DRAFT FINAL
WORK PLAN FOR THE EXPANDED SITE INSPECTION FOR PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) AT THE GABRESKI AIR NATIONAL GUARD BASE

WESTHAMPTON, LONG ISLAND, NEW YORK

Contract Number: GS00Q140A DU127
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Prepared for:
Restoration Branch,
Operations Division,
Logistics and Installations
Directorate, Air National Guard
Readiness Center (NGB/A4OR)
Joint Base Andrews, Maryland

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Table of Contents

Table of Contents (Continued)

Table of Contents (Continued)

List of Tables

List of Figures

List of Appendices

Acronyms and Abbreviations

°F	Degrees Fahrenheit
%	Percent
106RW	106th Rescue Wing
3D	Three-Dimensional
AFFF	Aqueous Film Forming Foam
amsl	Above Mean Sea Level
ANG	Air National Guard
ANGB	Air National Guard Base
AOC	Area of Concern
APP	Accident Prevention Plan
ASTM	American Society for Testing and Materials
BB&E	NGB's Oversight Contractor
bgs	below ground surface
C6	Six Carbon Based…
C8	Eight Carbon Based…
CERCLA	Comprehensive Environmental Response, Compensation, and Recovery Act
CIP	Community Involvement Plan
cm/sec	Centimeter per Second
CoC	Chain-of-Custody
COC	Contaminant of Concern
COR	Contracting Officer Representative
CSM	Conceptual Site Model
DO	Dissolved Oxygen
DoD	Department of Defense
DQO	Data Quality Objective
EAR	Environmental Assessment and Remediations
ELAP	Environmental Laboratory Approval Program
ENV	Environmental
EPA	Environmental Protection Agency
ERPIMS	Environmental Resources Program Information Management System
ESI	Expanded Site Inspection
FAA	Federal Aviation Administration
FD	Fire Department
FS	Feasibility Study
ft	Foot/Feet
FTA	Fire Training Area
GIS	Geographical Information Systems
gpd/ft	Gallons per Day per Foot

Acronyms and Abbreviations (Continued)

gpd/ft²	Gallons per Day per Square Foot
GPS	Global Positioning System
GSA	General Services Administration
GW	Groundwater
HA	Health Advisory
HDPE	High-density Polyethylene
IDW	Investigation Derived Waste
IRP	Installation Restoration Program
LTM	Long-Term Monitoring
µg/kg	Micrograms per Kilogram
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MSL	Mean Sea Level
MW	Monitoring Well
N/A	Not Applicable
NFA	No Further Action
ng/L	Nanograms per Liter
NGB	National Guard Bureau
NGB/A4OR	National Guard Bureau, Operations Division, Restoration Branch
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OASIS	One Acquisition Solution for Integrated Services
ORP	Oxidation-Reduction Potential
PA	Preliminary Assessment
PAL	Project Action Limit
PE	Professional Engineer
PFAS	Per- and Poly-Fluoroalkyl Substances
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctane Sulfonate
pH	Potential of Hydrogen
PID	Photoionization Detector
PRL	Potential Release Location
PVC	Polyvinyl Chloride
PWS (1)	Public Water Supply
PWS (2)	Performance Work Statement
QA	Quality Assurance
QAPP	Quality Assurance Project Plan

Acronyms and Abbreviations (Continued)

QC	Quality Control
QCP	Quality Control Plan
RI	Remedial Investigation
ROE	Right of Entry
ROM	Rough Order of Magnitude
SAF/IE	Secretary of the Air Force for Installations, Environment, and Energy
SB	Soil Boring
SCDHS	Suffolk County Department of Health Services
SCWA	Suffolk County Water Authority
SED	Sediment Sample
SGPA	Special Groundwater Protection Area
SI	Site Inspection
SOP	Standard Operating Procedure
SS	Soil Sample
SSHP	Site Safety and Health Plan
STW	Stormwater
SVOC	Semi-Volatile Organic Compound
SW	Surface Water
UFP	Unified Federal Policy
US	United States
UST	Underground Storage Tank
USAF	United States Air Force
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
WGS84	World Geodetic System 1984
WMP	Waste Management Plan

Executive Summary

Parsons was contracted by the Restoration Branch, Operations Division, Logistics and Installations Directorate, Air National Guard Readiness Center (NGB/A4OR) to conduct an Expanded Site Inspection (ESI) for per- and polyfluoroalkyl substances (PFAS) at Gabreski Air National Guard Base (Gabreski ANGB or Base) located in Westhampton, Long Island, New York. The ESI will be completed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the New York State Department of Environmental Conservation (NYSDEC) is the regulatory authority for the ESI activities at the Base.

The goal of the ESI is to augment data collected during the previously completed site inspection (SI) and to assess the potential migration pathways between the Base and potential downgradient receptors. Additionally, soil and groundwater samples will be collected at four areas of concern (AOCs) which were not investigated during the SI to determine if there are PFAS source impacts at these AOCs. Another focus of the ESI is to determine if there are upgradient sources that may be contributing PFAS mass to groundwater and surface water beneath the Base. This abbreviated ESI Work Plan defines the overall project objectives, summarizes the results from previous PFAS assessments and inspection work at the Base, outlines the Base history, and presents the ESI tasks that will be conducted to achieve the project objectives.

Some PFAS compounds are used in the formulation of Aqueous Film Forming Foam (AFFF). Eight carbon based (C8) AFFF was used by the United States Air Force (USAF) and the Air National Guard (ANG) to extinguish petroleum fires starting from approximately 1970. Long-chain PFAS used in C8 AFFF, specifically perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS), are recognized as persistent, bio-accumulative, and toxic (ITRC, 2018). As of January 2018, C8 AFFF at Gabreski ANGB has been removed, disposed of, and replaced with six carbon based (C6) AFFF. C6 PFAS are currently considered lower in toxicity and have significantly reduced bioaccumulation potential compared to C8 PFAS (United States Environmental Protection Agency [USEPA], 2019).

Previous to this ESI, NGB/A4OR performed a Preliminary Assessment (PA) and SI for PFAS at the Base. The PA included a review of documented fire training and other areas suspected or known to have had a release of AFFF to the environment. The PA included a Base reconnaissance visit where 18 potential AOCs were inspected, Base personnel were interviewed, and on-Base documentation was reviewed. The PA identified 18 potential AOCs and recommended 16 for further investigation (BB&E, 2016). The SI included data collection to evaluate for the presence of PFAS at the 16 AOCs retained for further investigation from the PA (referred to as Potential release locations [PRLs] in the SI) and to assess potential PFAS migration off-Base. The SI consisted of the collection of soil, sediment, surface water, and groundwater samples. The SI results recommended the focus be placed on AOC 1 (Former Fire Training Area) since PFAS concentrations in groundwater were the highest detected during the SI and the AOC is located upgradient from the Suffolk County Water Authority (SCWA) Meetinghouse Road

drinking water wells, where PFAS impacts have been detected (AECOM, 2019). It was also recommended that further investigations of the AOC to determine the nature and extent of PFAS contamination be conducted during the Remedial Investigation phase. Additionally, AOC 3 and AOCs 19 through 22 were identified as requiring additional investigation during this ESI as they are located off-Base and were not investigated during the SI. The AOCs to be investigated during this ESI are shown on **Table ES.1**.

Table ES.1 – Areas of Concern

AOC/PRL Number	Site Name	SI Results
1	Former Fire Training Area (FTA) Installation Restoration Program [IRP] Site 7	Groundwater (GW) impact and soil below screening levels
3 (1)	Former Building 230-Vehicle Maintenance	Not investigated
19(2)	1994 Air Show Plane Crash	Not investigated
20(2)	1989 Air Plane Crash	Not Investigated
21(2)	Unknown Air Plane Crash	Not investigated
22 (3)	Current Shared FTA	GW and Soil

Notes: GW = Groundwater Impact
FTA = Fire Training Area
IRP = Installation Restoration Program
(1) AOC was recommended for no further action in PA report but NGB/A4OR agreed with the NYSDEC to investigate the AOC since it is a potential source area.
(2) NGB/A4OR agreed with the NYSDEC to investigate the plane crashes during their review of the SI report.
(3) Investigations conducted by others.

The NGB/4AOR encourages the use of Triad-based investigation approaches to manage decision uncertainty and increase confidence that investigation and remediation project decisions are made correctly and cost-effectively. The proposed Triad-based ESI approach employs systematic project planning, dynamic work strategies, and rapid turn-around sample analysis by a fixed laboratory to support real-time decision-making processes during the field phase. Parsons has designed an innovative and flexible Triad-based ESI approach that focuses on electronic field data collection, rapid-turn laboratory analyses, strong communications with NGB, Base, NGB's oversight contractor BB&E, and NYSDEC, and field-based real-time decision making.

The ESI includes a receptor survey to identify potential receptors downgradient of the Base which may be affected by the PFAS impacts on-base. Vertical profiling of the groundwater (upgradient base boundary and downgradient off-base) will be utilized to screen PFAS concentrations in groundwater from the water table to 100 feet below ground surface (bgs) following which monitoring wells will be installed based on the vertical profiling results. At the four AOC not previously investigated, two soil borings will be advanced with two soil samples collected from each boring and the installation on one shallow groundwater well. Groundwater samples will be collected from each newly installed monitoring well and from select existing monitoring wells. In addition, 16 surface water samples and co-located sediment samples will be collected from off-Base surface water features, and 11 storm water samples will be collected from the on-Base/off-Base storm water infrastructure features as summarized below in **Table ES.2**.

Target analytes for ESI activities are the 24 PFAS compounds in the USEPA draft target analyte list (USEPA, 2018). A list of the 24 PFAS compounds and the analytical methods to be used are provided in the Unified Federal Policy Quality Assurance Project Plan (UFP-QAPP) (**Appendix A**). Parsons plans to request rapid turn-around-times for analytical results (e.g. 5-day vs. 21-day) for samples collected from the Base boundary and furthest downgradient/downstream sample locations. Expedited analytical results from these locations will allow for optimal placement of contingency sample locations and monitoring wells (without an additional mobilization event) to ensure that the objectives of the ESI are achieved on schedule. Parsons will integrate the data generated during the primary sample collection into a three-dimensional Conceptual Site Model (CSM). Following collection of the primary samples and consistent with the Triad-based approach described above, additional contingency samples may be collected, if needed. Parsons will recommend locations for contingency samples based on a comprehensive review of the historical data along with the newly collected ESI data. The contingency sample locations will be finalized based on input from NGB, Base, BB&E, and NYSDEC. Based on the results of the sampling conducted at the primary locations summarized in **Table ES.2**, not all contingency locations/samples may be required. The number of allotted contingency samples, including monitoring well locations, are summarized below in **Table ES.3.**

Table ES.2 – Primary Sample Locations

AOC	Locations/Samples	Notes
1	2 Vertical Profiles 2 new MW/4 GW 1 existing MW/ 1 GW	One MW upgradient and one MW downgradient of AOC 1. One GW sample will be collected from a 2-foot interval every 10-feet (ft) starting from the top of the water table to 100 ft below ground surface (bgs) to determine proper placement of well screen; GW samples collected from 3 wells.
3	2 SB/4 SS 1 new MW/2 GW	Two soil borings with one boring converted into a shallow MW at AOC 3; two soil samples collected from each boring from 0–1 and 4-5 ft bgs; GW sample collected from new well.

Table ES.2 – Primary Sample Locations (Continued)

AOC	Locations/Samples	Notes
19	2 SB/4 SS 1 new MW/2 GW	AOC 19 and associated sample locations are located off-Base. Two soil borings with one boring converted into a shallow MW at AOC 19; two soil samples collected from each boring from 0–1 and 4-5 ft bgs; GW sample collected from new well.
20	2 SB/4 SS 1 new MW/2 GW	AOC 20 and associated sample locations are located off-Base. Two soil borings with one boring converted into a shallow MW at AOC 20; two soil samples collected from each boring from 0–1 and 4-5 ft bgs; GW sample collected from new well.
21	2 SB/4 SS 1 new MW/2 GW	AOC 21 and associated sample locations are located off-Base. Two soil borings with one boring converted into a shallow MW at AOC 21; two soil samples collected from each boring from 0–1 and 4-5 ft bgs; GW sample collected from new well.
22	1 Vertical Profile 1 new MW/2 GW 1 existing MW/1 GW	AOC 22 and associated sample locations are located off-Base. One MW downgradient of AOC 22. One GW sample will be collected from a 2-foot interval every 10- ft starting from the top of the water table to 100 ft bgs to determine proper placement of well screen; GW samples collected from new well; GW sample collected from existing well.
Upgradient/ and within Base Boundary	2 Vertical Profiles 2 new MW/4 GW 3 existing MW/3 GW 8 STW	Two MWs upgradient of Gabreski ANGB; one GW sample will be collected from a 2-foot interval every 10-ft starting from the top of the water table to 100 ft bgs to determine proper placement of well screen; GW samples collected from 2 new MWs and 3 existing MWs; and two STW upstream from AOC locations and 6 STW downstream from AOC locations.
Downgradient (Off Base)	4 Vertical Profiles 4 new MW/8 GW 3 existing MW/3 GW 16 SW/SED 3 STW	Four MW locations downgradient of Gabreski ANGB, one GW sample will be collected from a 2-foot interval every 10-ft starting from the top of the water table to 100 ft bgs to determine proper placement of well screen; GW samples collected from 4 new MWs and 3 existing MWs; 4 SW/SED from Aspatuck River; 4 SW/SED from Quantuck Creek; 4 SW/SED from the Old Ice Pond; 2 SW/SED from North Pond; and 3 STW located off Base.

Notes: GW = Groundwater sample (Groundwater samples include two rounds of sampling)).
MW = Monitoring well
SB = Soil boring
SED = Sediment Sample
SS = Soil sample (2 soil samples collected per boring)
STW= Stormwater
SW = Surface water

Table ES.3 – Contingency Samples and Wells

Location	Well or Sample Count	Notes
MWs	1	One contingency MW location with GW sample collected from a 2-foot interval every 10-ft starting from the top of the water table to 100 ft bgs to determine proper placement of well screen.
Groundwater	2	2 sample rounds per MW installed will be performed following completion of each MW (per NGB/4AOR, 2009 guidance).
Soil Borings	1	Two soil samples will be collected per soil boring.
Surface Water/Sediment	1	Co-located surface water and sediment sample at one location.
Storm Water	1	NA

Notes: MW = Monitoring Well
GW= Groundwater

SECTION 1.0 Introduction

The Restoration Branch, Operations Division, Logistics and Installations Directorate, Air National Guard Readiness Center (NGB/A4OR) performed a Preliminary Assessment (PA) and Site Inspection (SI) at the Gabreski Air National Guard Base (Gabreski ANGB or Base) located in Westhampton, Long Island, New York in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process for per- and poly-fluoroalkyl substances (PFAS) in soil, surface water, sediment, and groundwater. The United States Environmental Protection Agency (USEPA) identifies the SI as the on-site investigation to determine what hazardous substances are present and if they are being released to the environment. The previous SI activities were confined to 16 on-Base previously identified potential release locations (PRLs). The 16 PRLs were determined to have confirmed releases and are now called areas of concern (AOCs). The SI recommended the focus be placed on AOC 1 to determine if PFAS has migrated off- Base and impacted the Suffolk County Water Authority (SCWA) Meetinghouse Road drinking water wells which are located downgradient of AOC 1. Therefore, this Expanded Site Investigation (ESI) Work Plan details the activities that will be conducted to augment the data collected in the SI, assess four new AOCs, and determine if there are off-Base upgradient sources and/or downgradient impacts to off-Base receptors. The data collected from the work detailed in this abbreviated ESI Work Plan will be evaluated to determine if further remedial investigation and/or response action is appropriate at the Gabreski ANGB.

1.1 PROJECT AUTHORIZATION

Parsons was contracted by the NGB/A4OR under the United States (US) General Services Administration (GSA) One Acquisition Solution for Integrated Services (OASIS) Pool 1 contract number GS00Q14OA DU127, delivery order W9133L-18-F-0052, to perform an ESI focusing on off-Base upgradient sources and/or downgradient impacts from the AOCs to off-Base receptors. The ESI will be conducted in accordance with CERCLA; the New York State Department of Environmental Conservation (NYSDEC) is the regulatory authority for the ESI activities at the Gabreski ANGB.

1.2 SCOPE AND OBJECTIVES

This ESI Work Plan defines the overall project objectives, briefly summarizes the results from the previous PA and SI, outlines the site history, and presents the ESI tasks that will be conducted to achieve the project objectives. Much of the historical information and approved methods are provided in previous reports (see **Section 2.0**). Thus, for a complete understanding of the environmental setting of Gabreski ANGB and approved methods, the referenced reports should also be reviewed in addition to this abbreviated work plan.

This ESI Work Plan identifies the equipment, methods, and staffing necessary to perform the following tasks:

- Incorporate relevant information into the ESI approach for investigating on off-Base upgradient sources and/or downgradient impacts to off-Base receptors and the six AOCs (1, 3, 19, 20, 21, and 22) requiring additional investigations;

- Gather site specific information to evaluate the fate and transport mechanisms related to PFAS to determine potential exposure pathways;
- Identify topography, vegetation, soil characteristics, climate, and land use at the Base and adjacent areas;
- Collect and evaluate soil, sediment, surface water, storm water, and groundwater samples for PFAS constituents utilizing industry best management practices to make defensible decisions;
- Determine if PFAS constituents are migrating on-Base from upgradient sources;
- Evaluate if PFAS constituents are migrating off-Base, and if they are, determine if there are potential connections between Gabreski ANGB and impacts to private and public supply wells;
- Confirm if PFAS constituents are present at each new AOC in quantities or concentrations that warrant additional investigation as part of the Remedial Investigation (RI)/Feasibility Study (FS) phase, and if so, what the appropriate data quality objectives (DQOs) should be.

Target analytes for ESI activities are the 24 PFAS compounds in the USEPA draft target analyte list (USEPA, 2018). The 24 PFAS compounds and analytical methods are listed in the UFP-QAPP (**Appendix A**).

In addition, a separate Community Involvement Plan (CIP) is being produced to outline public outreach actions and activities associated with environmental remediation at the Gabreski ANGB. The CIP will detail the methods used to inform the public of remedial activities and results. In addition, it will discuss how the public will be able to provide input and be involved in the decision-making processes. Methods developed in the CIP will be used for public outreach and involvement with the ESI.

Work under this delivery order will be completed in accordance with applicable and appropriate United States Air Force (USAF) and ANG policies, regulations and guidance, and Federal, State and local laws. Key references and policy documents for this ESI include, but are not limited to, the following:

- NGB/A4OR, 2009. Air National Guard Environmental Restoration Program Investigation Guidance. September.
- Secretary of the Air Force for Installations, Environment, and Energy (SAF/IE), 2016. Policy on Perfluorinated Compounds. August.
- USEPA, 1992. Interim Final Guidance for Performing Site Inspections Under CERCLA. EPA 540-R-92-021. September.
- USEPA, 2005. Federal Facilities Remedial Site Inspection Summary Guide. July.
- USEPA, 2016a. Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS). EPA 822-R-16-004. May.
- USEPA, 2016b. Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA). EPA 822-R-16-005. May.
- USEPA, 2018. Technical Brief Perfluoroalkyl and Polyfluoroalkyl Substances. EPA 600/F-17/022d. September.

1.3 PROJECT ORGANIZATION AND RESPONSIBILITIES

The NGB/A4OR is the lead organization for this ESI. Parsons will provide oversight and management of personnel and subcontractors. A list of key personnel and their responsibilities is provided in **Table 1.1.**

Table 1.1 Key Project Personnel

Organization	Name	Role/Responsibility
NGB/A4OR	Mr. Winston Crow, Professional Engineer (PE)	Contracting Officer Representative (COR)
NGB/A4OR	Ms. Jody Murata	Project Manager
Gabreski ANGB	Nick Kilb	ANG Base Environmental Coordinator
Gabreski ANGB	Lt Colonel David Keith Carrick	106th Rescue Wing Mission Support Officer Commander
Suffolk County Airport	Mr. Anthony Cegilo	Airport Manager
NYSDEC	John Swartwout	Project Manager/Section C Chief
New York State Department of Health (NYSDOH)	Steven Karpinski	DOH Representative
Parsons	Ms. Toni Mehraban	Project Manager
Parsons	Mr. Dan Griffiths	Technical Director
Parsons	Mr. John Santacroce	Task Leader
Parsons	Ms. Jenny Prince	Health and Safety Manager
Parsons	Ms. Katherine Lapierre	Chemist
Parsons	Mr. Ken Rice	Regulatory Specialist
Parsons	Ms. Rhonda Stolberg	Geographical Information Systems (GIS) Manager
BB&E	Ms. Cindy Lang	Oversight

Mr. John Santacroce is the Parsons Task Lead for the SI field operations. He will supervise and coordinate field activities and will act as the liaison between site personnel and field subcontractors (i.e., driller, laboratory, and waste management contractor).

1.4 WORK PLAN ORGANIZATION

This work plan is organized into the following Sections and Appendices:

Section 1.0 Introduction - Provides an introduction to the Gabreski ANGB ESI Work Plan.

Section 2.0 Background Information - Provides a facility description and summarizes previous investigations and environmental setting.

Section 3.0 Conceptual Site Model (CSM) and Expanded Site Investigation (ESI) Approach - Provides a detailed description of the rapid decision-making procedure for field activities, data quality objectives, conceptual site model, and sampling design and rational for the ESI.

Section 4.0 Field Investigation Methodology - Provides details on field investigation methods including sampling, decontamination, surveys, and investigation derived waste (IDW).

Section 5.0 References - List of references used in the preparation of this ESI Work Plan.

Appendix A - Unified Federal Policy for Quality Assurance Project Plan (UFP-QAPP)

Appendix B - Standard Operating Procedures (SOPs)

Appendix C - Site Safety and Health Plan (SSHP)

Appendix D - Waste Management Plan (WMP)

Appendix E - Quality Control Plan (QCP)

Appendix F - AECOM Regional Site Inspections Report

SECTION 2.0 Background Information

2.1 FACILITY DESCRIPTION

Gabreski ANGB is located in Westhampton Beach, New York at the Francis S. Gabreski Suffolk County Airport and situated on the southeastern side of Long Island. Gabreski ANG is home to the 106th Rescue Wing (106RW) of the New York Air National Guard (**Figure 2.1**). The ANGB is just north of the Village of Westhampton Beach and approximately 90 miles east of New York City. The Base is in the south-western portion of the airport property and leases approximately 88.5-acres of the 1,486-acre airport property from Suffolk County. The Base supports the operation and maintenance of the 106RW and houses aircraft, support personnel, vehicles, and equipment. Gabreski ANG fire and rescue units support both military and civilian aircraft incidents.

The US Army developed the site in 1941 as the Westhampton Beach Army Airfield to use for gunnery training for World War II fighter pilots and instructors while leasing the property from Suffolk County. The Army discontinued its use of most of the property from 1948 to 1951. In 1951, the USAF reactivated the airfield as the Suffolk County Air Force Base. In 1969, the USAF deactivated and closed the base and Suffolk County began operating the airfield as Suffolk County Airport, which was renamed Francis S. Gabreski Airport in 1991.

Military operations were reintroduced in June 1970 when the 102nd Air Refueling Squadron of the 106th Air Refueling Group, New York ANG, relocated to Suffolk County. In 1972, the unit's mission changed from air refueling to fighter-interceptor, with the new mission of controlling the skies along the northeast coastline. In 1975, the designation and mission changed again to "Aerospace Rescue and Recovery", later shortened to "Air Rescue" and then simply "Rescue". The names of the 102nd Rescue Squadron and 106RW were assigned in 1995; however, the location of the ANG facilities has not changed since 1971. The mission of the 106RWing is to provide peacetime and combat search and rescue services on a world-wide basis using HC-130P Hercules aircraft and HH-60G Pave Hawk helicopters.

Historically, firefighting training activities were conducted at the Base. Firefighting foams (e.g., Aqueous Film Forming Foam [AFFF]) were used during the training activities and were stored at the Base. Some PFAS compounds are used in the formulation of AFFF. Eight carbon based (C8) AFFF was used by the USAF and the ANG to extinguish petroleum fires starting from approximately 1970. Long-chain PFAS used in C8 AFFF, specifically PFOA and PFOS, are recognized as persistent, bioaccumulative, and toxic (ITRC, 2018). As of January 2019, C8 AFFF at Gabreski ANGB has been removed, disposed of, and replaced with six carbon based (C6) AFFF. C6 PFAS are currently considered lower in toxicity and have significantly reduced bioaccumulation potential compared to C8 PFAS (USEPA, 2019).

2.2 PROJECT ACTION LIMITS

Screening criteria, i.e. Project Action limits (PAL), were established during the PFAS SI (AECOM, 2019) and remain unchanged for the ESI. The USEPA and the NYSDEC have not developed or promulgated additional screening criteria since the SI was completed. The applicable PALs are summarized below and are described in more detail in the UFP-QAPP (**Appendix A**):

- The PAL for PFAS in soils and sediment (specifically PFOA and PFOS) are 1,260 micrograms per kilogram (μg/kg).
- The PAL for PFAS in groundwater is the USEPA Health Advisory (HA) for Drinking Water (surface water or groundwater) which is 70 nanograms per liter (ng/L) (combined PFOA and PFOS when both are present).

2.3 PREVIOUS INVESTIGATIONS

Previous investigations were completed at Gabreski ANGB for PFAS by NGB/A4OR and are described below and in **Table 2.1**. PFAS investigation conducted off-Base by others are described in Sections 2.3.6 and 2.3.7:

- The PA which included a review of documented fire training and other areas suspected or known to have had a release of AFFF to the environment. The PA included a Base reconnaissance visit where 18 potential AOCs were inspected, Base personnel were interviewed, and on-Base documentation was reviewed. The PA identified 18 potential AOCs and recommended 16 for further investigation (BB&E, 2016).

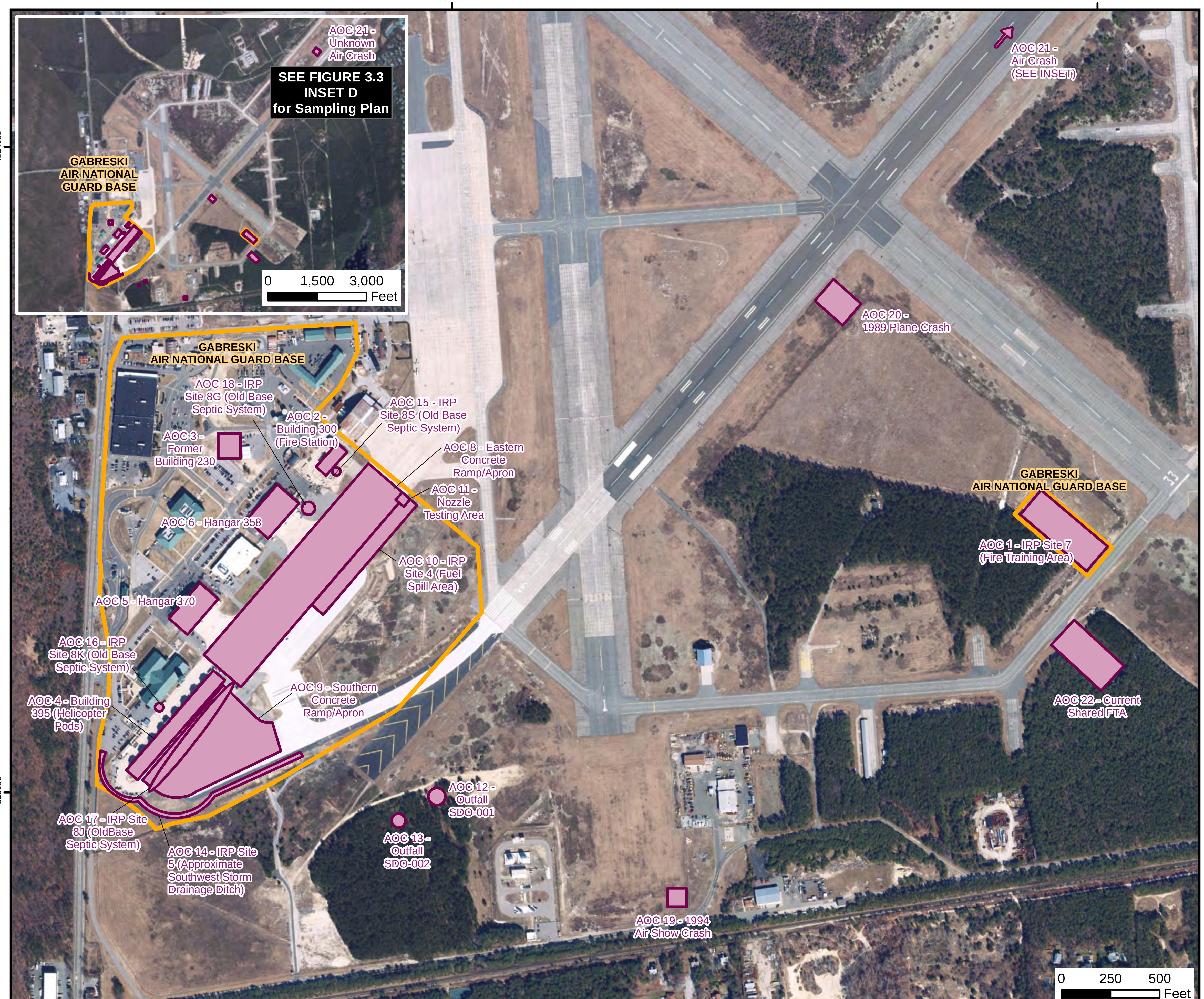
- SI data collected was used to evaluate the presence of PFAS at the 16 AOCs retained for further investigation from the PA and to assess if PFAS are migrating off-Base. The SI results recommended the focus of future investigations be placed on off-Base migration since the highest PFAS concentrations in groundwater was detected at AOC-1, located upgradient from the SCWA Meetinghouse Road drinking water wells, where PFAS impacts have been detected. AOCs 3, and AOC 19 through 22 were identified as requiring additional investigation during this ESI as they are located off-Base and were not investigated during the SI.

The following subsections provide a brief summary of information obtained during the PA, the SI, and investigations conducted by others for those AOCs proposed to be investigated during this ESI. However, the findings of each report are not repeated in full and thus, should be reviewed in conjunction with this ESI Work Plan for comprehensive understanding of the history of the AOCs to be investigated.

2.3.1 AOC 1 - FORMER FTA (IRP SITE 7) SI RESULTS

AOC 1 (also known as Installation Restoration Program [IRP] Site 7) is a former Fire Training Area (FTA) used by the USAF from 1943 to 1971. The AOC is located approximately 130 feet northwest of the taxiway on the southeastern side of the Airport. The area was originally an unlined pit encompassing one acre where waste fuels, solvents, and jet fuel were reportedly poured directly on the ground and ignited for firefighting training exercises. The FTA was paved with concrete hard stand in 1971 after the ANG took over operations until 1986 when fire training was discontinued at the AOC. A burn area was constructed in 1978 and measured 50 feet (ft) x 50 ft with a 1-foot high berm to enclose the area. The burn procedures were modified during this time by floating a layer of fuel inside the berm on water, then either separating the fuel into a concrete underground storage tank (UST), or the excess fuel was burned off.

Figure 2.1
Site Map
Gabreski Air National Guard Base



Legend

- Area of Concern (AOC)
- Installation Boundary

DATA SOURCES
-Image: ESRI, 2016
-ANG Base: Installation Boundary, AOC Boundary

PARSONS

NATIONAL GUARD BUREAU
OPERATIONS DIVISION
RESTORATION BRANCH
(NGB/A4OR)

DESIGNED BY: RGS	Expanded Site Inspections for Perfluorinated Compounds at Multiple Air National Guard Installations	
DRAWN BY: RGS		
CHECKED BY: TM	SCALE: AS SHOWN	CONTRACT NUMBER: GS00Q140A DU127
	DATE: 4/30/2019	DELIVERY ORDER NUMBER: W9133L-18-F-0052
SUBMITTED BY: TM	Coordinate System: WGS 1984 UTM Zone 18N	

PATH: F:\GISCADD\projects\OASIS\GIS\Gabreski\Maps\Workplan\GABRESKI_sitemap.mxd

Table 2.1 – Summary of the PA and SI by Site

AOC/PRL Number	Site Name	Media Impacted Above PALs
1	Former IRP Site 7	Groundwater
2	Building 300 Former Fire Station	Groundwater, Soil
3 (1)	Former Building 230 Vehicle Maintenance	No Further Action (NFA)
4	Building 395 (Helicopter Pods)	Groundwater
5	Hanger 370	Groundwater
6	Hangar 358	Groundwater, Soil
7	Building 250 Warehouse	NFA
8	Eastern Concrete Ramp/Apron	Groundwater
9	Southern Concrete Ramp/Apron	Groundwater
10	IRP Site 4 Fuel Spill Area	Groundwater
11	Nozzle Testing Area	Groundwater
12	Outfall SDO-001	None
13	Outfall SDO-002	None
14	IRP Site 5 Southwest Storm Drainage Ditch	Groundwater
15	IRP 8S Old Base Septic System	Groundwater
16	IRP 8K Old Base Septic System	None
17	IRP 8J Old Base Septic System	Groundwater
18	IRP 8G Old Base Septic System	Groundwater, Soil

Notes: FTA = Fire Training Area
IRP = Installation Restoration Program
NFA = No Further Action
(1) AOC was recommended for no further action in PA report but NGB/A4OR agreed with the NYSDEC to investigate the AOC since it is a potential source area.

Fuel that was used for the firefighting training exercises was stored in a steel above ground storage tank located approximately 250 ft south-southeast of the former FTA. Both tanks were connected to the former FTA by buried piping. According to Base personnel, AFFF and protein foam were used, although usage amounts are unknown (BB&E, 2016). The concrete and a portion of the berm remain; and the area is currently used as munitions storage for the Base.

Volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) were detected above the NYSDEC action levels in 1989. An RI was conducted in 2001 and found VOCs, SVOCs, arsenic, and lead in groundwater samples above the NYSDEC action levels. In 2004 long-term monitoring (LTM) of the groundwater was implemented and conducted until October 2012 when NYSDEC issued a No Further Action (NFA) for the site (SAIC, 2012). During the 2001 RI activities PFAS were not contaminants of concern (COCs) and thus soil or groundwater samples were not analyzed by the laboratory for PFAS compounds.

During the 2018 PFAS SI, five soil borings (IRP7-SB01, IRP7-SB02, IRP7-SB03, IRP7-SB04/IRP7-MW01, and IRP7-SB05/IRP-MW02) with two of the borings converted into groundwater monitoring wells were installed at the AOC (refer to **Figure 3.3** for the soil boring and well locations). The wells were installed with 10 feet of screen and at depths ranging from 42.7 ft bgs and 43.4 ft bgs respectively. Two soil samples from each boring and a groundwater sample from each well were collected and submitted for PFAS analysis. The results indicated:

- PFOA and PFOS were detected in the soil but below the PAL of 1,260 µg/kg.
- PFOA and PFOS was detected in the groundwater in both wells at concentrations above the PAL of 70 ng/L. The highest concentrations were detected at well IRP7-MW01; 32,000 ng/L for PFOS and 520 ng/L for PFOA.

This AOC is located about 3,200 ft upgradient of the SCWA Meetinghouse Road well field.

2.3.2 AOC 3 – FORMER BUILDING 230 - VEHICLE MAINTENANCE

Building 230 was built in 1962 and demolished on 27 February 2012. A concrete parking area for mobility containers now covers the former footprint. Building 230 was utilized for vehicle maintenance, including the occasional maintenance of AFFF-carrying fire department (FD) vehicles. An NFA was recommended in the PA Report (BB&E, 2016) since there were no reports or records of accidental AFFF releases at former Building 230. NGB/A4OR agreed with the NYSCE during the SI review period to investigate former Building 230 as a potential source area for PFAS contamination.

2.3.3 AOC 19 – 1994 AIR SHOW PLANE CRASH

According to records of communication contained in the PA Report (BB&E, 2016), an air show plane crash occurred off-Base and in a grassy area south of the wastewater treatment plant in 1994. No other information was contained in the report regarding the crash. Since an investigation of the crash was not conducted previously, the NGB/A4OR agreed to investigate this area as a potential source for PFAS contamination.

2.3.4 AOC 20 - 1989 AIRPLANE CRASH

According to records of communication contained in the PA Report (BB&E, 2016), a plane crashed and caught on fire on the runway located off-Base in 1989. No other information was contained in the report regarding this plane crash. Since an investigation of the plane crash was not conducted previously, the NGB/A4OR agreed to investigate this area as a potential source for PFAS contamination.

2.3.5 AOC 21 – UNKNOWN AIR CRASH

The NYSDEC identified an unknow air crash that occurred at the approach end of Runway 24 during their review of the AECOM SI report (NYSDEC, 2018). No other information was provided on this crash from the NYSDEC or on-Base personnel. Since an investigation of the crash was not conducted previously, the NGB/A4OR agreed to investigate this area as a potential source for PFAS contamination.

2.3.6 AOC 22 – CURRENT SHARED FTA

AOC 22 is the current FTA located southwest from the former FTA where firefighting exercises are conducted by ANG and the Suffolk County Airport (the AOC is considered an off-Base site). Gabreski ANG supplies emergency fire services to both the military and civilian sectors of the Airport.

In July 2016, the NYSDEC conducted a groundwater investigation in response to reports that the SCWA had detected PFAS in groundwater monitoring wells located downgradient of the Gabreski ANG. The investigation focused on the current and former FTA for PFAS impacts.

Six groundwater profile points were advanced downgradient of the current and former FTA (Environmental Assessment and Remediations [EAR], 2016). Profile points (GP-1 and GP-2) were located along the east and southwest sides of the current FTA and the remaining four profiles (GP-3 through GP-6) were downgradient of the former FTA (refer to **Figure 3.3** for the locations of the groundwater profile points). Discreet groundwater samples were collected from each profile location every 10 ft starting at the water table and ending at approximately 80 ft bgs. Approximately five discreet samples were collected from each location, for a total of 43 groundwater samples including 11 quality assurance/quality control (QA/QC) samples. In addition, two soil borings (SB-1 and SB-2) were advanced along the east and west sides of the current FTA. Soil samples were collected at the ground surface and 2 ft bgs from each boring. The results indicated:

- The highest PFOS and PFOA concentrations in groundwater were typically detected at the top of the water table and exceeded the PAL. PFOS and PFOA concentrations in the rest of the samples at each location were above and below the PAL. PFOS was detected in 31 of the 32 groundwater samples with concentrations ranging from < 2 ng/L to 58,900J ng/L. PFOA was detected in 31 of the 32 groundwater samples with concentrations ranging from < 2 ng/L to 6,930 ng/L.
- PFOS concentrations at the water table and downgradient from the former FTA ranged from 699J ng/L (GP-6) to 44,300J ng/L (GP-4) and PFOA ranged from 31.2 ng/L (GP-6) to 653 ng/L (GP-4). PFOS concentrations above the PAL were mostly detected in the samples collected from GP-4 and GP-5 locations. PFOA concentrations in the remaining samples at each location were below the PAL.
- PFOS concentrations detected at the water table for the current FTA ranged from 22,900 ng/L (GP-2) to 58,900J ng/L (GP-1) and for PFOA ranged from 2,170 ng/L (GP-2) to 6,390 ng/L (GP-1). PFOS concentrations in most of the other samples continued to be above the PAL while the PFOA concentrations were below the PAL.
- PFOA was not detected in the four soil samples while PFOS was detected in three of the four soil samples collected from the current FTA. PFOS was detected above the PAL only in sample SB-1 (1,610 µg/kg) collected at 2 ft bgs.

In May 2018, the NYSDEC conducted another investigation of the current FTA for PFAS impacts (EAR, 2018). The investigation consisted of the installation and sampling of three soil borings (SB-1 through SB-3) and two monitoring wells (MW-1 and MW-2; refer to **Figure 3.3** for locations of the monitoring wells and soil borings). Soil samples for PFAS analysis were collected from 3.5 to 4.0 ft bgs for SB-1 and SB-2 since samples above this depth were collected at these locations in July 2016. Three soil samples from SB-3 and eight soil samples from well MW-2 and one groundwater sample from each well were also submitted for PFAS analysis. The results indicated:

- PFOS and PFOA concentrations exceeding the PAL were detected in each of the monitoring wells. The highest PFOS (58,400 ng/L) and PFOA (12,600 ng/L) concentration was detected in MW-2 which is located on the southeast side of the current FTA.
-
- PFOA and PFOS were detected in each soil sample collected from the three soil borings and MW-2. PFOS concentrations only exceeded the PAL and were detected in the MW-2 surface sample (1,440 μg/kg) and SB-3 (1,660 μg/kg) collected from 3.5-4.0 ft bgs.

2.3.7 OFF-BASE PFAS INVESTIGATIONS CONDUCTED BY OTHERS

There have been numerous off-Base PFAS investigations conducted by others. The results of those investigations are presented below.

- A groundwater investigation was conducted in October 2016 to determine if PFAS is present in the groundwater at Hampton Business District property located in the northwest portion of the Gabreski Airport (ZEB, 2016). The 85-acre property is leased by Rechler Equity Partners from Suffolk County and the southern portion of the property abuts the northern Base boundary. Three existing groundwater monitoring wells (MW001, MW002, and MW003) located along Cook Street in the southern portion of the property were sampled for PFAS in October 2016 (refer to **Figure 3.2** for the well locations). These wells are located hydraulically upgradient of the northern Base boundary. The results indicated:
  - PFOS was detected in each of the monitoring well and concentrations exceeding the PAL were detected in well MW002 (104 ng/L).
  - PFOA was detected in each of the monitoring wells and concentrations were below the 70 ng/L PAL. PFOA concentrations ranged from 10.1 (MW001) to 15.3 ng/L (MW003).
- Suffolk County Department of Health Services (SCDHS) conducted a groundwater investigation in June 2016 to assess possible PFAS sources in response to the impacts found at the SCWA Meetinghouse Road public water supply wellfield (SCDHS, 2016). Four groundwater profile points (MH-1 through MH-4) were installed along South Country Road, south and hydraulically downgradient of the Airport property and north of the Meetinghouse Road wellfield (refer to **Figure 3.4** for the location of SCDHS profile points). Discreet groundwater samples were collected from each location every 10 ft starting at the water table and ending at approximately 95 ft bgs. Approximately eight to nine discreet samples were collected from each location. In addition to PFAS analysis, the samples were also analyzed for VOC, SVOC, metals, and chlorinated pesticides. The results indicated:
  - PFOA/PFOS were detected in three (MH-1, MH-2, and MH-3) of four profile points.

- PFOS was detected above the PAL in MH-1 at 30-35 ft bgs (960 ng/L) and 40-45 ft bgs (440 ng/L); MH-2 at 30-35 ft bgs (120 ng/L) and 50-55 ft bgs (190ng/L); and MH-3 at 20-25 ft bgs (750 ng/L), 30-35 ft bgs (14,300 ng/L), 80-85 ft bgs (410 ng/L) and 90-95 ft bgs (170 ng/L).
- PFOA was detected above the PAL only at MH-3 at 30-35 ft bgs (780 ng/L).

- A semi-annual groundwater sampling event was conducted in August 2016 at the former Canine Kennel Site (PWGC, 2018). The former Canine Kennel Site is located on the eastern edge of the Gabreski Airport. Six groundwater wells (MW-01 through MW-06) were sampled and analyzed for PCBs, PFAS, and 1,4-dioxane at the request of the NYSDEC (refer to **Figure 3.4** for the location of the wells). The results indicated:
  - PFOA and PFOS were detected in each of the monitoring wells. PFOS concentrations exceeding the PAL were detected in monitoring wells MW-01 (17,000 ng/L), MW-05 (1,600 ng/L), and MW-06 (260 ng/L). PFAS above the PAL was only detected in MW-01 (150 ng/L)
  - The highest PFOA and PFOS concentrations were detected in well MW-01, which is the upgradient well for the site indicating that the source of PFAS impact is likely off-site and upgradient of the Canine Kennel Site (PWGC, 2018).
- A groundwater investigation was conducted in October 2018 at the former Canine Kennel Site to define the extent of PFAS contamination and identify potential source areas (PWGC, 2018). Six groundwater profile points (VP-1 and VP-6) were advanced along the north, south, and east sides of the former Canine Kennel Site (refer to **Figure 3.4** for the profile point locations). Discreet groundwater samples were collected from each profile location every 10 ft starting at the water table and ending at approximately 100 feet bgs. Nine discreet samples were collected from each location. The results indicated:
  - PFOS and PFOA were detected at the six prolife points. Concentrations exceeding the PAL for PFOS were detected in five of six locations and PFOA was detected in four of six locations.
  - PFOS concentrations that exceeded the PAL included VP-1 (16-20 ft bgs at 9,000 ng/L, and every 10 foot interval from 66 to 100 ft bgs ranging from 82 to 590 ng/L); VP-2 (26-30 ft bgs at 450 ng/L, and every 10 foot interval from 46 to 100 ft bgs ranging from 94 to 400 ng/L); VP-4 (46-50 ft bgs at 1,100 ng/L, and every 10 foot interval from 76 to 90 ft bgs ranging from 95 to 240 ng/L); VP-5 (46-50 ft bgs at 150 ng/L), and VP-6 (16-20 ft bgs at 280 ng/L, 46 to 50 ft bgs at 310 ng/L and 86 to 90 ft bgs at 85 ng/L).
  - PFOA concentrations that exceeded the PAL included VP-1 (16-20 ft bgs at 100 ng/L), VP-4 (46-50 ft bgs at 330 ng/L), VP-5 (46-50 ft bgs at 530 ng/L), and VP-6 (46 to 50 ft bgs at 110 ng/L).
- In May 2018, the NYSDEC investigated the area in the vicinity of outfalls SDO-001 and SDO-002 located off-Base and in the southern portion of the Airport for PFAS impacts (EAR, 2018). The investigation consisted of the installation and sampling of two monitoring wells (MW-3 and MW-4), sampling three existing monitoring wells (SW-08, SW-09, and an unknown MW), and the collection of soil, sediment and surface water samples at the outfalls discharge pipes (refer to **Figure 3.2** for monitoring well, soil boring, and sediment and surface water sample locations). The results indicated:

  - PFOA and PFOS were detected in each of the six monitoring wells. PFOS and PFOA concentrations exceeding the PAL were detected in monitoring well SW-08 and only the PFOS concentration exceeded the PAL in well SW-09. The highest PFOA concentration was detected in well SW-08 (1,430 ng/L) located upgradient of outfall SDO-002 and highest PFOS was detected in SW-09 (4,900 ng/L) located upgradient of outfall SDO-001.
  - PFOA and PFOS were detected in the surface water sample collected at SDO-001 outfall (no sample was collected at SDO-002 since it was dry). Only PFOS exceeded the PAL in the SDO-001 (190 ng/L) sample.
  - PFOA and PFOS were detected in the sediment sample and the three soil samples collected at the SDO-001 outfall and the three soil samples collected at outfall SDO-002. The PFOA and PFOS concentrations were below the PAL in the seven samples.
- SCDHS collected surface water samples for PFOA and PFOS analysis from three surface water bodies located east and west of Gabreski ANG. Two surface water samples were collected from Beaverdam Creek located west and downgradient of the Base in December 2017 and May and August 2018, one surface water sample was collected from the Quantuck Creek in August 2016 and May and December 2018, and one surface water sample was collected from the Old Ice Pond in December 2017 and May and August 2018. Limited information was available about the sampling; surface water results were presented on a drawing titled "Westhampton PFOS/PFOA Surface Water Sampling Results". These results indicated:
  - PFOA and PFOS were detected in the two surface water samples collected from Beaverdam Creek. PFOS concentrations ranged from 1.6 ng/L (GA003, December 2017) to 5.28 ng/L (GA001, August 2018). The PFOA concentrations ranged from 1.3 ng/L (GA001, December 2017) to 3.67 ng/L (GA003, August 2018).
  - PFOA and PFOS were detected in the surface water samples collected from Old Ice Pond and Quantuck Creek. The highest PFOS concentrations were detected in the samples collected from the Old Ice Pond while the PFOA concentrations were similar at both locations.
  - PFOS concentrations in Old Ice Pond ranged from 25.7 ng/L (GA004, December 2017) to 138 ng/L (GA004, August 2018). The PFOA concentrations ranged from 2.6 ng/L (GA004, December 2017) to 3.84 ng/L (GA004, August 2018).
  - PFOS concentrations in Quantuck Creek, which is downgradient from the Old Ice Pond, ranged from 17.2 ng/L (GA002, May/December 2018) to 25.7 ng/L (GA002, August 2016). The PFOA concentrations ranged from 3.2 ng/L (GA002, May/December 2018) to 4.01 ng/L (GA002, August 2016).
- SCDHS has conducted an evaluation of private wells near Gabreski ANG (NYSDEC, 2018). Beginning in 2016, a private well survey identified 75 properties served by 76 private wells. Sampling found 11 of these wells had PFOS and PFOA concentrations detected above the EPA HA. In response to the detection of PFOS in the groundwater in the eastern area of Gabreski Airport, SCDHS is currently conducting private well surveys in Quogue and East Quogue. Twenty-six properties served by 27 private wells have been identified in Quogue downgradient of Gabreski Airport. In East Quogue, 28 properties near the Gabreski Airport and served by a private well have been identified.

2.4 ENVIRONMENTAL SETTING

The following sections summarize the environmental setting of Gabreski ANGB, specifically the topography, climate, vegetation, geology, and hydrogeology. These were comprehensively discussed in the previously referenced reports. Thus, for a complete understanding of the environmental setting of Gabreski ANGB, the referenced reports should also be reviewed in addition to this abbreviated ESI Work Plan.

2.4.1 SITE TOPOGRAPHY AND DRAINAGE

Gabreski ANGB property is generally flat with subtle rolling terrain and stream channels that slope down from the north to the south-southeast. Surface elevations range from approximately 20 ft above mean sea level (amsl) in the southern portion of the property to 70 ft amsl in the northern portion of the base.

While most of the precipitation percolates into the soil, surface water runoff from the majority of the property discharges into the Aspatuck Creek System. Runoff from the western portion drains into Aspatuck Creek while runoff from the eastern portion drains into Quantuck Creek. Both creeks flow into Quantuck Bay, and ultimately into the Atlantic Ocean (AECOM, 2019).

2.4.2 CLIMATE

Westhampton is located in a region with four distinct seasons. Summers are warm and humid, and winters are very cold, wet and windy; and is partly cloudy year-round. Average temperatures typically range from 24 degrees Fahrenheit (°F) in the winter to 80°F in the summer. On average, 39 inches of precipitation falls as rain each year with 26 inches as snowfall.

2.4.3 VEGETATION

Gabreski Airport is located within the Long Island pine barrens. The pine barrens are characterized by open, sunlit woodlands dominated by pitch pine interspersed with white and scrub oak.

2.4.4 GEOLOGY

Gabreski ANGB is located on a glacial outwash plain that slopes south from the Ronkonkoma Moraine to bays and barrier islands, which form the southern boundary of Long Island. Five unconsolidated formations are found below, or near, the Gabreski ANGB. These units dip generally to the south with the thicker units very widespread and underlying most of Suffolk County. A description of each unit is provided below.

2.4.4.1 BEDROCK

The bedrock that underlies the unconsolidated deposits include hard, dense schist, gneiss, and granite similar in character to that which underlies much of the mainland in nearby parts of New York and Connecticut. Elevation of the bedrock is approximately 1,600 ft below mean sea level (MSL). These rocks are either metamorphosed Precambrian or early Paleozoic Age sediments.

2.4.4.2 RARITAN FORMATION

The Raritan formation rests directly on highly to slightly weathered bedrock. The formation is probably entirely continental and was laid down as a coastal-plain deposit by streams flowing off the mainland. On Long Island, the formation has two fairly distinct members: the Lloyd sand member and the Raritan Clay Member.

The Lloyd Sand Member overlies the bedrock and provides a reliable source of drinking water. The Lloyd sand member is approximately 400 feet thick and consists of white and gray fine-to-coarse sand containing silt and clay in the interstices. It also includes beds of clay or sandy clay and coarser textured beds that contain gravel. The unit consists chiefly of sand and coarse gravel, which contains some pebbles at least 2 inches in diameter. The voids between the pebbles are for the most part filled with sand and some clay. The sandy portion of the unit has a moderate hydraulic conductivity while the clayey beds has a low hydraulic conductivity (Garber, M.S., 1986).

The Raritan Clay Member which overlies the Lloyd sand, makes up the balance of the Raritan formation. The top of the clay member is approximately 1000 ft below MSL at the Airport. Its thickness is about 200 ft and composed of a solid silty clay with that is gray, red or white in color with few lenses of sand and gravel and abundant lignite and pyrite. It is not clearly bedded, as the textures and colors grade into one another. Zones containing well-marked, narrow bands of light-colored silty clay alternate with darker colored clay.

2.4.4.3 MAGOTHY FORMATION

Above the Raritan Clay lies the Magothy Formation which is a thick body of continental deposits composed of lenses of sand, sandy clay, clay, and some gravel and is unconformably overlain by upper Pleistocene deposits. The present upper surface of the Magothy on Long Island is an erosional surface, and the original thickness is not known. The Magothy formation underlies most of Long Island except for some western areas where it was removed by erosion. It may extend beneath Long Island Sound but is probably truncated by erosion and overlain by Pliestocene deposits. To the south, the Magothy formation, like the Raritan, extends out under the sea, where it also probably changes from a terrestrial to a marine deposit.

The Magothy is composed of beds of poorly sorted quartzose sand mixed with and interbedded with silt and clay, and locally it contains pebbles or small lenses of gravel. Sandy clay and clayey sand make up most of the fine beds, but there are also several thick beds of clay some as much as 50 ft thick. The basal 100 to 150 ft of the Magothy contains a greater proportion of coarse-grained material. This consists partly of coarse sand and gravel that contains pebbles as much as 2 or 3 inches in diameter. Voids are largely filled with silt and soft clay. The coarse-grained beds are separated by beds of sandy clay.

2.4.4.4 MONMOUTH GREENSAND

Unconformably overlying the Magothy formation is the Monmouth Greensand. This unit is not present beneath the Airport or to the north but is present 3,000 ft to the south. This unit extends southward and forms a wedge-like layer which thickens towards the south. It is approximately 50 ft thick beneath the barrier beach. The Monmouth Greensand consists of interbedded marine deposits of dark-gray, olive-green, dark-greenish-gray, and greenish-black glauconitic and lignitic clay, silt, and clayey and silty sand. This layer has a low hydraulic conductivity and tends to confine the water of the underlying aquifer (Dames & Moore, 1986).

2.4.4.5 GARDINERS CLAY

An approximately 40-ft-thick clay bed lies above the Magothy formation and below the glacial deposits below the Airport. This clay is present at about 100 ft below MSL at the Airport and extends southward where it overlaps the Monmouth Greensand. The Gardiners clay pinches out just north of the Airport, but equivalent clay bodies can be found locally at various locations on Long Island. This unit is made up of green and gray clay, silt, and clayey and silty sand including some interbedded clayey and silty gravel. This layer as a whole has low hydraulic conductivity and tends to confine water in the underlying aquifer (Dames & Moore, 1986).

2.4.4.6 GLACIAL DEPOSITS

These upper Pleistocene sediments are composed of glacial outwash deposits; lucastrine and marine deposits; and terminal, ground, and ablation-moraine till deposits. The sediments below the Airport are mostly outwash deposits consisting of stratified fine to coarse sand and gravel of light- to dark-brown, tan, and yellowish-brown color. Till deposits known as the Ronkonkoma Terminal Moraine are hills and located approximately 2 miles north of the Airport. Lacustrine and marine deposits are usually thin and discontinuous and are found locally throughout Long Island.

The Pleistocene epoch is divided into four major glacial stages: the Nebraskan, Kansan, Illinoian, and Wisconsin. The youngest epoch, the Wisconsin, produced Long Island Sound and most of the topographic features of Suffolk County as it is known today. During the earlier part of the Wisconsin stage, the ice sheet moved to about the middle of the county and stopped, leaving before it the central ridge or terminal moraine. This ice sheet was called the Ronkonkoma sheet, and the moraine, which runs the entire length of the county from the Nassau County line to Montauk Point, was given the same name. The glacier retreated from this point back to the north of Long Island and then re-advanced. The last advance terminated along the north shore, and again, a hilly terminal moraine was formed. This last advance of the ice was called the Harbor Hill sheet, and the moraine was called the Harbor Hill Moraine.

After the two ice sheets reached their southern limits in the county, they began to melt. As they melted, meltwater streams flowed from the glaciers and carried a large volume of sand and gravel farther south. The sand and gravel were deposited in a more or less flat plain, developing what is known as an outwash plain. Two outwash plains are in the county, with the one between the Ronkonkoma moraine and the Atlantic Ocean being the one present below the Airport (Dames &Moore, 1986).

The upper Pleistocene glacial deposits which underlie the Airport are mainly outwash deposits consisting of 100 ft of stratified fine to coarse sand and gravel. Sieve analyses of two subsurface samples indicated the following average percentages: 90.5% sand, 7.9% gravel, and 1.6% silt/clay. Surface soil was found to contain higher percentages of silt (ABB-ES, 1997).

2.4.5 HYDROGEOLOGY

The Gabreski ANGB property lies within a Special Groundwater Protection Area (SGPA) of Suffolk County. The SGPAs are watershed recharge areas important for the maintenance of large volumes of high-quality groundwater, with the overarching goal of the SGPA to protect the water supply. The SGPAs are designated as Critical Environmental Areas which have unique natural settings. Groundwater beneath the Base is found within three different aquifers (Upper Glacial aquifer; Magothy and Lloyd aquifers) which are designated as Sole Source Aquifers since 1978. A description of each aquifer and aquitard overlying Gabreski is provided below.

2.4.5.1 LLOYD AQUIFER

Overlying the bedrock is the Lloyd Aquifer which correlates to the Lloyd Sand Member of the Raritan Formation. The Lloyd aquifer is considered one of the most important aquifers on Long Island largely because it yields adequate supplies of good water in areas, where supplies from overlying formations are inadequate or are contaminated by or readily subject to contamination by sea water. The Lloyd can supply water under these circumstances because it is overlain by the relatively impermeable and virtually continuous blanket of the clay member. The hydraulic conductivity of the Lloyd around the Airport was estimated to be 300 gallons per day per square foot (gpd/ft^2) and transmissivity was estimated as 75 gpd/ft (Dames & Moore, 1986).

2.4.5.2 RARITAN CLAY

The Raritan Clay member of the Raritan formation is considered an aquitard separating the underlying Lloyd Aquifer from the overlying Magothy Aquifer. Thickness below the airport is approximately 200 ft. The hydraulic conductivity of a clay similar to the Raritan was determined to be 0.2 gpd/ft^2 (9.4 x 10-6 cm/sec), which is several orders or magnitude less than either the Lloyd or Magothy aquifers indicating that mixing of waters is quite small (Dames & Moore, 1986).

2.4.5.3 MAGOTHY AQUIFER

Although part of the Magothy consists of dense clay and layers or coarse sand and gravel, by far the greater part of the Magothy formation is made up of sandy clay and clayey sand. The formation as a whole, because of this thickness, can transmit and store large amounts of groundwater. Wells that are constructed and developed carefully generally yield large quantities of water from all but the most clayey parts of the formation. Hydraulic conductivity of the Magothy below the Airport was estimated to be 380 gpd/ft^2, and transmissivity was at least 300 gpd/ft with a saturated thickness of approximately 930 ft. Below the Airport, the top of the Magothy aquifer is about 150 ft below MSL. This confined, artesian nature of the Magothy would cause an upward flow of water through the overlying Gardiners clay (Dames & Moore, 1986).

2.4.5.4 GARDINERS CLAY

This clay is poorly permeable and constitutes a confining layer for the underlying aquifer. Occasionally, some sand layers within the Gardiner may yield small quantities of water. The effectiveness of the Gardiners clay as a barrier to groundwater movement is an important factor in determining whether contamination reaching the groundwater in the glacial sands would be carried down to the lower aquifer. The clayey and silty sand zones in the clay would offer relatively little restriction to the movement of the water, which could then pass downward wherever the hydraulic gradient is favorable. Water can pass through the Gardiners clay, although at a slow rate, in small amounts and probably at most places only by circuitous routes. Below the Airport, the beds of clay and sand within the Gardiners clay are an effective barrier to the movement of groundwater into lower aquifers. The combination of low permeability with the generally upward movement of water within the Magothy aquifer would tend to keep near surface contamination from migrating into the lower aquifer (Dames & Moore 1986).

2.4.5.5 UPPER GLACIAL AQUIFER

The Upper Glacial aquifer correlates to the saturated interval of the glacial outwash deposits of the Wisconsin glaciation. This water-bearing unit is an unconfined aquifer present directly below the Airport. The clean, coarse sand and gravel is very porous and highly permeable. There is virtually no surface runoff since rainfall infiltrates where it falls due to the high porosity of the soils. Much of the groundwater is obtained from the Upper Glacial aquifer for Central Suffolk County. There are no effective barriers to the movement of water anywhere in the unit, but there may be substantial variation in permeability over short distances.

Some of these minor variations in water-bearing characteristics might become significant in connection with possible movement of a contaminant. As the moraine and outwash deposits were developed by water flowing generally from north to south, individual lenses of sand and gravel may be elongated in this direction. Thus, there may be threads of material with relatively higher permeably material along which water might move a little more rapidly under proper hydraulic conditions. Hydraulic conductivity of the outwash deposits was estimated to be about 2000 gpd/ft^2 (9.4 x 10-2 cm/sec) (ABB-ES, 1997), and transmissivity is approximately 200 gpd/ft (2.9 x 10-1 cm^2/s) (Dames & Moore, 1986).

Aquifer flow is generally south southeast toward the headwaters of Quantuck Creek. Depth to groundwater averages 35 to 40 ft bgs. Slug tests performed on installation monitoring wells and piezometers (screened in the upper glacial aquifer) produced hydraulic conductivities ranging from 1.6 x 10-2 to 5.2 x 10-2 cm/sec (Dames & Moore, 1986).

2.4.6 OFF-BASE AREAS AND RECEPTORS OF CONCERN

Potential receptors of concern for PFAS compounds are off-Base and include public water supply (PWS) wells, domestic drinking water wells, and hydraulic discharge areas (brooks, rivers and wetlands).

The SCWA Meetinghouse Road wellfield is located approximately 3,200 feet southeast from Gabreski ANG AOC 1- Former FTA. The Meetinghouse Road wellfield consists of PWS wells #12A, #14, #15A, #17, #19, #20, and #22. The PWS wells are reportedly screened in the upper glacial deposits with depths ranging from 54 ft bgs (#14) to 108 ft bgs (#22). The PWS wells with PFAS detections above the EPA HA include #12A, #14, #17, #19, and #22. According to the SCWA, the drinking water from Meetinghouse Road is treated with granular activated carbon filtration systems for the PFAS contamination. The PWS wells are believed to lie within an area of highly transmissive sands and gravels and the extraction of large volumes of groundwater from the wells may have the potential to induce a strong groundwater gradient towards the wells.

The GUS Guerrera wellfield is located approximately 400 feet southwest and downgradient from Gabreski ANGB. The GUS Guerrera wellfield consists of PWS wells #1, #2, and #3 which are reportedly screened in the upper glacial deposits with depths ranging from 103 ft bgs (#1) to 105 ft bgs (#3). Two (#1 and #2) of the three wells have detections of PFAS above the EPA HA.

According to the SCDHS there area at least 76 private wells near Gabreski ANGB. Sampling indicated that 11 of these wells had detections of PFOS and PFOA concentrations above the EPA HA. SCDHS is currently conducting private well surveys in Quogue and East Quogue. Twenty-six properties served by 27 private wells have been identified in Quogue downgradient of Gabreski Airport. In East Quogue, 28 properties near the Gabreski Airport and served by a private well have been identified.

Surface water receptors located downgradient and off-Base include the Aspatuck River, the Quantuck Creek, the Old Ice Pond and North Pond. Surface water samples collected from the Quantuck Creek, and the Old Ice Pond has PFAS detected in the samples during each of the three rounds of sampling. Concentrations in the samples collected from the Quantuck Creek ranged from 17.2 ng/L (May 2018) to 25.7 ng/L (August 2016) for PFOS and 3.2 ng/L (December 2018) to 4.01 ng/L (August 2016) for PFOA. Concentrations in the samples collected from the Old Ice Pond ranged from 25.7 ng/L (December 2017) to 136 ng/L (August 2018) for PFOS and 2.6 ng/L (December 2017) to 3.84 ng/L (August 2018) for PFOA.

SECTION 3.0 Conceptual Site Model and Expanded Site Investigation Approach

3.1 TRIAD-BASED APPROACH

The NGB/4AOR encourages the use of Triad-based investigation approaches to manage decision uncertainty and increase confidence that investigation and remediation project decisions are made correctly and cost-effectively. The proposed Triad-based approach employs systematic project planning, dynamic work strategies, and rapid turn-around sample analysis by an offsite fixed analytical laboratory to support real-time decisions. Parsons has designed an innovative and flexible Triad-based ESI approach that focuses on electronic field data collection, rapid-turn laboratory analyses, strong communications with NGB/4AOR, Gabreski ANGB, NGB/4AOR's oversight contractor BB&E, and NYSDEC, and field-based real-time decision making. This system of continuous communication and team-based decision-making during data collection will allow the entire team to be engaged throughout the ESI process. The ESI approach includes a set of pre-defined primary sample locations by media to fill initial data gaps and a number of contingency samples by media with undefined locations, the placement of which can be tailored to best fit the remaining data gaps following primary sample collection.

Parsons will manage all data in a unified database which incorporates historic PFAS data and associated field data from Gabreski ANGB to streamline data management, improve data quality, and allow for the use of advanced analytics to assess PFAS across the base. Mobile devices will be used to collect field data from all sampling, monitoring, or reconnaissance events. Data from the mobile devices will upload directly to Parsons' secure platform (Microsoft SharePoint) and the programmatic database in near real time to allow for rapid quality assurance and control review and improved data quality. Laboratory results and data generated from other sources are merged into the same database to provide a complete picture of all data available at any time. Web dashboards, hosted within Parsons' SharePoint site, will be deployed to NGB/4AOR, Gabreski ANGB, BB&E, and NYSDEC for querying and viewing data analytics in multiple formats, including GIS views for project progress and quality assurance. The underlying database will follow the same structure as ANG's Environmental Resources Program Information Management System (ERPIMS) and Geobase.

Parsons has developed a primary sampling plan, as described in detail in later sections of this work plan, which will be implemented at the onset of the ESI field program. Parsons will then integrate the data generated during the primary sample collection into the web dashboard described above and a three-dimensional (3D) CSM (described in Section 3.3) available for online viewing by the NGB/4AOR, Gabreski ANGB, BB&E, and NYSDEC. Parsons will host web-based ESI contingency scoping meetings with technical representatives from NGB/4AOR, Gabreski ANGB, BB&E, and NYSDEC to discuss the new analytical results, review the updated CSM, and provide recommendations regarding the placement of contingency samples. Representatives from NGB/4AOR, Gabreski ANGB, BB&E, and NYSDEC will be notified at least two days in advance of an ESI contingency scoping meeting. A conference call-in number, call-in code, and WebEx meeting invitation will be provided by Parsons such that the CSM and proposed near term sampling plans can be shared with all parties using 3-dimensional representations of the site and all data collected to date. Participants will also have access to a SharePoint site where tabulated data, boring logs, and the updated CSM will be available for review. The average ESI contingency scoping call duration will be approximately one hour. At the end of the call, the goal is to obtain consensus on the interpretation of the CSM and placement of additional contingency samples. Following consensus, the contingency sample plan will be communicated to the field team.

The deployment of the proposed Triad-based real time decision making ESI process will ultimately ensure that the ESI dataset meets project objectives with concurrence from all interested parties.

3.2 DATA QUALITY OBJECTIVES

This section documents the problem statement and project goals, identifies the information inputs and boundaries of the ESI, and provides a high-level overview of the investigative approach more specifically detailed in subsequent sections and in the UFP-QAPP (**Appendix A**).

3.2.1 STEP 1. STATE THE PROBLEM

An SI at Gabreski ANGB confirmed the presence of PFAS in soil and groundwater at numerous AOCs (AECOM, 2019). Several off-Base investigations and sampling events have been conducted by others that indicate off-Base groundwater and surface water is impacted by PFAS. The following discussion summarizes the SI conclusions and recommendations:

- SI activities determined that PFAS was present in all groundwater samples collected at each of the 16 AOCs and was found to exceed the PALs at 13 AOCs. These wells are all on Base and were installed within or downgradient of the AOCs. Five of the AOC specific wells were also located near the Base boundary and all contained levels of PFAS above the USEPA HA.
- During the SI, PFAS was detected at concentrations as high as 20 ng/L in the surface water sample collected at the Outfall SDO-001 (AOC 12) which is located off-Base. Although below the USEPA HA, this indicates that PFAS may be transported off-Base in stormwater.
- Recommendations in the SI included full delineation of PFAS impacts at the 16 AOCs with focus on AOC 1 (Fire Training Area), development of a comprehensive CSM, and expanding the investigation activities downgradient of Gabreski ANGB. Although the ESI will partially address this recommendation, the complete delineation of the AOCs will be conducted during a future RI.
- During review of the SI and as described in Section 2.3, additional potential on-Base and off-Base AFFF releases were identified but were not investigated during the SI. These include AOC 3 (Former Vehicle Maintenance Building 230); the three plane crashes associated with AOCs 19, 20, and 21; and AOC 22 (the current shared fire training area). As the ESI is designed to assess the relationship of these off-Base releases, ANG sources, and potential impacts to receptors, these AOCs will be investigated as part of this ESI and will be supplemented by the data collected by other agencies as summarized in Section 2.3.

During the development of this ESI Work Plan, locations upgradient of the Base and downgradient of the impacted AOCs were identified as requiring investigation. Additionally, nearby off-Base surface water features were identified for further investigation.

3.2.2 STEP 2. IDENTIFY THE GOAL OF THE STUDY

The goals associated with the planned PFAS ESI at the Gabreski ANGB are as follows:

1. Confirm and further assess the presence of PFAS in media, including:
   - Groundwater at and downgradient of impacted AOCs, downgradient of Gabreski ANGB, and in background/control wells upgradient of Gabreski ANGB;
   - Sediment and surface water within off-Base surface water features located downgradient from the Base boundary;
   - Storm water on-Base and downstream of AOCs, downgradient off-Base from the Base boundary, and from upgradient background/control locations of the AOCs.
2. Confirm the presence or absence of PFAS in soil and groundwater at AOCs not previously investigated during the SI including:
   - AOCs 3, 19, 20, 21, and 22
3. Perform a receptor survey.
4. Assess potential migration pathways of PFAS-contaminated groundwater from Gabreski ANGB to off-Base receptors including the Gus Guererra wellfield, Meetinghouse Road wellfield, and downgradient private wells.

3.2.3 STEP 3. IDENTIFY INFORMATION INPUTS

Primary information inputs on this project include:

- Historic data collected during previous work at Gabreski ANGB, and off-Base.
- Analytical results of the soil, sediment, groundwater, surface water, and storm water sampling outlined in the ESI Work Plan.
- Field observations made during site reconnaissance and execution of field activities (e.g., determination of soil lithology, measured depth to water table, etc.).
- Secondary data listed in the UFP-QAPP Worksheet #13 (**Appendix A**).

3.2.4 STEP 4. DEFINE THE BOUNDARIES OF THE STUDY

ESI activities are focused on AOC-1, the AOCs which were not investigated during the SI, on/off-base groundwater, on and off-Base Stormwater and off-Base surface water, and sediment. The ESI also includes sampling points upgradient of the Gabreski ANGB to assess potential for off Base sources. Vertical assessment including subsurface soil and groundwater sampling will also be conducted to determine preferential pathways. As primary samples are collected, the data will be continually reviewed and ESI contingency scoping meetings will be held to determine where additional contingency samples are most beneficial to meet the goals of the ESI (see **Section 3.1**).

3.2.5 STEP 5. DEVELOP THE ANALYTIC APPROACH

A total of 24 PFAS target analytes have been selected for ESI activities. The 24 target analytes were chosen based on the PFAS compounds included in the USEPA draft target analyte list (USEPA, 2018). A list of the 24 PFAS target analytes and the analytical methods that will be used are provided in the UFP-QAPP (**Appendix A**). Soil, sediment, groundwater, surface water, and storm water will be analyzed to determine the presence of and concentration of these 24 PFAS compounds. For target analytes with PALs defined in the UFP-QAPP (**Appendix A**), analytical results of the soil, sediment, groundwater, surface water, and stormwater samples will be compared to those PALs.

3.2.6 STEP 6. SPECIFY PERFORMANCE OR ACCEPTANCE CRITERIA

Performance and acceptance will be achieved through application of the quality assurance/quality control (QA/QC) methods and procedures outlined within the UFP-QAPP (**Appendix A**), and ultimately determined through NGB/4AOR approval of and regulatory concurrence with the final results, as presented in a subsequent ESI Report.

3.2.7 STEP 7. DEVELOP THE PLAN FOR OBTAINING DATA

This ESI Work Plan describes a phased approach to sampling and analysis, wherein primary samples will be collected, analyzed, and evaluated to inform placement of contingency samples by group consensus. This process will provide the opportunity to optimize the sampling process and maximize the amount of information gained from this ESI. Details of the QA/QC methods and procedures are detailed in the UFP-QAPP (**Appendix A**).

3.3 CONCEPTUAL SITE MODEL

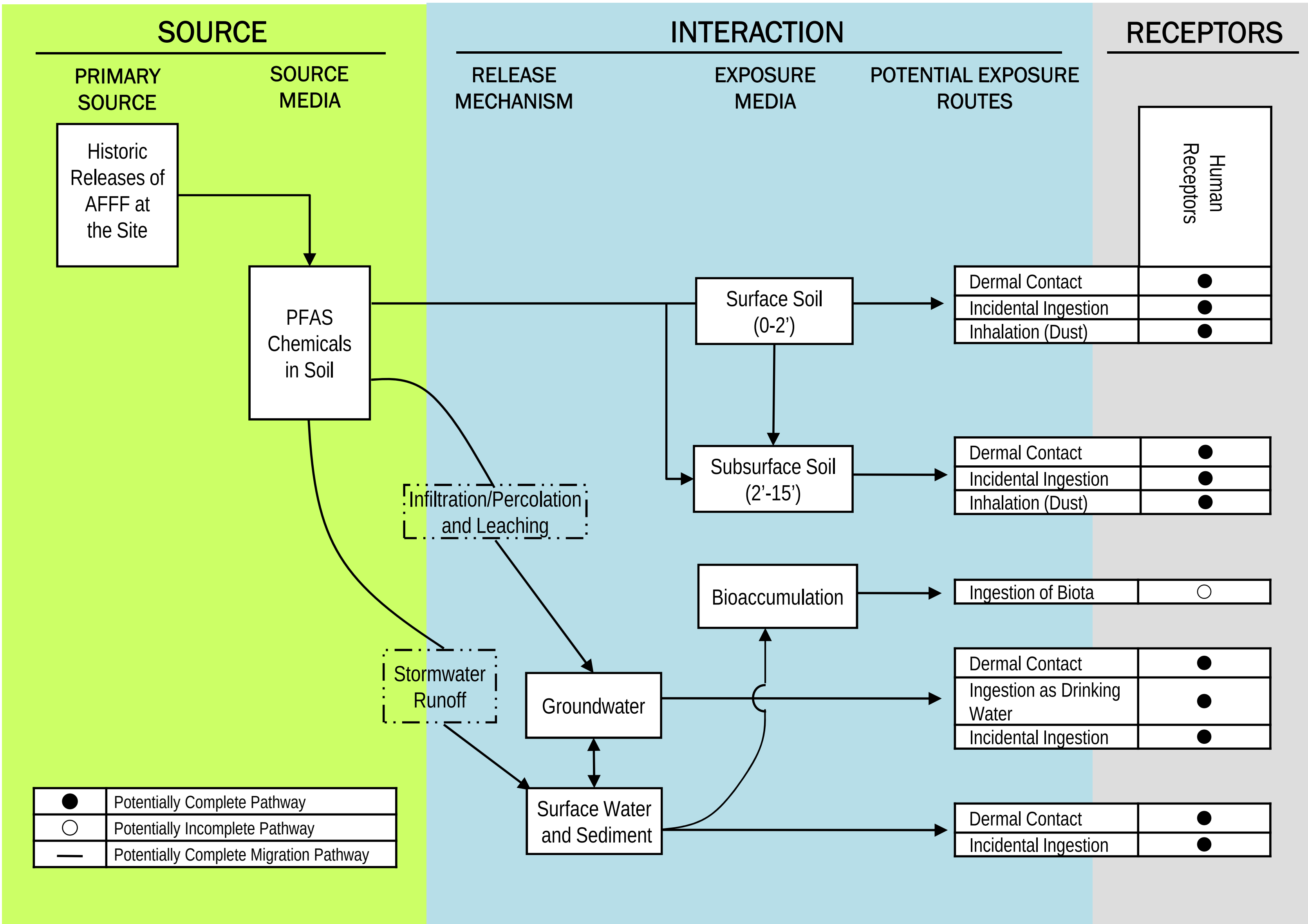
Based on past use and storage of AFFF at Gabreski ANGB, releases of PFAS may have occurred at the AOCs identified for study during the SI, including FTAs, hangars, current and former fire departments, storage buildings, etc. PFAS are relatively mobile in groundwater, less volatile than many other groundwater contaminants, sometimes transported on airborne particles, and generated by transformation of precursors. The fate and transport for PFAS is highly dependent upon surface water and groundwater flow because PFAS are highly soluble in water. A CSM is depicted in **Figure 3.1** showing the potential pathways to human receptors.

PFAS compounds are not considered to be volatile and transport of PFAS impacts through vapor transport (e.g., impacts to in-door air related to soil gas) are considered to be unlikely. However, PFAS compounds are highly soluble in water and as a result are easily transported in surface water and groundwater, potentially resulting in the transport and distribution of PFAS impacts downgradient of source areas. As a result, the ingestion of contaminated surface water and groundwater is considered to be the primary exposure pathway of concern and is the primary focus of this ESI.

PFAS was detected above the USEPA HA at the two public water supply wellfields and 11 private wells downgradient from Gabreski ANGB. PFAS was also detected in the surface water bodies downgradient of Gabreski ANGB. These impacts may be related to PFAS released at Gabreski ANGB and the connection between Gabreski ANGB source areas and the downgradient wells and surface water

FIGURE 3.1 – HUMAN RECEPTOR CONCEPTUAL SITE MODEL

Expanded Site Inspection for Perfluorinated Compounds Work Plan
Gabreski Air National Guard Base, Westhampton, Long Island, New York



bodies is a primary investigation goal of this ESI. The ESI will supplement existing NYSDEC and SCDHS PFAS data with additional sampling to determine the presence or absence of a connection.

The first step to conducting the proposed focused investigation will be to prepare a 3D representation of the Gabreski ANGB area using a software package called CTech. The 3D representation will depict site soil stratigraphy, site surface features, existing monitoring wells, and historic sample results in three dimensions. During the course of the focused investigation, the 3D representation will be updated in real time to consider newly collected stratigraphic and contaminant data. The real-time updates to the site CSM, embodied in the 3D representation, will then be utilized to optimize contingency sample locations during the Triad-based approach. The 3D representation will be used to clarify placement of proposed sample locations with respect to existing datapoints and known stratigraphic features. This real-time CSM update and field decision-making process will accelerate the completion of the ESI and will result in a higher value site characterization dataset to be used for future decision-making.

3.4 AOC-SPECIFIC SAMPLING DESIGN AND RATIONALE

Primary sample locations, including proposed monitoring well locations, are detailed below in **Tables 3.1 through 3.3**. AOC specific soil borings and monitoring wells will be installed at five AOCs (AOC 3, 19, 20, 21, and 22) which were not investigated during the previous SI. Parsons plans to request rapid turn-around-times for analytical results (e.g., 5-day vs. 21-day) for samples collected from the Base boundary groundwater profiles and at the farthest downgradient/downstream sample locations. Expedited analytical results from these locations will allow for optimal placement of contingency sediment and surface water sample locations to ensure objectives of the ESI are met on schedule.

3.5 DOWNGRADIENT SAMPLING DESIGN AND RATIONALE

Several of the SCWA wells at the Meetinghouse Road and Gus Guerrera PWS systems and numerous private water wells are impacted by PFAS. Therefore, the approach to the off-Base and downgradient portion of the ESI will focus on assessing PFAS migration pathways between Gabreski ANGB and these impacted wells to evaluate the potential that the ANG is the primary contributor to the impacts at the wells. Regional groundwater flow beneath and surrounding the Base in the upper glacial aquifer is to the south and southeast, and possibly southwest. The downgradient groundwater profiling design was developed to evaluate groundwater between the AOCs at Gabreski ANGB and the Meetinghouse Road PWS wells (located south of Gabreski ANGB) and the Gus Guerrera well field to the southwest. The plan recognizes the suspected groundwater divide near the southwest corner of the Base which may be influenced by the Gus Guerrera Wells and the general effect of pumping has on the depth of the plume(s). The plan includes the use of groundwater profiling in 10-foot intervals, similar to the approach applied by the SCDHS and the NYSDEC during their off-base investigations. This approach is also consistent with the Triad Approach being applied to this project. A permanent monitoring well will be installed at each of the downgradient well locations after review of the groundwater profile data.

Table 3.1 – Monitoring Well Locations

AOC	Proposed Well ID	Purpose of Well	Rationale for location	Figure Reference
1	GB-IRP7-MW03 GB-IRP7-MW04 Existing well: IRP7-MW01	Upgradient and downgradient of AOC 1 and existing source monitoring well	Two new MWs will be installed, one upgradient and the other downgradient of the Former FTA to asses upgradient and downgradient PFAS concentrations. Profiling will be used to determine each MW's screen interval; groundwater samples will be collected every 10 feet from the top of the water table to 100 feet bgs. Adequate drill rig access exists, no right-of-entry (ROE) required.	**Figure 3.3, Inset A**
3	GB-03-MW01	Determine presence of PFAS in soil and groundwater	One MW will be installed at the location of the former vehicle maintenance facility. The purpose is to determine the presence or absence of PFAS at the AOC and if there is a contributing source. Adequate drill rig access exists, no ROE required.	**Figure 3.2**
19	GB-19-MW01	Determine presence of PFAS in soil and groundwater	One MW will be installed at the location of this air show crash location near the water treatment plant. The purpose is to determine the presence or absence of PFAS at the AOC and if there is a contributing source. Adequate drill rig access exists, no ROE required.	**Figure 3.3, Inset B**
20	GB-20-MW01	Determine presence of PFAS in soil and groundwater	One MW will be installed at the approximate location of the 1989 air show located adjacent to Runway 24 on the County Airport Property. The purpose is to determine the presence or absence of PFAS at the AOC and if there is a contributing source. Adequate drill rig access exists, will need to coordinate ROE with the County Airport.	**Figure 3.3, Inset C**
21	GB-21-MW01	Determine presence of PFAS in soil and groundwater	One MW will be installed at the approximate location of the reported air crash located north and near the approach to Runway 24 on the County Airport Property. The purpose is to determine the presence or absence of PFAS at the AOC and if there is a contributing source. Adequate drill rig access exists, will need to coordinate ROE with the County Airport.	**Figure 3.3, Inset D**

Table 3.1 – Monitoring Well Locations (Continued)

AOC	Proposed Well ID	Purpose of Well	Rationale for location	Figure Reference
22	GB-OB-MW04 Existing Well: MW-2 (Current FTA)	Down Gradient of AOC -22 and confirm results by Others	One MW will be installed downgradient from AOC and one existing MW will be sampled at the AOC to confirm the results of the NYSDEC investigation. Profiling will be used to determine the screen interval of the newly installed MW; groundwater samples will be collected every 10 feet from the top of the water table to 100 feet bgs. Adequate drill rig access exists, MWs located on County Airport Property, will need ROE to access locations.	**Figure 3.3, Inset A, and Figure 3.4**
Upgradient On Base Boundary	GB-BB-MW01 GB-BB-MW02	North and west upgradient control wells	Both proposed MWs are located upgradient of the AOCs. Profiling will be used to determine screen interval, if there are no PFAS detections, the screen will be set to straddle the water table. Adequate drill rig access exists, no ROE required.	**Figure 3.2**
Within Base Boundary	Existing Wells: IRP5-MW01 ECR-SW7 ECR-MW01	Confirm SI Results	Three existing on-Base MWs will be sampled to confirm the SI results and to monitor the downgradient edge of the on Base AOCs. No ROE required.	**Figure 3.2**
Downgradient (Off Base)	GB-OB-MW01 GB-OB-MW02 GB-OB-MW03 GB-OB-MW05 Existing Wells: SW-8 (AOC 13), SW-9 (AOC 12) MW-1 (Canine Kennel)	Monitor groundwater between AOCs and receptors	A total of four new MWs will be installed between the Base southern boundary and downgradient receptors including, private/public wells, and surface water bodies. Prior to installation of the MWs groundwater profiling will be used to identify the impacted groundwater; samples will be collected every 10 feet from the top of the groundwater table to 100 ft bgs. Three existing MWs will be sampled to confirm previous sampling results. All locations are drill rig accessible and located on County Airport property, will need to coordinate ROE with County Airport.	**Figures 3.2 and 3.4**

Notes: SB= Soil Boring, MW = Monitoring well, BB=Base Boundary, IRP=Installation Restoration Program, ECR=Eastern Concrete Ramp, OB=Off Base B= On Base, ROE = Right of Entry. Exact locations may differ slightly due to field conditions and rights-of-entry.

Table 3.2 – Stormwater Sample Locations

AOC	Proposed Sample Location	Purpose of Sample	Rationale for location	Figure Reference
Upgradient On-Base	GB-B-ST01 GB-B-ST02	Assess stormwater upgradient of the AOCs.	Located at manholes/catch basins at the upgradient side of the on-Base stormwater system. Sample B-ST01 is located near the vehicle storage shed and B-ST02 is in the parking lot north of the main gate. Assess status of PFAS upgradient of AOCs.	**Figure 3.2**
Upgradient Off-Base	GB-OB-ST01	Assess stormwater upgradient of the AOCs on the County Airport Property.	Located at a catch basin off Base north of the northeast property boundary to assess if a PFAS source is present upgradient of the Base. ROE will need to be obtained from the County Airport.	**Figure 3.2**
8	GB-08-ST01 GB-08-ST02 GB-08-ST03 GB-08-ST04	Assess stormwater drainage near multiple AOCs located adjacent to the Eastern Concrete Apron (AOC 8).	Samples will be collected from four catch basins and/or manholes along the stormwater line for AOC 8. This line discharges to Outfall SDO-001 (AOC 12).	**Figure 3.2**
12	GB-12-ST01	Assess stormwater drainage to AOC 12.	A storm water sample will be collected from outfall SDO-001 to assess PFAS impacts coming from on-Base.	**Figure 3.2**
13	GB-13-ST01	Assess stormwater drainage to AOC 13.	A stormwater sample will be collected from outfall SDO-002 to assess PFAS impacts coming from on-Base.	**Figure 3.2**
14	GB-14-ST01 GB-14-ST02	Assess stormwater drainage from the Sothern Concrete Apron (AOC 9) and the Helicopter Pods (AOC 4).	Sample 14-ST01 will be collected at the discharge point into the storm drainage ditch (AOC 14) from the stormwater line in front of the Helicopter Pods (AOC 4). The second sample 14-ST02 will be collected at the discharge point of the storm drainage ditch to the stormwater line discharging to Outfall SDO-002 (AOC 13).	**Figure 3.2**

Notes: B = on Base, OB = off Base, ST=Stormwater
ROE = Right of Entry. Exact locations may differ slightly due to field conditions and rights-of-entry.

Table 3.3 - Soil Sample Locations

AOC	Proposed Sample Location	Purpose of Sample	Rationale for location	Figure Reference
3	GB-03-SB01 GB-03-SB02	Confirm presence or absence of PFAS within the AOC 3 area	AOC 3 was identified during the PA but was assigned a NFA status. However, this is considered a potential source area due to its history of maintenance of AFFF carrying vehicles. The subsurface soil samples will be collected from two locations within the footprint of the former Building 230 to assess the potential presence of PFAS in the soil. Consistent with the SI, two soil samples will be collected at each location at 0-1 ft bgs and 4-5 ft bgs.	Figure 3.2
19	GB-19-SB01 GB-19-SB02	Confirm presence or absence of PFAS within the AOC 19 area	AOC 19 was not sampled during the SI. Subsurface soil samples will be collected from two locations near the reported plane crash to assess the potential presence of PFAS in soil. Consistent with the SI, two soil samples will be collected at each location at 0-1 ft bgs and 4-5 ft bgs.	Figure 3.3, Inset B
20	GB-20-SB01 GB-20-SB02	Confirm presence or absence of PFAS within the AOC 20 area	AOC 20 was not sampled during the SI. Subsurface soil samples will be collected from two locations near the reported plane crash to assess the potential presence of PFAS in soil. Consistent with the SI, two soil samples will be collected at each location at 0-1 ft bgs and 4-5 ft bgs.	Figure 3.3, Inset C
21	GB-21-SB01 GB-21-SB02	Confirm presence or absence of PFAS within the AOC 21 area	AOC 21 was not sampled during the SI. Subsurface soil samples will be collected from two locations near the reported plane crash to assess the potential presence of PFAS in soil. Consistent with the SI, two soil samples will be collected at each location at 0-1 ft bgs and 4-5 ft bgs.	Figure 3.3, Inset D

Notes: SB = Soil Boring

The off-Base and downgradient portion of the ESI will include the installation of four downgradient monitoring wells and the collection of groundwater samples from three off-base downgradient wells as detailed in **Table 3.1**.

Additional downgradient sampling will be conducted to investigate surface water and sediment in nearby surface water bodies to determine if there are or confirm PFAS impacts are present. Stormwater from the Base and the adjacent County Airport is directed into a series of catch basins and ditches which eventually drain to the Aspatuck River and Quantuck Creek (**Figure 3.3**). Additionally, elevated levels of PFAS have been detected in surface water samples from the Old Ice Pond and Quantuck Creek collected by the SCDHS (**Figure 3.4**) These water bodies may also receive contributions from shallow groundwater in the area and are not a source of drinking water. The off-Base and downgradient portion of the ESI will include the collection of 14 co-located downgradient surface water and sediment samples as detailed in **Table 3.4**.

3.6 CONTINGENCY SAMPLES AND WELLS

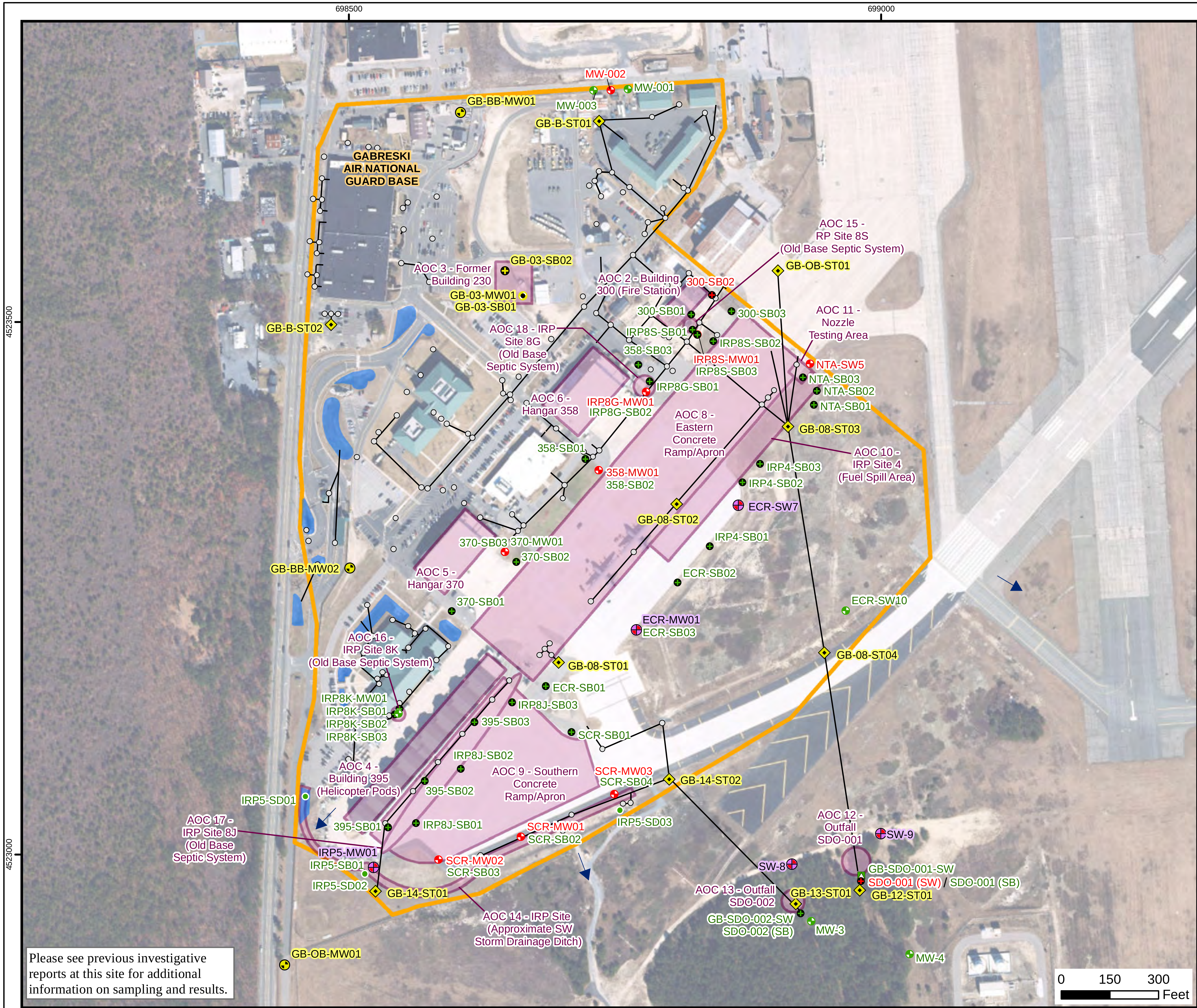
Contingency samples will be used to fill in remaining data gaps following primary sample collection defined in the sections above. The number of contingency samples by media is provided in **Table 3.5**.

3.7 DOWNGRADIENT RECEPTOR SURVEY

A second component to the offsite ESI approach is to perform a potential receptor survey. The receptor survey is an iterative approach combined with understanding the fate and transport of PFAS off-Base. Initially the area immediately downgradient of Gabreski ANGB will be evaluated for sensitive receptors. Sensitive receptors include, but are not limited to, identifying where a complete PFAS migration pathway from Gabreski ANGB may exist including:

- Public supply wells
- Private drinking water supply wells
- Private non-drinking water supply wells (e.g., agriculture wells)
- Surface water bodies

The receptor survey identifies the locations of each receptor in relation to Gabreski ANGB and assesses its potential for being impacted by PFAS from Gabreski ANGB. Depending on the PFAS impact potential (e.g., if a complete migration pathway could exist), additional assessment of the receptor is performed. The additional assessment will be determined on a case-by-case basis dependent on the characteristics of the potential receptor. Examples of additional assessment may include further analytical sampling at the receptor, between the receptor and the Base, investigating historical and potential future exposure pathways and durations at the receptor, etc. Following the additional assessment, if PFAS risk to the receptor remains plausible, then analytical data (e.g., tap water samples, soil samples etc.) may be collected. It is possible that additional receptors may need to be evaluated following the CSM update once the new fate and transport information gathered from short TAT samples is available.



Please see previous investigative reports at this site for additional information on sampling and results.

Figure 3.2
ANG Base
Proposed Primary Sample Locations
Gabreski Air National Guard Base

Legend

Previous Investigation's Samples
(symbol in red if exceedance):
- Groundwater Well
- Groundwater Vertical Profile Boring
- Soil Boring
- Soil Sample
- Supply Well
- Surface Water and Sediment Sample

Proposed ESI Primary Samples:
- Existing Groundwater Well with Exceedance - Well to be Resampled
- Groundwater Well with Co-Located Soil Boring
- Groundwater Well with Profile
- Soil Boring
- Stormwater
- Surface Water & Sediment Sample
- Stormwater System
- Stormwater System Pond
- Approximate Groundwater Flow Direction
- Area of Concern (AOC)
- Installation Boundary

DATA SOURCES
-Image: ESRI, 2016
-ANG Base: Installation Boundary, AOC Boundary (modified by Parsons), Stormwater System and Ponds
-Previous Investigations: AECOM, 2019; SCDHS 2016; PWGC 2018; EAR 2018; ZEB 2016; NYSDEC 2016
-Parsons: Proposed Samples

PARSONS

NATIONAL GUARD BUREAU
OPERATIONS DIVISION
RESTORATION BRANCH
(NGB/A4OR)

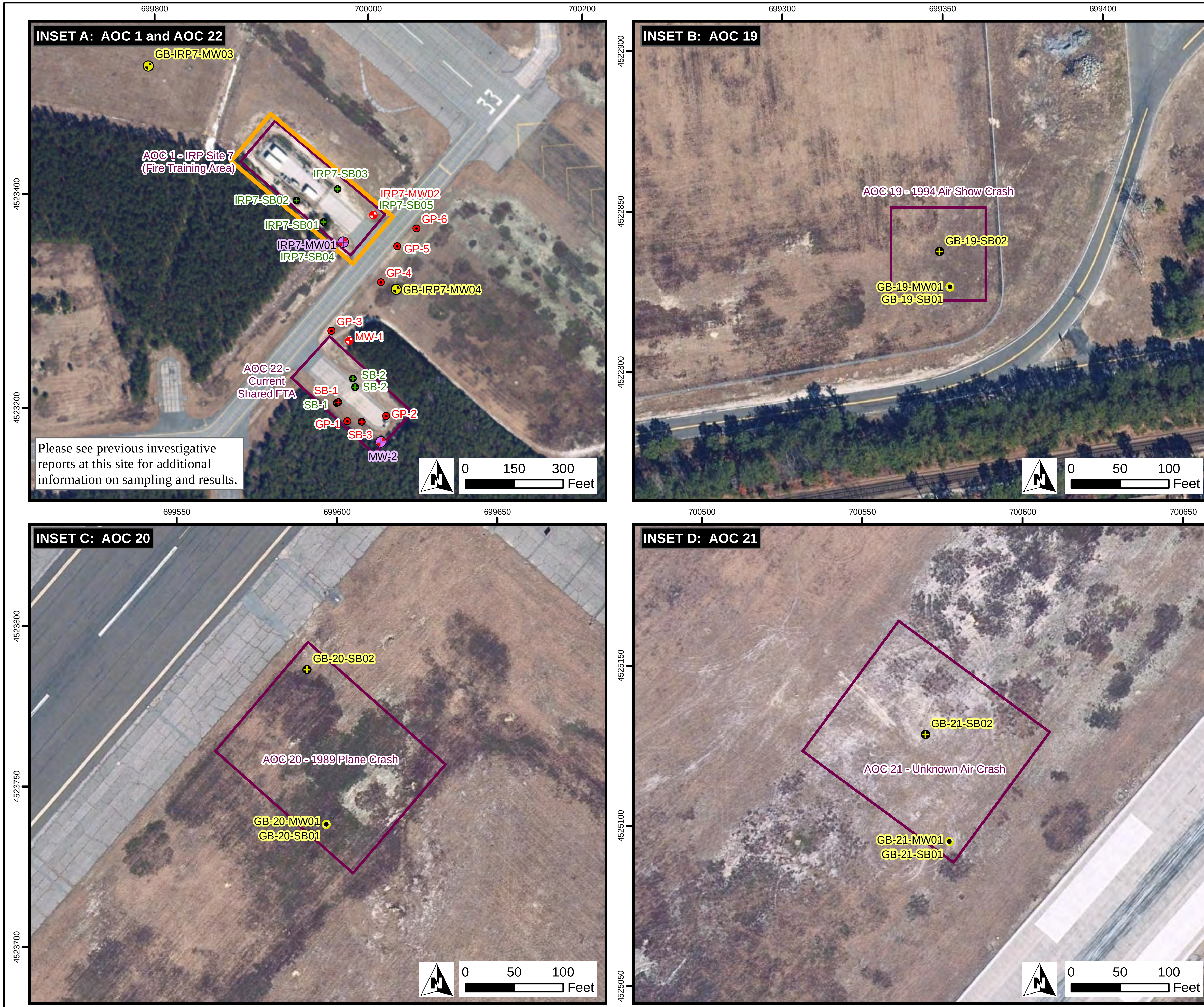
DESIGNED BY: RGS
DRAWN BY: RGS
CHECKED BY: TM
SUBMITTED BY: TM

Expanded Site Inspections for Perfluorinated Compounds at Multiple Air National Guard Installations

SCALE: AS SHOWN
CONTRACT NUMBER: GS00Q140A DU127
DATE: 4/30/2019
DELIVERY ORDER NUMBER: W9133L-18-F-0052
Coordinate System: WGS 1984 UTM Zone 18N

PATH: F:\GISCADD\projects\OASIS\GIS\Gabreski\Maps\Workplan\GABRESKI_sampling_mainbase.mxd

Figure 3.3
AOC 1, 19, 20, 21, 22
Proposed Primary Sample Locations
Gabreski Air National Guard Base



Legend

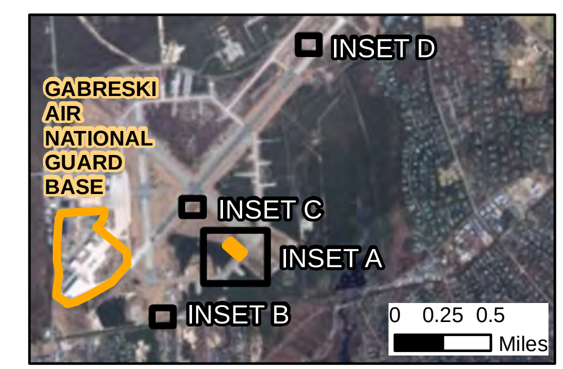
Previous Investigation's Samples (symbol in red if exceedance):

- Groundwater Well
- Groundwater Vertical Profile Boring
- Soil Boring
- Soil Sample
- Supply Well
- Surface Water and Sediment Sample

Proposed ESI Primary Samples:

- Existing Groundwater Well with Exceedance - Well to be Resampled
- Groundwater Well with Co-Located Soil Boring
- Groundwater Well with Profile
- Soil Boring
- Stormwater
- Surface Water & Sediment Sample

- Approximate Groundwater Flow Direction
- Area of Concern (AOC)
- Installation Boundary



DATA SOURCES
-Image: ESRI, 2016
-ANG Base: Installation Boundary, AOC Boundary (modified by Parsons)
-Previous Investigations: AECOM, 2019; SCDHS 2016; PWGC 2018; EAR 2018; ZEB 2016; NYSDEC 2016
-Parsons: Proposed Samples

PARSONS	NATIONAL GUARD BUREAU OPERATIONS DIVISION RESTORATION BRANCH (NGB/A4OR)		
DESIGNED BY: RGS	Expanded Site Inspections for Perfluorinated Compounds at Multiple Air National Guard Installations		
DRAWN BY: RGS			
CHECKED BY: TM	SCALE: AS SHOWN	CONTRACT NUMBER: GS00Q140A DU127	
	DATE: 4/30/2019	DELIVERY ORDER NUMBER: W9133L-18-F-0052	
SUBMITTED BY: TM	Coordinate System: WGS 1984 UTM Zone 18N		

PATH: F:\GISCADD\projects\OASIS\GIS\Gabreski\Maps\Workplan\GABRESKI_sampling_1_19_20_21_22.mxd

Figure 3.4
Off Base Areas
Proposed Primary Sample Locations
Gabreski Air National Guard Base

Legend

Previous Investigation's Samples (symbol in red if exceedance):
- Groundwater Well
- Groundwater Vertical Profile Boring
- Soil Boring
- Soil Sample
- Supply Well
- Surface Water and Sediment Sample

Proposed ESI Primary Samples:
- Existing Groundwater Well with Exceedance - Well to be Resampled
- Groundwater Well with Co-Located Soil Boring
- Groundwater Well with Profile
- Soil Boring
- Stormwater
- Surface Water & Sediment Sample

- Approximate Groundwater Flow Direction
- Area of Concern (AOC)
- Installation Boundary

DATA SOURCES
-Image: ESRI, 2016
-ANG Base: Installation Boundary, AOC Boundary (modified by Parsons)
-Previous Investigations: AECOM, 2019; SCDHS 2016; PWGC 2018; EAR 2018; ZEB 2016; NYSDEC 2016
-Parsons: Proposed Samples

PARSONS	NATIONAL GUARD BUREAU OPERATIONS DIVISION RESTORATION BRANCH (NGB/A4OR)		
DESIGNED BY: RGS	Expanded Site Inspections for Perfluorinated Compounds at Multiple Air National Guard Installations		
DRAWN BY: RGS			
CHECKED BY: TM	SCALE: AS SHOWN	CONTRACT NUMBER: GS00Q140A DU127	N
	DATE: 4/30/2019	DELIVERY ORDER NUMBER: W9133L-18-F-0052	
SUBMITTED BY: TM	Coordinate System: WGS 1984 UTM Zone 18N		

PATH: F:\GISCADD\projects\OASIS\GIS\Gabreski\Maps\Workplan\GABRESKI_sampling_overview.mxd

Table 3.4 – Downgradient Surface Water and Sediment Sample Locations

AOC	Proposed Sample Location	Purpose of Sample	Rationale for location	Figure Reference
Off-Base, Old-Ice Pond and Wildlife Refuge	GB-OBNP-SW01, -SD01 GB-OBNP-SW02, -SD02 GB-OBOIP-SW01, -SD01 GB-OBOIP-SW02, -SD02 GB-OBOIP-SW03, -SD03 GB-OBOIP-SW04, -SD04	Assess surface water and sediment in Old Ice Pond and the Wildlife Refuge downgradient of the southeast Base boundary.	Samples will be collected from, or near, the Base-side stream bank at locations allowing for sampling access. One control sample will be collected from the opposing bank OBOIP-SED/SW03. These ponds and associated tributaries may be a local discharge area for groundwater flow to the southeast.	Figure 3.4
Off-Base, Quantuck Creek	GB-OBQC-SW01, -SD01 GB-OBQC-SW02, -SD02 GB-OBQC-SW03, SD03 GB-OBQC-SW04, -SD04	Assess surface water and sediment in Quantuck Creek downgradient of the southeast Base boundary.	Samples will be collected from, or near, the Base-side stream bank at locations allowing for sampling access. Water from the Old Ice Pond flows into this brackish waterbody.	Figure 3.4
Off-Base, Aspatuck River	GB-OBAR-SW01, -SD01 GB-OBAR-SW02, -SD02 GB-OBAR-SW03, -SD03 GB-OBAR-SW04, -SD04	Assess surface water and sediment in Aspatuck River downgradient of the southern Base boundary.	Samples will be collected from, or near, the Base-side stream bank at locations allowing for sampling access. Stormwater from the Base may flow to the Aspatuck River.	Figure 3.4

Notes: OBAR = Off Base Aspantuck River
OBNP = Off Base North Pond
OBOIP = Off Base Old Ice Pond
OBQC = Off Base Quantuck Creek
SD = Sediment
SW = Surface Water

Table 3.5 – Contingency Samples and Wells

Location	Well/Sample Count	Notes
Monitoring Wells	1	One contingency MW location with GW sample collected from a 2-foot interval every 10-ft starting from the top of the water table to 100 ft bgs to determine proper placement of well screen.
Groundwater Samples	2	2 sample rounds per MW installed will be performed following completion of each MW (per NGB/4AOR, 2009 guidance).
Soil Borings	1	Two soil samples will be collected per soil boring.
Surface Water/Sediment	1	Co-located surface water and sediment sample at one location.
Storm Water	1	NA

The receptor survey includes a desktop component (e.g., well database searches, aerial photographic reviews, document reviews) and a ground confirmation/reconnaissance component. It is already known due to investigations by the NYSDEC and SCDHS that there are two public water supply well fields, numerous residential wells and surface water impacts at the Old Ice Pond. The ground confirmation / reconnaissance component began with the initial ground reconnaissance during the project kickoff meeting on 14 November 2018. Additional receptor survey activities will continue during and following work plan approval and field work mobilization, including private well searches for up to a four-mile radius from each AOC (e.g., 4-miles to the west of the most western AOC and 4-miles to the north of the most northern AOC). Following the ESI activities, the receptor survey results in conjunction with the CSM will enable for mitigation strategies to be prepared and rough order of magnitude (ROM) costs calculated, if residential sampling is necessary. It should be noted that the state and county regulators have completed much of this work and mitigation measures are in place to provide non PFAS impacted drinking water.

SECTION 4.0 Field Investigation Methodology

The field investigation consists of site preparation activities including the mobilization/demobilization of field team personnel and equipment, utility clearance, and surface/subsurface soil, groundwater, surface water/sediment and stormwater sampling for PFAS analysis. This section provides a general overview of the procedures and methods to be utilized during the field investigation. Details concerning sampling activities and analytical methodology including specific procedures for PFAS-related investigations are presented in the SOPs (**Appendix B**). Health and safety requirements for ESI field activities are provided in the SSHP (**Appendix C**). Field investigation methodologies were developed following the Air National Guard Environmental Restoration Program Investigation Guidance (NGB/A4OR, 2009) best management practices and past experience with each method on similar sites.

4.1 SITE PREPARATION

No vegetation clearance is planned during field investigation activities; rather the field team will work around existing site vegetation. If vegetation clearance is required these activities will be conducted in accordance with the health and safety procedures outlined in the Accident Prevention Plan (APP, Parsons, 2019). Traffic control measures may be required to complete investigations near some AOCs and off base. If traffic control is deemed necessary, it will be coordinated with Gabreski ANGB, County Airport and/or Town of Westhampton Beach.

4.2 PERMITS AND NOTIFICATION

Parsons will coordinate security access to Gabreski ANGB with the Base Environmental Manager at least two weeks prior to the start of field work. Any necessary credentials for Parsons and their subcontractors will be submitted to the Base Environmental Manager as necessary.

Along with installation security access, upfront coordination of off-Base ROE access is crucial to project execution. Parsons will initiate and facilitate the ROE process for access to any off-Base private and/or municipal property for performing utility locations; site surveys; surface soil, sediment, and surface water sampling; boring installation; MW installation; etc. This will be accomplished by generating a database of parcels requiring ROEs. The database will include the affected parcel number(s), landowner contact information, physical address of parcel, purpose of ROE, etc., and will be utilized to send tailored ROE letters and maps to affected landowners. All ROE packages will be reviewed and approved by the NGB/4AOR prior to transmission to property owners.

Utility clearance, including ground penetrating radar, will be conducted by a subcontracted private utility locating subcontractor with input from the Parsons field team and Gabreski ANGB personnel. Parsons or its drilling subcontractor will obtain clearance with Dig Safely New York (811) at least two weeks prior to beginning ESI drilling work. A site walk will be scheduled with the appropriate Gabreski ANGB personnel to mark out locations of subsurface activities. All field work will be coordinated with the Base Environmental Manager and/or his/her designee. All on- and off-Base borings and wells will be marked out during this site visit and prior to the driller contacting Dig Safely. If a proposed well falls on private property outside of the Dig Safely jurisdiction, a private utility locator will be subcontracted by Parsons to clear those locations.

Federal Aviation Administration (FAA) approval may be required for well installations near taxi ways and flight lines. Following approval of MW locations, Parsons will coordinate with Gabreski ANGB and the County Airport to prepare FAA form 7460-1 for any locations requiring FAA approval. In accordance with FAA policy form 7460-1 will be electronically submitted at least 45-day prior to the start of well installation activities.

4.3 SOIL BORINGS

Soil borings will be drilled to characterize potential impacts to unconsolidated soils via direct push, sonic, or traditional auger drilling methods. The specific procedures are specified in **SOP Environmental (ENV)-07** (**Appendix B**). Soil borings will be drilled to a depth of up to 5 feet bgs or to refusal at bedrock or boulders. The boring depth was selected to be consistent with the SI and is a depth below typical appurtenance burial. Two soil samples will be collected at each soil boring location at 0 to 1 ft bgs and 4 to 5 ft bgs (or just above the top of rock or refusal if the refusal is shallower than 5 ft bgs). Boring and or sampling depth may be adjusted in the field to sample at the depth of any AOC-specific appurtenance (cesspool, drainage pipe, holding tank, etc.). All drilling materials and decontamination water will be PFAS-free.

During borehole advancement, soil core samples will be collected in single-use, disposable Polyvinyl Chloride (PVC) or High-Density Polyethylene (HDPE) liners using a decontaminated, stainless steel trowel or spoon. Samples will be transferred directly from the core sleeve into laboratory-supplied PFAS-free HDPE jars and labeled using an approved pen type or pencil in accordance with the UFP-QAPP (**Appendix A**). Soil cores collected from areas where VOC impacts are possible will be screened with a Photoionization Detector (PID) and directly observed for evidence of impacts (i.e., staining or odors). The soil cores will be logged for lithological descriptions by a field geologist using the Unified Soil Classification System (USCS). Observations and measurements will be recorded electronically on tablet computers in activity specific forms. If permitted by the Base, photographs will also be taken of each soil core to photo-document soil conditions and observations. At a minimum, depth interval, recovery thickness, PID concentrations (if VOCs are believed to be present), moisture, relative density, color (using a Munsell soil color chart), and texture (using Burmister soil descriptions and USCS classifications) will be recorded. Additional observations to be recorded may include groundwater or perched water depth, organic material, or cultural debris. Boring logs will be completed electronically on handheld tablets and uploaded to the Parsons database for use in the Triad rapid decision-making processes.

Soil borings will be abandoned at completion of sampling activities unless they are being converted into MWs. Soil borings will be abandoned in accordance with State- and Base-specific requirements. Soil borings in grass covered areas will be abandoned by backfilling with bentonite chips and topsoil. Borings in asphalt shall be abandoned by backfilling with bentonite chips to approximately 6 inches bgs, and the remainder of the borehole will be patched with asphalt cold patch. Soil borings in concrete will be restored with field mixed concrete placed into the borehole to provide as flush a surface as possible. The field crew will return 24 hours after abandonment to top off backfill materials as necessary to account for materials settlement.

4.4 MW INSTALLATION, DEVELOPMENT, AND CONDUCTIVITY TESTS

Monitoring wells will be installed at AOC-1, the four AOCs not previously investigated, at two upgradient on-Base locations, and 5 downgradient off-Base locations. At the four AOC specific locations, the soil boring will be converted to a monitoring wells and the screen will be installed to straddle the shallow water table as the purpose of these wells is to determine the presence or absence of PFAS impacts at source areas. For these locations each well will be installed with a 10-foot screen with 2 feet straddling above the water table. Groundwater profiling will be conducted at AOC-1, AOC 22, the upgradient on-Base locations and downgradient off-Base locations prior to installation of permanent monitoring wells. Groundwater profiling will be conducted in 10-foot intervals from the water table to 100 feet bgs. The samples will be collected via direct push drilling methods with a 2-foot retractable screen. If the formation allows for it a duel casing method will be used to keep the hole open between samples and to allow later installation of the monitoring well. The results of the profile samples will be reviewed, and a 10-foot screen interval will be selected for the monitoring well. The specific procedures for drilling and MW installation are provided in SOP ENV-07 (Appendix B).

New MWs will be developed no sooner than 48 hours following installation by pumping and surging using an inertial pump with HDPE tubing and an HDPE surge block. Deep wells may be developed by the drilling subcontractor utilizing air lift methods. Development of wells will be completed per SOP ENV-05 (Appendix B).

Parsons will perform in-situ hydraulic conductivity tests (i.e., slug tests) at each newly installed MW. These tests will provide data on aquifer characteristics which will be used to refine the CSM. Conductivity testing will be conducted in accordance with SOP ENV-06 (Appendix B). Each slug test (falling and rising head tests) will be conducted in accordance with the American Society for Testing and Materials (ASTM) D4044/D4044M-15. A pressure transducer/data logger will be placed into each well and a mechanical slug will then be lowered into the well to displace a known and fixed volume of water. The slug will be constructed of stainless steel or PVC pipe (filled with sand, capped, and sealed) and will be of an appropriate size to cause sufficient water displacement depending on water column in the well and well diameter. The transducer will continuously record the water level in the MW as the hydraulic head is decreased during the falling head test. Data logging will continue as the hydraulic head increases during the rising head test in response to removal of the slug until the water level within the MW has again reached equilibrium. The slug test data will be analyzed using the Bower and Rice (1976) method and the results will be presented in both tabular and graphical form.

4.5 GROUNDWATER SAMPLING

Samples will be collected no sooner than 48 hours following development via low-flow sampling methods using bladder pumps with disposable PFAS-free bladders or peristaltic pumps with disposable PFAS-free tubing per SOP ENV-03 (Appendix B). Prior to sampling, a sitewide gauging event will be conducted and water levels and total well depth will be measured to the nearest 0.01 inch and recorded prior to sampling. The pump tubing will be PFAS-free (i.e., HDPE or other PFAS-free material) and placed a minimum of two feet above the bottom of the MW to prevent disturbance of sediments that may be in the well sump. All reusable sampling equipment (e.g., stainless steel bladder pump casings) will be decontaminated as prescribed in SOP ENV-03 (Appendix B). Groundwater sampling parameters will be recorded on electronic field forms which will be uploaded to the project database.

Each sample will be collected into laboratory-supplied HDPE bottle ware and submitted to the contract laboratory for analysis. All sample containers will be PFAS-free. Samples will be packaged on ice and transported daily via overnight commercial carrier under standard chain-of-custody procedures to the laboratory. The laboratory method detection limits for these analytes are presented in the UFP-QAPP (Appendix A).

In accordance with ANG's Investigation Guidance (NGB/4AOR, 2009), two rounds of groundwater samples will be collected from the MWs: an initial round and a confirmatory round. The confirmatory groundwater sampling round will be conducted a minimum of 2 days and a maximum of 2 weeks following completion of the initial groundwater sampling round. The confirmatory round will be conducted using sampling procedures that are identical to those used in the initial round.

4.6 SURFACE WATER, SEDIMENT, AND STORMWATER SAMPLING

In general, sediment and surface water samples will be co-located and will be collected in accordance with SOP ENV-04 (Appendix B). Where surface water and sediment samples are collected at the same location, surface water samples will be collected first to minimize siltation. Surface water samples will be collected by inserting a capped sampling container (polypropylene or HDPE) with the opening pointing down to avoid the collection of surface films. To avoid cross-contamination from sampling materials to sample media, the outside of all capped sample containers will be rinsed multiple times with the surface water being sampled before filling the containers. Once deployed, the container will be pointed up to fill and the sampler (including gloved hands) will be positioned downstream of where the sample is being collected. Samples will be transferred directly into laboratory-supplied PFAS-free HDPE jars and labeled using an approved pen type or pencil. Sample collection will take place prior to any measurement of water depth to minimize the potential for cross-contamination due to surface water/sediment contact with field equipment. Surface water potential of hydrogen (pH), conductivity, temperature, dissolved oxygen (DO), turbidity, and oxidation-reduction potential (ORP) will be measured at each location after sediment sampling. Additionally, the current meteorological conditions including recent precipitation events will be recorded. Sediment samples will be either collected using a stainless-steel trowel, a Petite Ponar Grab sampler, or core sampler with an HDPE sleeve, depending on field conditions at each sampling location. Additionally, the current meteorological conditions, including recent precipitation events, will be recorded. Sediment samples will be collected within the upper 4 inches of sediment. If a Ponar sampler is used, any overlying water will be decanted, and a stainless-steel trowel will be used to transfer the upper 2 to 4 inches of sediment into the sample container. Collected sediment will be placed directly into laboratory-supplied PFAS-free HDPE jars and labeled using an approved pen type or pencil.

Surface water and sediment samples will be collected following a minimum of 48 hours of clear weather with no significant storm events to ensure that these sample results represent ambient flow conditions. Stormwater samples will be collected within 12 hours of a storm event such that these samples represent increased flow conditions. Laboratory requirements will also be the same for storm water samples.

4.7 EQUIPMENT DECONTAMINATION

Non-disposable sampling equipment will be decontaminated between uses in accordance with the procedures in the applicable SOPs (**Appendix B**). The general procedure will be as follows; donning a new pair of nitrile gloves, equipment will be 1) rinsed with a Citranox® (or similar) cleaning solution, 2) rinsed with laboratory-provided PFAS-free water, 3) rinsed with methanol, and 4) rinsed with laboratory-provided PFAS-free water. All rinsate samples will be collected in sealed containers for disposal. For groundwater sampling, the flow-through cell and any non-dedicated equipment (i.e., water-level probe, multi-parameter instrument probe) that contacts well water will be decontaminated between uses. Field equipment used at locations that are suspected of containing PFAS will be cleaned as per above in triplicate. Larger equipment such as drill rigs will be cleaned with PFAS-free potable water using a high-pressure washer or steam. Equipment blank samples will be analyzed for PFAS as prescribed in the UFP-QAPP (**Appendix A**). The same PFAS-free potable water source that was used during the SI will be used for the ESI; specifically, PFAS-free water from Monadnock Mountain Spring Water in Wilton NH.

4.8 LOCATION SURVEY

The horizontal position of all soil borings, surface water, sediment, and stormwater sampling locations will be surveyed using a hand-held Global Positioning System (GPS) unit. Parsons will subcontract a New York-licensed surveyor to survey all new MWs to collect detailed information, including horizontal location, top of well casing elevation, and ground surface elevation. Each survey will be referenced to the World Geodetic System 84 (WGS84) datum.

4.9 ANALYTICAL METHODS

A total of 24 PFAS target analyes have been selected for ESI activities. The 24 target analytes were chosen base on the PFAS compounds included in the USEPA draft target analyte list (USEPA, 2018). A list of the 24 PFAS target analytes and the analytical methods that will be utilized are listed in the UFP-QAPP (**Appendix A**). Samples will be shipped to the contract laboratory, a Department of Defense (DoD) approved laboratory that is experienced in handling environmental samples, is Environmental Laboratory Approval Program (ELAP) certified for PFAS analyses and meets DoD Installation Restoration QA Program requirements. The laboratory will provide analytical results within the time frame specified on the chain-of-custody (CoC). Accelerated turnaround times will be requested when appropriate in support of the rapid decision-making process. Data validation/review will be conducted on laboratory results by Parsons chemists in accordance with procedures specified in UFP-QAPP.

4.10 DATA MANAGEMENT

Field and analytical data collected during this project are critical to site characterization efforts and the establishment / refinement of a CSM. Investigation data will be recorded and maintained for future use and reporting. Logbooks and field data sheets will be used to record data collection activities. Project documentation will be collected and managed on-Base during the field activities. Field and laboratory data will be recorded and entered into a computerized submission format in accordance with NGB/A7O 10-01, Policy on ERPIMS, including the Data Loading Handbook. The field and analytical laboratory data required to complete Group 1, 2 and 3 data tables and satisfy ERPToolsX field, record, and submission data validity requirements will be collected including:

- Sample site information;
- Soil boring/sample location coordinates (latitude, longitude, elevation);
- Lithology/stratigraphy/hydrogeology;
- Temporary/permanent groundwater MW construction details;
- Field tests (e.g., water level, temperature, pH, specific conductivity, turbidity);
- Sample type (e.g., normal, field QC), matrix, sampling method, collection date/time, depth interval;
- Sample handling, preparation and analyses, and
- Sample results (analyte concentrations, dilutions, data qualifiers, method reporting/detection limits).

Samples collected during the ESI will be analyzed by TestAmerica Laboratory using methods identified in the UFP-QAPP (**Appendix A**). Sample collection, data analysis, and data reporting are addressed in the UFP-QAPP (**Appendix A**).

Surveying data will be compliant with NGB/A7O 11-01, Policy on Collection of Digital Spatial Data for MWs During Environmental Investigations at Air National Guard Sites (Supplements A7CV 07-03, 15 Aug 2007, same subject).

GIS data will be compliant with the latest spatial data requirements, currently NGB/A7O 14-01, Requirements for Geospatial Data Deliverables.

Sampling identification nomenclature is detailed in Worksheet 26 of the QAPP.

4.10.1 DATA VALIDATION AND VERIFICATION

Data verification will be performed on 100% of the analytical data produced for this project. Data verification consists of checking laboratory reports for completeness to ensure that all samples submitted were analyzed for the methods requested on the Chain-of-Custody and that all required target analytes were reported. A detailed summary of data verification procedures can be found in Worksheets #34 and #35 of the project QAPP.

Data for samples associated with the IDW will be validated at a Stage 2a. Stage 2a includes a review of hold times, laboratory sensitivity limits, field and laboratory QC (blanks, laboratory control samples, Matrix Spike (MS) / Matrix Spike Duplicate (MSD) samples, field duplicates, etc.) and sample dilutions/reanalysis.

A Stage 3 validation will be performed on all analytical data produced for this project other than IDW data. A Stage 3 validation includes all elements of the Stage 2a validation, plus a review of sequence and preparation logs, initial calibrations, calibration verifications, instrument blanks, low-level standards, internal standards, and all other method-specific QC listed in Worksheets #24 and #28 of the project QAPP. In addition, a Stage 3 validation includes recalculation of 10% of data. For recalculation, the raw instrument response is re-quantified against the calibration, along with all sample-specific factors (such as dilution, percent moisture, sample aliquot size, etc.) to verify the final reported results match the raw data.

A detailed summary of data validation procedures can be found in Worksheets #34 and #36 of the project QAPP. If any problems are identified during the designated level of review, a higher level of review, including inspection of the raw data, may be warranted. All issues found, as well as documentation of the level of review performed, will be documented in the Data Validation Report produced for each laboratory data package.

4.11 INVESTIGATION DERIVED WASTE MANAGEMENT

IDW generated during ESI activities (e.g., soil cuttings, well development fluids, and decontamination/water) will be containerized in labeled 55-gallon drums, totes, roll-off bins or similarly approved containers. IDW will be managed in accordance with the Waste Management Plan (**Appendix D**) and in accordance with ANG Policy 05-1 for IDW (NGB/4AOR, 2009). The containerized IDW will be sampled and characterized for waste profiling as specified in the QAPP. The IDW will be labeled and stored within an approved area at the Base until it is disposed of by a licensed disposal subcontractor. During disposal, containerized IDW will be shipped under manifest and final disposition reports will be generated for all disposed of IDW. Shipping manifests and disposition reports will be included in the ESI report.

4.12 QUALITY CONTROL PLAN

The QCP is attached as **Appendix E.** The purpose of the QCP is to ensure Parsons performs services in accordance with the 2 August 2018 revised performance work statement (PWS) for the ESI. The QCP describes procedures for controlling and measuring the quality of work throughout the execution of the tasks required by the PWS. The QCP applies to work performed by Parsons and its subcontractors, and includes details on the following:

- Roles and Responsibilities
- Methods and Procedures
- Field Operations and Documentation
- Nonconforming Activities and Corrective Actions
- Data Management/Document Control
- Project Deliverables
- Training

Furthermore, the UFP-QAPP (**Appendix A**) also describes the methods and procedures necessary to complete the ESI and achieve the required project objectives. Specifically, it is used to ensure environmental data collected are scientifically sound, of known and documented quality, and suitable for their intended purposes.

4.13 SCHEDULE

Table 4.1 summarizes the planned schedule for the completion of key project activities.

Table 4.1 – Proposed Schedule for Gabreski ANGB

Activities	Expected Start Date	Predecessor and Timeline
Field Work Mobilization	July 2019	Within 30 days of the approval of the Final Work Plan
Completion of the Field Work	September 2019	Not applicable (N/A)
Receipt of the Laboratory Data	October 2019	30 days after demobilization
Prepare and Submit Draft ESI Report	January 2020	60 days after receipt of the laboratory data
Prepare and Submit Draft Final ESI Report	March 2020	30 days after receipt of review comments
Prepare and Submit Final ESI Report	June 2020	30 days after receipt of Regulatory review comments

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