unless and until the regional model can be more thoroughly evaluated by MassDEP and EPA, all references to the model should be removed from the Area 1 FSP and base-wide PFAS RI Work Plan and that future reliance of the model for decision-making purposes be terminated pending review and approval by all stakeholders.

Response: The regional groundwater flow model was not utilized in the Area 1 FSP and is not mentioned in the Area 1 FSP or the PFAS RI work plan.

The information presented in the regional model provides a synthesis of the currently available information on groundwater flow at Devens. It is understood that additional, site-specific data need to be collected during the RI to support decision-making.

Page-Specific Comments

Comment #1: Page 1, Section 2.0 – Please amend the discussion to include "the study goals, questions and decision statement summarized in Worksheet #11 (Data Quality Objectives) of the UFP-QAPP."

Response: In an overall effort to expedite the preparation and review of RI planning documents, information is generally not duplicated between the planning documents. The FSP is an addendum to the RI Work Plan which includes the QAPP. Section 2.0 of the FSP directly references Worksheet #11 of the QAPP. In preventing redundant information between the RI Work Plan, QAPP, and FSP, reviewers will have less content to review and all reviewers' comments on the same information can be addressed at one time in a uniform and consistent manner.

Comment #2: Page 2, Section 2.0 – For reasons discussed in the General Comments 2-6 above, the currently proposed sampling program is inadequate for purposes of meeting the objectives identified in the May 2018 SI Report and for complying with requirements for conducting a CERCLA RI. While Army has indicated its willingness to expand the currently proposed sampling program, if warranted, as part of a subsequent field effort, this phased approach to adequately characterize the nature and extent of PFAS contamination at each of the PFAS AOCs will undoubtedly extend the timeframe required to complete the base-wide investigation of PFAS at the former Fort Devens.

Response: The analytical data will be provided to the regulatory agencies on a frequent (e.g., weekly) basis so that it can quickly be reviewed, discussed, and additional field activities can be conducted in a timely manner to accelerate the data collection in support of obtaining the objectives of the RI. The objectives include characterizing the nature and extent of contamination and evaluating risk to human health and the environment. As the data will be provided to the regulators on a timely basis to make decisions on additional field activities, the additional field activities are not intended to consist of a separate "Phase" of investigation. See also the responses to General Comments #2-6.

Comment #3: Page 2, Section 2.0, ¶ 2 – Please amend the last sentence to read, "… to achieve the study goals and DQOs *specified on the previous page*.

Response: The DQOs are provided in Worksheet #11 in the QAPP.

Comment #4: Page 2, Section 2.0, ¶ 3 – The investigation of PFAS contamination at the Grove Pond wellfield is not an objective of the CERCLA RI. While the Area 1 FSP should collect data sufficient to identify/evaluate potential off-site impacts associated with PFAS emanating from the former Fort Devens site, the identification of potential source areas not associated with Devens should not be an acknowledged component of the CERCLA base-wide investigation of PFAS at the former Fort Devens Superfund site. Although Army has included the collection of samples from off-site locations in the Town of Ayer, the results will no bearing on the field work required to adequately evaluate potential sources areas and impacts to nearby drinking water supply wells associated with previously confirmed PFAS detections at Devens.

Response: The Army understands the objective to characterize nature and extent and assess the risk of PFAS from Army sources. Upgradient samples are required to properly evaluate potential impacts to Grove Pond. The Army does not plan to delineate off-site sources of PFAS.

Comment #5: Page 3, Section 2.0, ¶ 5 - Additional surface water and sediment samples should be collected from the entire stretch of Cold Spring Brook originating at AOC 57 and continuing downgradient to Bowers Brook into Grove Pond.

Response: The number of surface water and sediment samples was increased based on EPA's input during the Area 1 sampling rationale working meeting (May 24, 2018). Surface water and sediment samples will be collected at eight locations along Cold Spring Brook (Figure 8).

Comment #6: Page 4, Section 5.0 - For reasons discussed in the General Comments 2 - 6 above, the currently proposed sampling program is inadequate for purposes of meeting the objectives identified in the May 2018 SI Report and for complying with requirements for conducting a CERCLA RI. While Army has indicated its willingness to expand the currently proposed sampling program, if warranted, as part of a subsequent field effort, this phased approach to adequately characterize the nature and extent of PFAS contamination at each of the PFAS AOCs will undoubtedly extend the timeframe required to complete the base- wide investigation of PFAS at the former Fort Devens.

Response: Refer to response to Page-Specific Comment #2.

Comment #7: Page 4, Section 5.1. AOCs 57, 74 and 75 – Upon closer evaluation of the proposed soil boring and vertical groundwater profiling locations for AOCs 57 and 74, EPA recommends that Army revise the proposed sampling program to focus more on the downgradient delineation of PFAS in the areas. Specifically, many of the proposed sample locations are less than 60 feet from previously confirmed PFAS detections and will do very little to further characterize the site or resolve long-standing issues, questions and assumptions regarding regional hydrogeology, shallow and deep groundwater flow and the potential off-site migration of contamination and impacts related thereto. EPA believes that sample collection over a wider area should be considered at this site to more effectively delineate and quantify PFAS contamination, both horizontally and vertically, and to make informed decisions, based on actual site data, regarding shallow and deep overburden groundwater flow and contaminant migration pathways.

Response: The proposed groundwater vertical profiling and soil sampling program for AOCs 74 and 57 encompass the area between potential source areas and/or known PFAS groundwater contamination and potential receptors and/or discharge areas for groundwater (i.e., Cold Spring Brook or the Grove Pond Municipal Well field). It is a reasonable approach to begin groundwater sampling investigation by advancing vertical profiling borings at areas of reported AFFF application or, at AOCs with no known source of PFAS identified yet, at borings located upgradient, cross gradient and downgradient of known PFAS groundwater contamination. The temporary well points or existing monitoring wells sampled at AOCs 74 and 57 during the SI only sampled water near the water table, therefore groundwater vertical profiling through the saturated overburden for the RI within the areas of PFAS detections is needed to determine the vertical extent of PFAS contamination in these areas and therefore, is not considered redundant to the water table sampling completed during the SI.

The sampling program at AOCs 74 and 75 is designed to characterize the extent of PFAS contamination in soil and groundwater between potential source areas and potential receptors and/or discharge points. In addition, as stated in Section 5.1.2 – AOC 57, 74, and 75 Sampling Plan, paragraph 1 of page 8; the potential for vertical hydraulic gradients in groundwater adjacent to Cold Spring Brook will be evaluated through the installation of overburden monitoring well couplets at AOCs 74 and 57. If groundwater vertical gradients measured at the well couplets and groundwater vertical profiling data collected from borings advanced on Devens adjacent to Cold Spring Brook indicate that the potential exists for PFAS groundwater contamination to underflow Cold Spring Brook then, as stated in Section 5.1.2 – AOC 57, 74 and 75 Sampling Plan, Groundwater Vertical Profiling, additional investigation further downgradient of AOCs 74 and 57 (i.e., east of Cold Spring Brook) will be completed.

Comment #8: Page 6, Section 5.1.2, Groundwater Vertical Profiling - As discussed in General Comment 4. above, EPA recommends that groundwater samples be collected at 5-foot intervals (from the top of the water table to bedrock) instead of the 10-foot intervals proposed. The collection of samples from more discrete sampling intervals will more accurately delineate PFAS contamination in the shallow and deep aquifer.

Response: See response to EPA General Comment #4.

Comment #9: Page 7, Section 5.1.2, Soil Borings – The draft Area FSP currently states that soil samples will be collected within 2 feet of the water table interface unless the water table is encountered at a depth less than 17 feet bgs. This could result in the deepest soil sample being as much as an 8-foot soil core extending to the water table. EPA recommends that the current protocol be amended to collect a 2-foot soil core at the water table for every sample by shortening the soil core directly above the 2-foot interval above the water table. This will allow for the collection of a 2-foot soil core at the water table.

Response: Page 7, paragraph 3, sentence 3 and 4 will be revised as follows:

"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."

The sampling nomenclature, anticipated depths for the borings in Table 5 will be revised accordingly.

Comment #10: Page 7, Section 5.1.2, Soil Borings – Please elaborate on the specific sampling method that will be used to collect vertical profile samples.

Response: Per Section 7 of the FSP: "Groundwater vertical profile borings will be conducted in accordance with the procedure specified in Worksheet #17 of the UFP-QAPP and SOP-F014 (Direct Push Technology)." See also the response to Page-Specific Comment #1.

Comment #11: Page 8, Section 5.2, Grove Pond Wellfield – For reasons discussed in Page-Specific Comment 4. above, the purpose of the Area 1 PFAS RI should not include the identification of potential sources of PFAS associated with the Town of Ayer Grove Pond water supply wells that are unrelated to the PFAS AOCs at Devens. As previously stated, the primary objective of the CERCLA RI is to define the nature and extent of PFAS contamination at the former Fort Devens Superfund site and evaluate the possible off-base migration of PFAS-contamination and identify potential risks to human health and the environment associated with any off-base releases. To ensure integrity of the CERCLA process, EPA will refrain from commenting on aspects of the proposed sampling program that go beyond the requirements set forth in CERCLA.

Response: The Army understands the objective to characterize nature and extent and assess the risk of PFAS from Army sources. Collecting upgradient samples of potential impact areas is consistent with the CERCLA process. The Army does not plan to delineate off-base sources of PFAS.

Comment #12: Page 9, Section 5.2.2, Installation of New Monitoring Wells – As requested in EPA's comments on the June 25, 2018 comments on minutes of the May 24, 2018, Area 1 sampling design conference call and General Comment 3. above, permanent monitoring wells should be installed during the initial phase of the PFAS RI to replace the non-viable MNG wells to complete the transect of groundwater monitoring wells in this critical portion of Area 1.

Response: As described in Section 5.2.2 of the Area 1 FSP: Installation of up to eight new overburden wells and two bedrock wells (if needed [i.e., if vertical profiling data indicate that PFAS contamination in the overburden extends to bedrock]) are planned for the Grove Pond investigation area. As requested by EPA, the tentative locations for new monitoring wells are shown on Figure 7 and several are anticipated to be in the vicinity of the non-viable MNG wells. However, the final locations and screen settings of the new groundwater monitoring wells will be based on a review of the PFAS data obtained from groundwater vertical profiling, soil sampling and existing monitoring wells. The final locations and depths will be reviewed with EPA and MassDEP.

Comment #13: Page 11, Section 7.0, Field Procedures – This section should be amended to identify the specific procedures required for the collection of samples for each of the sampling techniques listed. Alternatively, Army could develop an area-specific QAPP for the Area 1 FSP, as recommended in EPA's April 30, 2018 email to Army. The Area 1 QAPP would be comprised of UFP-QAPP worksheets and SOPs relevant to and referenced in the Area 1 FSP.

Response: A listing of all applicable sampling procedures needed to implement the Area 1 FSP is provided in Section 7.0 of the FSP. Field sampling procedures are provided as attachments to the QAPP. The QAPP is for the entire PFAS RI; there are no area-specific QAPPs.

U.S. ARMY RESPONSES TO MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION COMMENTS ON THE DRAFT AREA 1 FIELD SAMPLING PLAN ADDENDUM TO REMEDIAL INVESTIGATION WORK PLAN FOR PFAS
Former Fort Devens Army Installation, Devens, Massachusetts
16 August 2018

The following Army responses pertain to the Massachusetts Department of Environmental Protection (MassDEP) comments, dated 27 July 2018, on the draft *Area 1 Field Sampling Plan, Addendum to Remedial Investigation Work Plan for Per- and Polyfluoroalkyl Substances (PFAS), Former Fort Devens Army Installation, Devens, MA*, dated June 2018.

Comment #1: Section 5.1.2, Soil Borings: The groundwater samples collected during the SI were inadequate to determine where the highest groundwater PFAS concentrations exist at each AOC. Consequently, to target soil samples where the highest groundwater PFAS concentrations exist, the soil sample locations should be determined using the combined results from the SI samples and the RI groundwater profile samples when they are available.

Response: The fourth sentence in the first paragraph will be changed to read as follows:

"Therefore, soil borings are located within, immediately downgradient, and upgradient of highest groundwater PFAS concentrations reported in the SI. These locations may be adjusted based on the groundwater vertical profile results from samples collected during the RI."

Comment #2: Section 5.2.2: To the extent possible, detailed well construction information (e.g., construction materials, diameters, boring logs, screen and open borehole depth and elevation intervals, etc.) should be obtained for each of the Grove Pond supply wells to support the assessment of the field data that will be acquired from Grove Pond Well Field Area.

Response: Documents are currently being reviewed to accumulate information on the Grove Pond supply wells. This information will be provided to support the assessment of the field data.

Comment #3: Figure 3: The proposed Area 2 surface water and sediment samples appear to be located on or adjacent to a containment dam. The samples should instead be collected from a location(s) most likely to be impacted by PFAS released from Area 2 as determined by proximity to source area, surface and groundwater flowpaths, and long-term monitoring surface water sample results. The conditions used to determine the sampling locations should be documented in the RI report.

Response: Based on review of the groundwater flow, the PFAS data from sampling the LTM wells, and historical surface water data, location CSB-18-03 was moved closer to the shoreline, north of the containment dam. Based on the current information, this sample location is believed to be in an area most likely to be impacted by PFAS in Area 2 groundwater. The conditions used to determine the sampling locations will be documented in the RI report.

Comment #4: Figure 4: The Area 3 surface water and sediment samples should be collected from locations most likely to be impacted by PFAS released from Area 3 as determined by proximity to source area, surface and groundwater flowpaths, and long-term monitoring surface water sample results. The conditions used to determine the sampling locations should be documented in the RI report.

Response: The source area for detections of PFAS in the groundwater at Area 3 is unknown. There is only one LTM surface water sample location at Area 3 and thus, data from that location has limited usefulness in determining locations most likely to be impacted by PFAS. The location for proposed sample CSB-18-04 was selected to be downgradient of groundwater flow at Area 3 and the location for sample CSB-18-05 was selected to be slightly cross-gradient to the north of groundwater flow in Area 3 to account for variability in groundwater flow direction in Area 3. The conditions used to determine the sampling locations will be documented in the RI report.

Comment #5: Figure 5: Surface water and sediment samples CSB-18-06 and CSB-18-07 should be collected from locations most likely to be impacted by PFAS released from AOC 74 as determined by proximity to source area, surface and groundwater flowpaths, and long-term monitoring surface water sample results. The conditions used to determine the sampling locations should be documented in the RI report.

Response: There is limited information on the position of the source area and the groundwater flow path at AOC 74. As noted in the SI, the use of firefighting foams reportedly occurred "behind former Building 3773." Thus, the SI sample locations had to be selected largely based on topography and what was known about groundwater flow patterns. There are no LTM surface water sample results near AOC 74. The location for proposed RI sample CSB-18-06 was selected to be downgradient of groundwater flow at AOC 74 and the location for sample CSB-18-07 was selected to be slightly cross-gradient to the north of groundwater flow at AOC 74 to account for variability in groundwater flow direction. The conditions used to determine the sampling locations will be documented in the RI report.