FINAL
Preliminary Assessment Report
Barrigada Readiness Center
Guam

Perfluorooctanesulfonic acid (PFOS) and Perfluorooctanoic Acid (PFOA) Impacted Sites
ARNG Installations, Nationwide

January 2021

Prepared for:

Army National Guard Bureau
111 S. George Mason Drive
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UNCLASSIFIED

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Acronyms and Abbreviations

°F	degrees Fahrenheit
AECOM	AECOM Technical Services, Inc.
AFFF	aqueous film forming foam
amsl	above mean sea level
AOI	area of interest
ARNG	Army National Guard
CAFS	compressed air foam system
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CSM	conceptual site model
DA	United States Department of the Army
DFAC	dining facility
EDR ™	Environmental Data Resource, Inc. ™
FTA	fire training area
GUARNG	Guam Army National Guard
HA	Health Advisory
NCTAMS	Naval Computer and Telecommunications Area Master Station
PA	Preliminary Assessment
PFAS	per- and poly-fluoroalkyl substances
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
SI	Site Inspection
UCMR3	Unregulated Contaminant Monitoring Rule 3
US	United States
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
VSI	visual site inspection

Executive Summary

The Army National Guard (ARNG) is performing *Preliminary Assessments (PAs) and Site Inspections (SIs) for Perfluorooctanesulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA) Impacted Sites at ARNG Facilities Nationwide*. A PA for per- and polyfluoroalkyl substances (PFAS)-containing materials was completed for Barrigada Readiness Center (also referred to as the "facility") in Barrigada, Guam, to assess potential PFAS release areas and exposure pathways to receptors. Barrigada Readiness Center is leased from the United States (US) Navy by the Guam ARNG (GUARNG), and occupation of the property by GUARNG began in 2001. The performance of this PA included the following tasks:

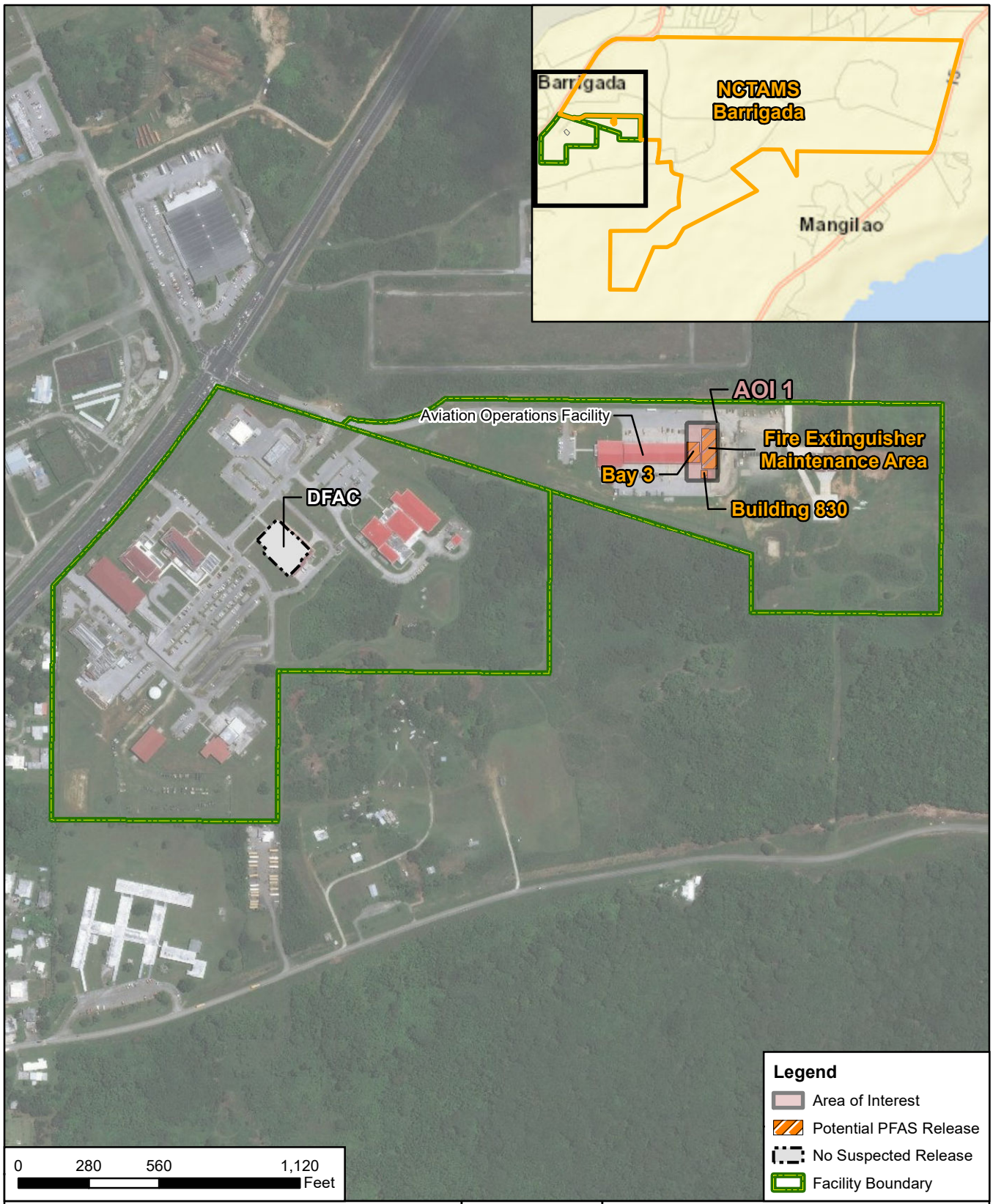
- Reviewed available administrative record documents and Environmental Data Resources, Inc. (EDR)™ report packages to obtain information relevant to potential PFAS releases, such as: drinking water well locations, historical aerial photographs, Sanborn maps, and environmental compliance actions in the area surrounding the facility;
- Conducted a site visit on 20 November 2019 and completed visual site inspections (VSIs) at locations where PFAS-containing materials were suspected of being stored, used, or disposed;
- Interviewed current GUARNG personnel during the site visit;
- Identified Area(s) of Interest (AOIs) and developed a preliminary conceptual site model (CSM) to summarize potential source-pathway-receptor linkages of potential PFAS in soil, groundwater, surface water, and sediment for each AOI.

One AOI related to a potential PFAS release was identified at Barrigada Readiness Center. The AOI is shown on **Figures ES-1** and described in **Tables ES-1** below.

Table ES-1: AOIs at Barrigada Readiness Center

Area of Interest	Name	Used by	Potential Release Dates
AOI 1	Fire Extinguisher Maintenance Area	GUARNG	Between 01-17 June 2016 and early 2019

Based on the documented release concerning the aqueous film forming foam at the facility, there is potential for exposure to PFAS contamination in media at or near the facility. The preliminary CSM for the Barrigada Readiness Center**,** which presents the potential receptors and media impacted, is shown on **Figure ES-2**. Based on the US Environmental Protection Agency (USEPA) Unregulated Contaminant Monitoring Rule 3 (UCMR3) data, it was indicated that PFAS were detected in a public water system above the USEPA's lifetime Health Advisory (HA) within 5 miles of the facility. The HA is 70 parts per trillion for PFOS and PFOA, individually or combined. The affected public water system is the GU Waterworks Authority – Northern System, which had detections of PFOS in groundwater ranging from 41 to 410 parts per trillion. The UCMR3 dataset is located in **Appendix A**. PFAS analyses performed in 2016 had method detection limits that were higher than currently achievable. Thus, it is possible that low concentrations of PFAS were not detected during the UCMR3 but might be detected if analyzed today.



CLIENT	ARNG			
Preliminary Assessment for PFAS at Barrigada Readiness Center, Guam				
REVISED	10/16/2020	GIS BY	MS	10/16/2020
SCALE	1:6,720	CHK BY	CR	10/16/2020
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	RG	10/16/2020

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Summary of Findings

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure ES-1

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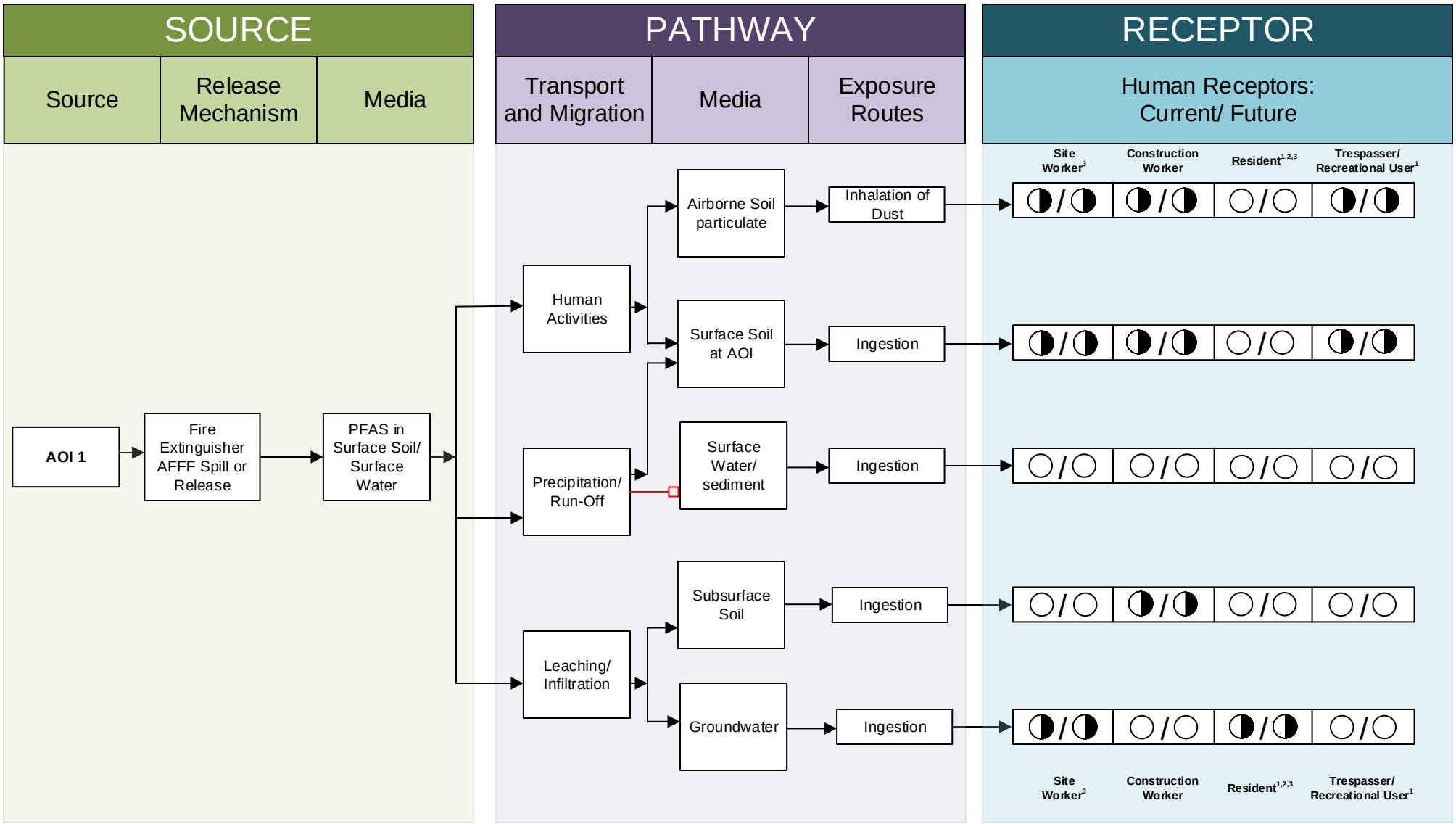


LEGEND

- Flow-Chart Stops
- Flow-Chart Continues
- Partial / Possible Flow
- Incomplete Pathway
- Potentially Complete Pathway
- Complete Pathway

NOTES

1. The resident and recreational users refer to off-site receptors.
2. Inhalation of dust for off-site receptors is likely insignificant.
3. UCMR3 data for municipal drinking water exceeded the HA of 70 parts per trillion for PFOS.

Figure ES-2
Preliminary Conceptual Site Model
Barrigada Readiness Center, Guam

1. Introduction

1.1 Authority and Purpose

The Army National Guard (ARNG) G9 is the lead agency in performing *Preliminary Assessments (PAs) and Site Inspections (SIs) for Perfluorooctanesulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA) at Impacted Sites at ARNG Facilities Nationwide*. This work is supported by the United States (US) Army Corps of Engineers (USACE) Baltimore District and their contractor AECOM Technical Services, Inc. (AECOM) under Contract Number W912DR-12-D-0014, Task Order W912DR17F0192, issued 11 August 2017.

The ARNG is assessing potential effects on human health related to processes at facilities that used per- and poly-fluoroalkyl substances (PFAS) (a suite of related chemicals), primarily in the form of aqueous film forming foam (AFFF) released as part of firefighting activities, although other PFAS sources are possible. In addition, the ARNG is assessing businesses or operations adjacent to the ARNG facility (not under the control of ARNG) that could potentially be responsible for a PFAS release.

PFAS are classified as emerging environmental contaminants that are garnering increasing regulatory interest due to their potential risks to human health and the environment. PFAS formulations contain highly diverse mixtures of compounds. Thus, the fate of these PFAS compounds in the environment varies. The regulatory framework at both federal and state levels continues to evolve. The US Environmental Protection Agency (USEPA) issued a lifetime Drinking Water Health Advisory (HA) for PFOA and PFOS in May 2016, but there are currently no promulgated national standards regulating PFAS in drinking water. The HA is 70 parts per trillion for PFOS and PFOA, individually or combined.

This report presents findings of a PA for PFAS-containing materials at Barrigada Readiness Center (also referred to as the “facility”) in Barrigada, Guam in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, the National Oil and Hazardous Substances Pollution Contingency Plan (40 Code of Federal Regulations [CFR] Part 300), and Army requirements and guidance (US Department of the Army [DA], 2016; DA, 2018).

This PA documents potential locations where PFAS-containing materials are stored and have the potential to be released into the environment at or adjacent to the Barrigada Readiness Center. The term PFAS will be used throughout this report to encompass all PFAS chemicals being evaluated, including PFOS and PFOA, which are key components of AFFF.

1.2 Preliminary Assessment Methods

The performance of this PA included the following tasks:

- Reviewed available administrative record documents and Environmental Data Resources, Inc. (EDR)™ report packages to obtain information relevant to potential PFAS releases, such as: drinking water well locations, historical aerial photographs, Sanborn maps, and environmental compliance actions in the area surrounding the facility;
- Conducted a site visit on 20 November 2019 and completed visual site inspections (VSIs) at locations where PFAS-containing materials were suspected of being stored, used, or disposed;
- Interviewed current Guam ARNG (GUARNG) personnel during the site visit;

- Identified Area(s) of Interest (AOIs) and developed a preliminary conceptual site model (CSM) to summarize potential source-pathway-receptor linkages of potential PFAS in soil, groundwater, surface water, and sediment for each AOI.

1.3 Report Organization

This report has been prepared in accordance with the USEPA *Guidance for Performing Preliminary Assessments under CERCLA* (USEPA, 1991). The report sections and descriptions of each are as follows:

- **Section 1** – **Introduction:** identifies the project purpose and authority and describes the facility location, environmental setting, and methods used to complete the PA.
- **Section 2** – **Fire Training Areas:** describes the fire training areas (FTAs) at the facility identified during the site visit.
- **Section 3** – **Non-Fire Training Areas:** describes other locations of potential PFAS releases at the facility identified during the site visit.
- **Section 4** – **Emergency Response Areas:** describes areas of potential PFAS release at the facility, specifically in response to emergency situations.
- **Section 5** – **Adjacent Sources:** describes sources of potential PFAS release adjacent to the facility that are not under the control of ARNG.
- **Section 6** – **Preliminary Conceptual Site Model:** describes the pathways of potential PFAS transport and receptors at the facility.
- **Section 7** – **Conclusions:** summarizes the data findings and presents the conclusions and uncertainties of the PA.
- **Section 8** – **References:** provides the references used to develop this document.
- **Appendix A** – Data Resources
- **Appendix B** – Preliminary Assessment Documentation
- **Appendix C** – Photographic Log

1.4 Facility Location and Description

Barrigada Readiness Center is in the east-central portion of Guam **(Figure 1-1)**. The facility falls within Barrigada off Route 16, and it is bordered to the north and east by the Naval Computer and Telecommunications Area Master Station (NCTAMS) Barrigada, to the west by Tiyan High School, and to the south by residential areas. The facility is approximately 60 acres.

Barrigada Readiness Center provides training and maintenance for the various units that support the GUARNG. The facility consists of office areas, gas station, maintenance shop, motor pool, a hangar, and storage buildings. In 1950, under the Organic Act of 1950, the property was quitclaimed by the Naval Government of Guam and transferred to the US Navy (Ogden, 1996). The facility property was owned by the US Navy as part of NCTAMS Barrigada, until it was leased to GUARNG in 2001. Leasing records were requested but were unavailable. According to interviewed personnel, an additional 27 acres was acquired in 2016 and is shown on **Figure 1-1** as the northeastern portion of the facility; GUARNG did not occupy the hangar, also called “Aviation Operations Facility”, prior to June 2016. Historical aerial imagery shows that the hangar was constructed between 2011 and 2014. The hangar does not contain any fire suppression system.

1.5 Facility Environmental Setting

The Barrigada Readiness Center is located approximately 2.5 miles south of Tumon Bay. Throughout the facility, the natural terrain slopes towards south towards the southern coastline of Guam, ranging from a maximum elevation of approximately 250 to 310 feet above mean sea level (amsl).

1.5.1 Geology

Guam has four major physiographic areas: limestone plateau, volcanic uplands, interior basin, and coastal lowlands with alluvial valley floors (Tracey et al., 1964). Barrigada Readiness Center overlies the limestone plateau, which includes the north plateau, Orote Peninsula, and the fringing limestone of the southeast coast. The north plateau is relatively flat and consists of reef-associated limestone that has been raised above sea level and tilted to the southwest. Sinkholes range from a few feet to approximately 75 feet deep over most of the limestone plateau.

The Barrigada formation is a white, relatively homogeneous, massive, detrital limestone having a characteristic assemblage of large foraminifera. The Barrigada limestone is the principal rock of northern Guam and underlies most of the northern half of the island; it unconformably overlies Alutom volcanics in some areas and is unconformably overlain by variably thick sequences of Mariana limestone (**Figure 1-2**). In many places, the Barrigada limestone is brecciated and ranges from compact and well-lithified to extremely friable. The permeability of the limestone is relatively high and contains fresh basal ground water up to approximately 7 feet above amsl (Ogden, 1996).

1.5.2 Hydrogeology

Guam can be divided into two hydrogeologic provinces. Groundwater in northern Guam is contained in permeable limestone, while the groundwater in southern Guam is contained in volcanic rock of low permeability. Barrigada Readiness Center is part of the northern Guam hydrogeologic province and overlays the “northern lens” aquifer situated in the Barrigada limestone. The term “northern lens” refers to the lens that develops as rainfall percolates through the surface soil to the underlying, highly porous limestone and accumulates on and displaces denser water.

The Barrigada limestone is characterized by high porosity due to the dissolution and cavernous features. Freshwater flows toward areas of discharge at the shore. The water table is several hundred feet above amsl in the interior and declines to sea level at the coast. Recharge of the aquifer increases the volume of the freshwater lens and lowers the elevation of the freshwater/saltwater interface. Under the provisions of the Safe Drinking Water Act, the groundwater lens of northern Guam was designated a “principal sole source aquifer” (Ogden, 1996).

An EDR™ report conducted a well search for a 1-mile radius surrounding the facility (**Appendix A**). Using additional online resources, such as state and local Geographic Information System databases, wells were researched to a 4-mile radius of the facility. There are no drinking water wells on the facility, but multiple production wells surround the facility to the north, northeast, and southwest. Based on the south/southeastern inferred groundwater direction, some of these production wells may be potentially downgradient from the facility. Groundwater features are presented in **Figure 1-2**.

1.5.3 Hydrology

Despite the large amount of rainfall that occurs on Guam, there are no perennial streams located on or in the vicinity of the facility because of high infiltration rates into the underlying limestone.

The entirety of the facility lies within the Fonte River-Frontal Hagatna Bay Watershed (**Figure 1-3**). The USEPA Unregulated Contaminant Monitoring Rule 3 (UCMR3) data indicated that PFOS/PFOA were detected in the GU Waterworks Authority – Northern System above the USEPA HA within a 5-mile radius of the facility. The detections of PFOS in this public water system ranged from 41 to 410 parts per trillion, and the UCMR3 dataset is located in **Appendix A**. The HA is 70 parts per trillion for PFOS and PFOA, individually or combined. PFAS analyses performed in 2016 had method detection limits that were higher than currently achievable. Thus, it is possible that low concentrations of PFAS were not detected during the UCMR3 but might be detected if analyzed today.

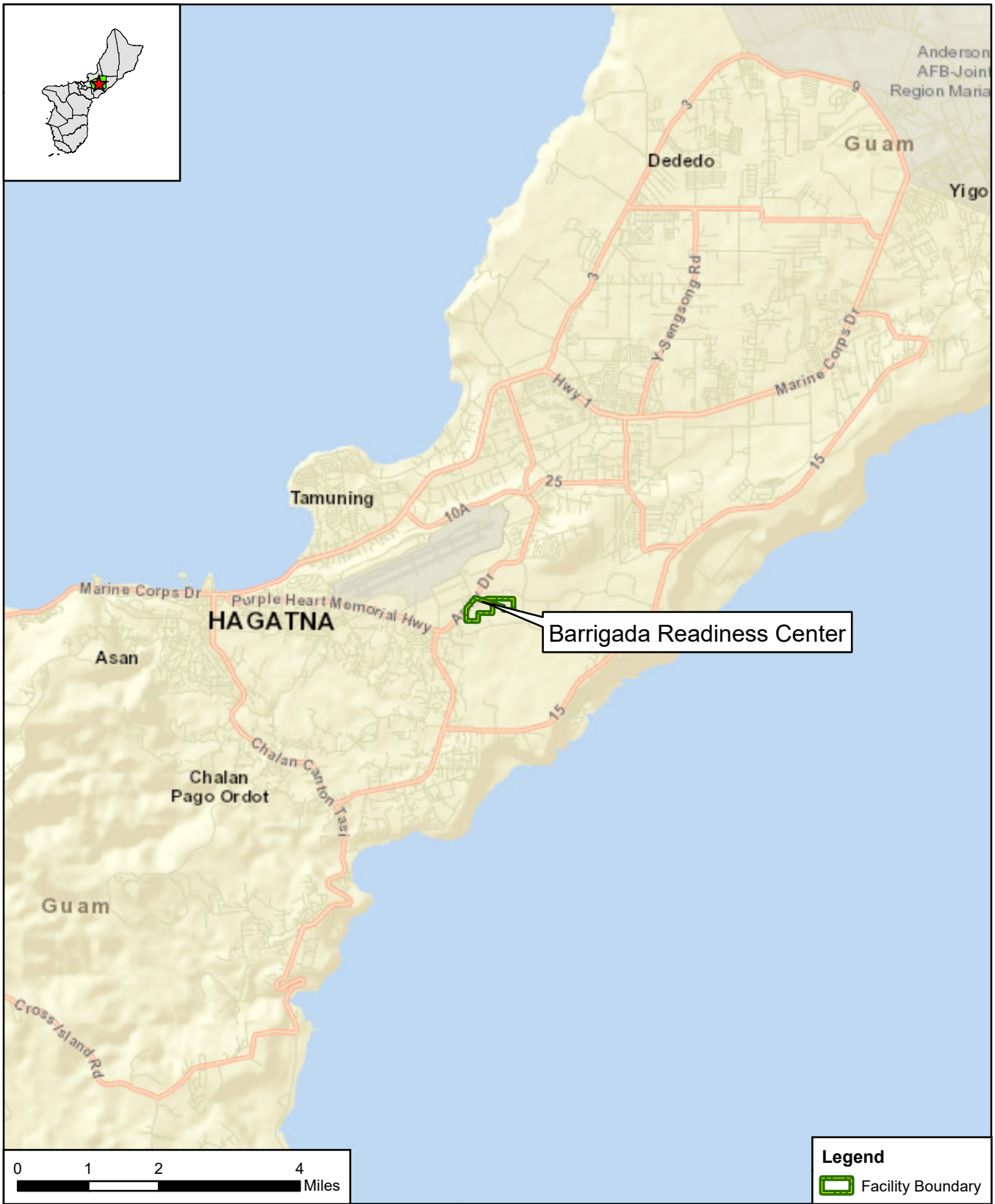
1.5.4 Climate

Guam's climate is characterized by mild temperatures, easterly trade winds year-round, and humid conditions typical of the tropics. Guam has two seasons: rainy (between July and November) and dry (between January and May). The temperature ranges from mid to high-80s degrees Fahrenheit (°F), with temperatures decreasing at higher elevations. Humidity on Guam ranges from approximately 75 to 100 percent. Annual rainfall ranges from 80 inches in the coastal lowland areas to 100 inches in the interior upland of southern Guam (Ogden, 1996).

1.5.5 Current and Future Land Use

Current Barrigada Readiness Center operations include training and maintenance for the various units that support the GUARNG. In addition, a medivac unit uses the hangar in the northern portion of the property. GUARNG currently leases the property from the US Navy, which borders the property to the north and east. The town of Barrigada also abuts the Readiness Center to the south and west.

Reasonably anticipated future land use is not expected to change from the current land use described above.



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Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,		PM	RG	8/19/2020

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Facility Location

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12420 Milestone Center Drive
Germantown, MD 20876

Figure 1-1

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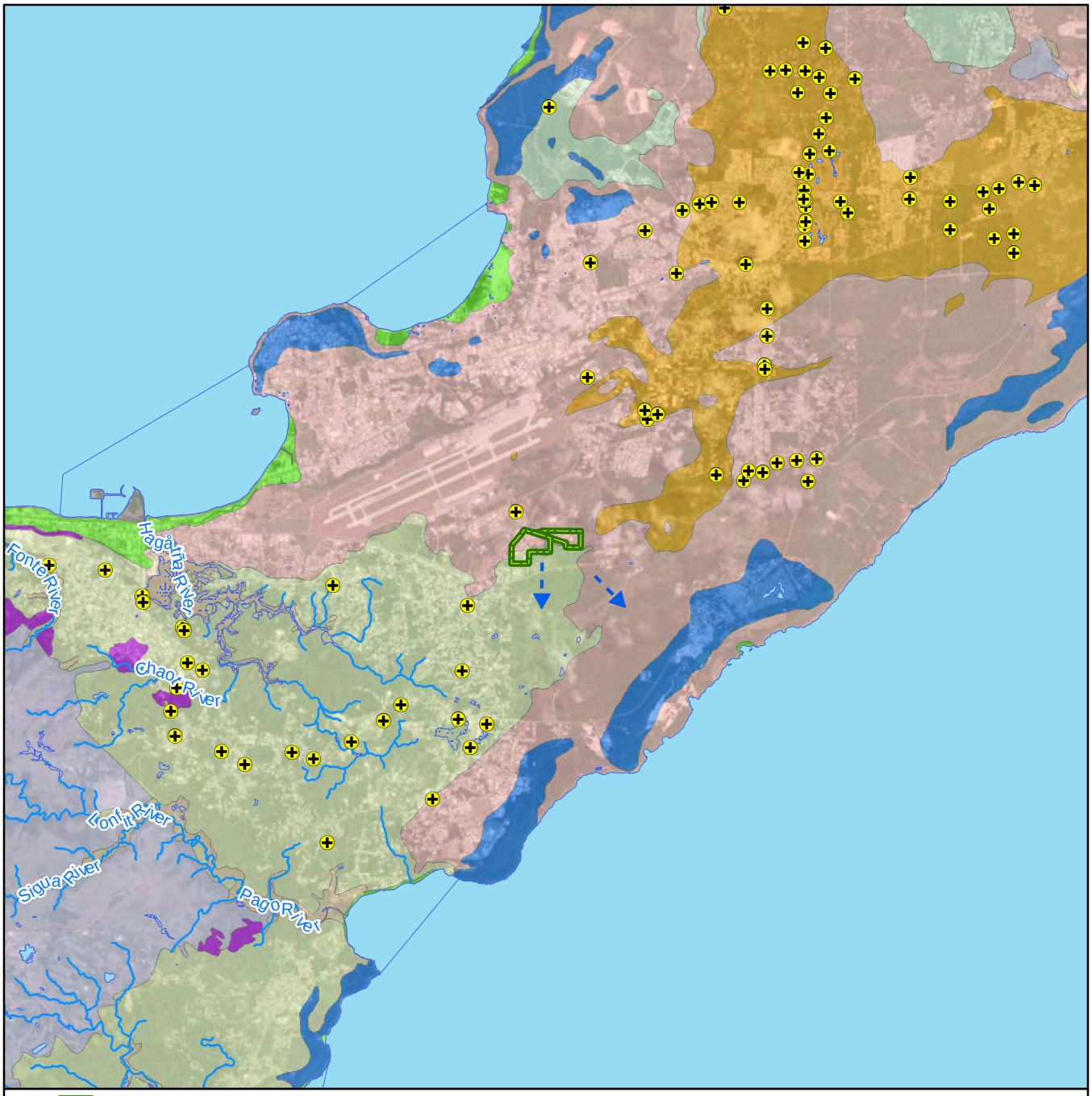

Facility Boundary
Water Body
Wetland
River/Stream
Inferred Groundwater Flow Direction

Geology

Artificial fill
Beach deposits
Alluvium
Merizo Limestone
Reef facies
Molluscan facies
Detrital facies
Hagåtña Argillaceous Member
Alifan Limestone
Barrigada Limestone
Alutom Formation

Well

Production Well

0 0.75 1.5 3 Miles

CLIENT	ARNG			
Preliminary Assessment for PFAS at Barrigada Readiness Center, Guam				
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Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	RG	8/20/2020

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Groundwater Features

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Figure 1-2

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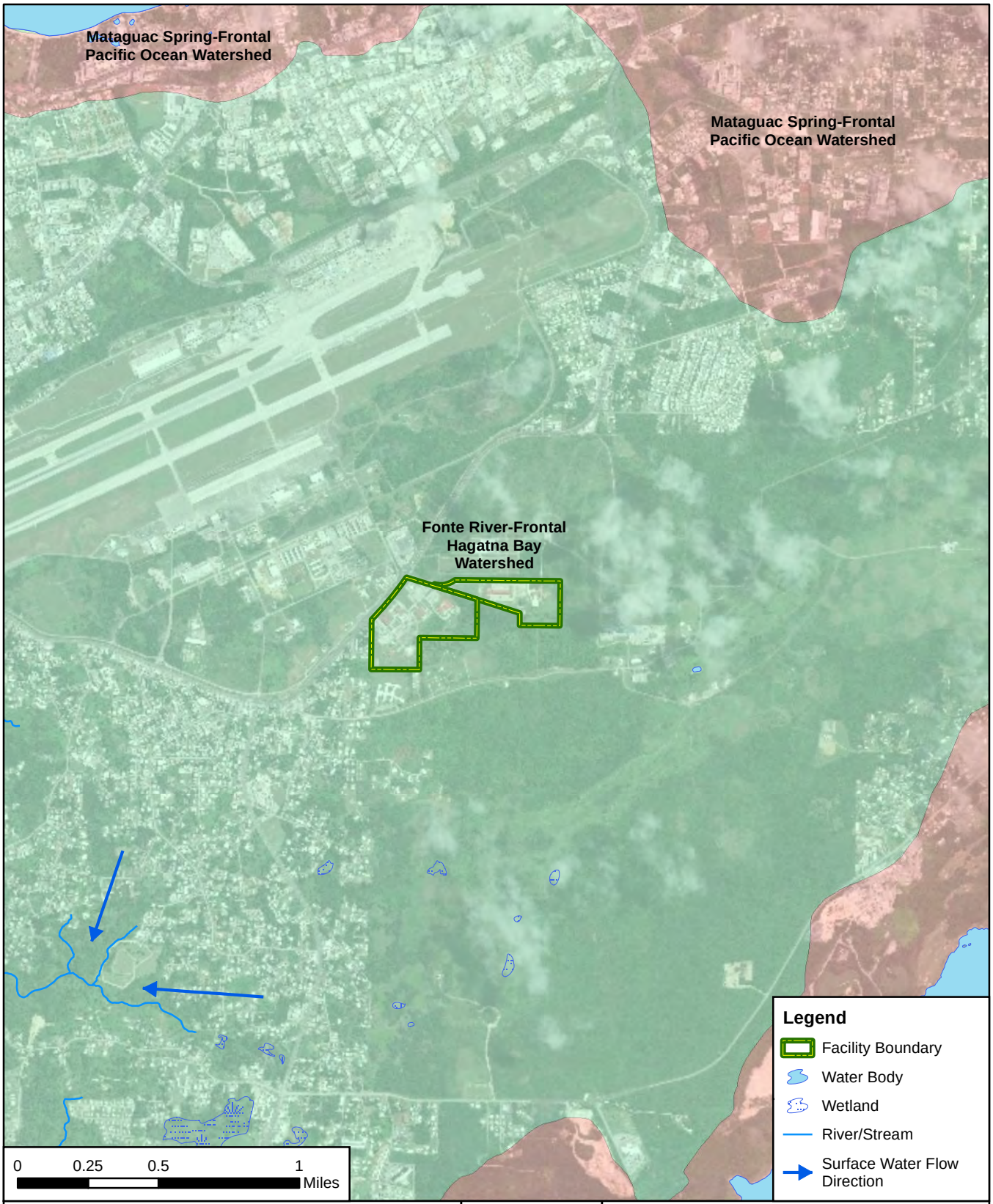

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Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	RG	8/19/2020

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Surface Water Features

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Figure 1-3

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2. Fire Training Areas

No FTAs were identified within the facility during the PA through interviews (**Appendix B**), EDR™ reports (**Appendix A**), or from observations made during the VSI. The personnel interviewed had institutional knowledge spanning from 2015 to present. Information regarding the timespan between 2001 (beginning of property lease) and 2015 was not available.

3. Non-Fire Training Areas

In addition to FTAs, the PA evaluated areas where PFAS-containing materials may have been broadly used, stored, or disposed. This may include buildings with fire suppression systems, paint booths, AFFF storage areas, and areas of compliance demonstrations. Information on these features obtained during the PA are included in **Appendices A** and **B**. Four non-FTAs were identified during the PA. Descriptions of the non-FTAs are presented below, and locations of the non-FTAs are shown on **Figure 3-1**.

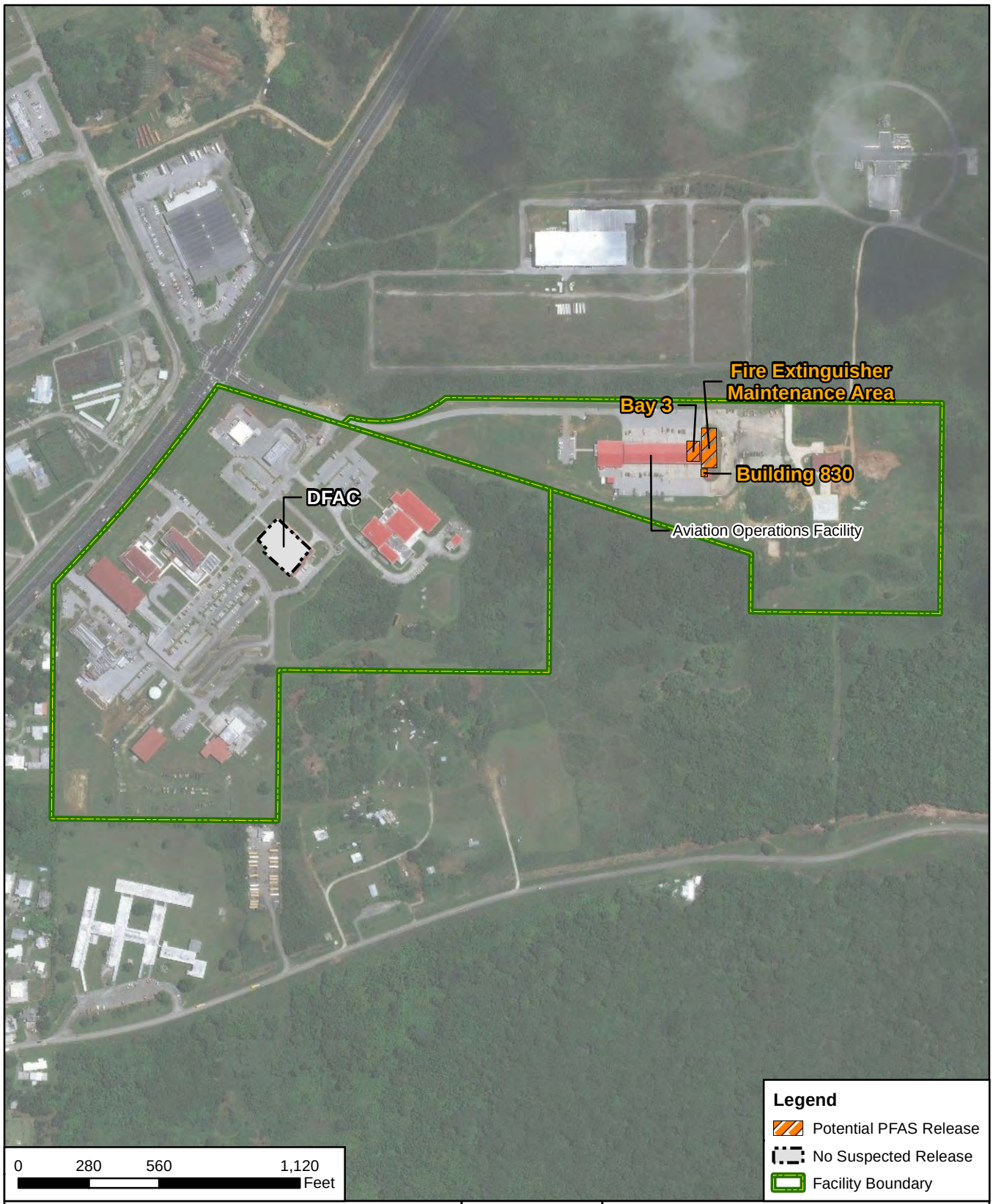
3.1 Fire Extinguisher Maintenance Area

Between the 1st and 17th of June 2016, new Tri-Max ™ compressed air foam systems (CAFSs) were issued to GUARNG, and personnel received training on the new systems. Training was conducted in the northern grassy area of the hangar. As part of the training, personnel were instructed on how to load the Tri-Max™ and were shown the various parts of the extinguisher. In addition, hands-on demonstrations were conducted on how to properly use the Tri-Max™. Based on interviews, there was a large amount of foam released during the hands-on demonstrations. One of the interviewees maintained that the Tri-Max™ CAFSs were filled with soap and not AFFF during the demonstrations because the AFFF material had not yet arrived. According to interviewed personnel, GUARNG did not occupy the hangar, also called “Aviation Operations Facility”, prior to June 2016 and AFFF was only acquired after their arrival. Although it is unclear whether soap or AFFF was used in the training exercises, no other training or use with the Tri-Max™ CAFSs was conducted after the DA issued the memorandum “Limiting Use of Aqueous Film Forming Foam” on 29 June 2016 (DA, 2016).

In early 2019, the Tri-Max ™ CAFSs were emptied of AFFF and moved to a 55-gallon drum plus a 5.5-gallon drum. To empty the Tri-Max ™, the personnel interviewed stated that they siphoned the AFFF and then used a shop vac once the siphoning was no longer productive. Absorbent pads were placed around the CAFSs and drums during the siphoning process to catch any AFFF spills. The shop vac was cleaned with the spigot located on the southeast end of the hangar, and the rinse water was allowed to drain naturally. After being cleaned, the shop vac was disposed of in regular municipal waste. The used absorbent pads were placed in a single 55-gallon drum and stored with the AFFF drums inside Building 830, a storage shed located also in the grassy area of the hangar next to where training and maintenance activities were conducted. The AFFF and used absorbent pad drums inside Building 830 were sitting on top of spill containment pallets, and no spills were observed during the VSI (see Photos 5-7 in **Appendix C**). The empty and filled CAFSs were stored in Bay 3 of the hangar when not in use. Two empty CAFSs were observed inside Bay 3 during the VSI (see Photo 1 in **Appendix C**). Both storage locations, Bay 3 and Building 830, are shown on **Figure 3-1**.

3.2 Dining Facility

The dining facility (DFAC) is located on the southwest portion of Barrigada Readiness Center. The DFAC is equipped with an Ansul R-102 wet chemical fire suppression system. The wet chemical agent used in the system is composed of a mixture of organic salts and reportedly does not contain PFAS (Ansul, 2017). The DFAC is not considered to be a potential release area of PFAS.



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Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	RG	10/16/2020

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Non-Fire Training Area

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Figure 3-1

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4. Emergency Response Areas

No instances of emergency responses were identified at Barrigada Readiness Center during the PA, based on the institutional knowledge of the interviewees (spanning from 2015 to present). The facility relies on the local fire department or the nearby federal fire department for emergency needs. There has been no need for response as of the date of the PA interviews. Interviewees highlighted their history of zero incidents at the facility (**Appendix B.1**).

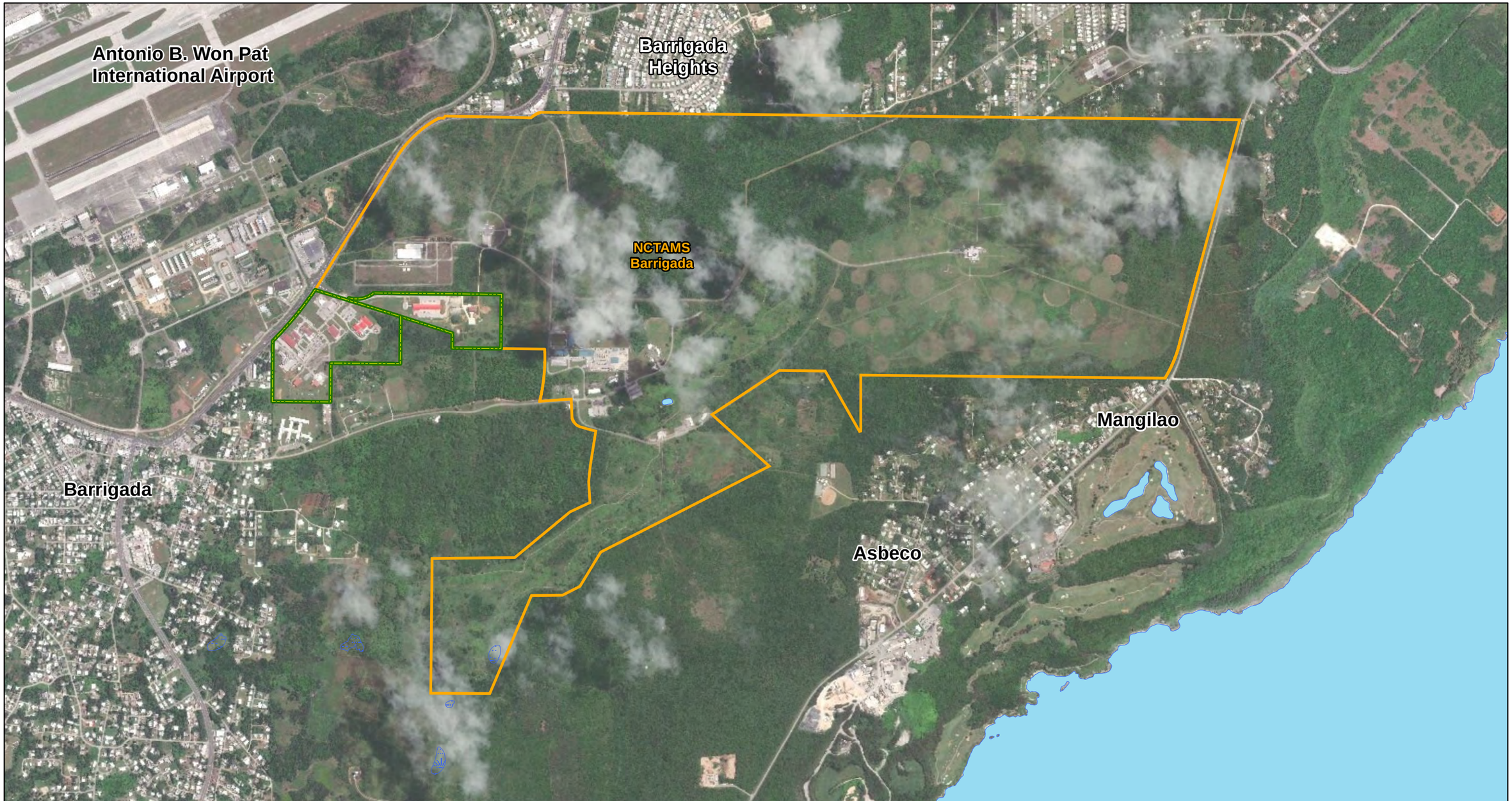
5. Adjacent Sources

One potential off-facility source of PFAS adjacent to Barrigada Readiness Center, not under the control of the GUARNG, was identified during the PA. A description of the adjacent source is presented below, and the adjacent source is shown on **Figure 5-1**.

5.1 NCTAMS Barrigada and Naval Activities

NCTAMS Barrigada is located adjacent to the Barrigada Readiness Center. The US Navy is in the process of performing a focused SI for PFAS at NCTAMS; additional information regarding the investigation was not available at the time of the PA report. Because portions of the facility are located both downgradient and side gradient to areas of NCTAMS, it is possible that NCTAMS is a potential off-facility source of PFAS.

During document reviews, a former fire station was identified within a Naval Activities property site (Ogden, 1996). The history and the extent of AFFF use, if any, at the former fire station is unknown, but the approximate location of the former fire station is located about 10 miles southwest of the facility. Review of the EDR™ did not reveal other likely PFAS sources near the facility.



CLIENT	ARNG			
PROJECT	Preliminary Assessment for PFAS at Barrigada Readiness Center, Guam			
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Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	RG	10/16/2020

Legend

- Potential PFAS Release
- Facility Boundary
- Water Body
- Wetland

0 750 1,500 3,000 Feet

N

Adjacent Sources

AECOM
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Germantown, MD 20876

Figure 5-1

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6. Preliminary Conceptual Site Model

Based on the PA findings, one AOI was identified at Barrigada Readiness Center. The AOI location is shown on **Figure 6-1**. The following sections describe the CSM components and the specific preliminary CSM developed for the AOI. The CSM identifies the three components necessary for a potentially complete exposure pathway: (1) source, (2) pathway, and (3) receptor. If any of these elements are missing, the pathway is considered incomplete.

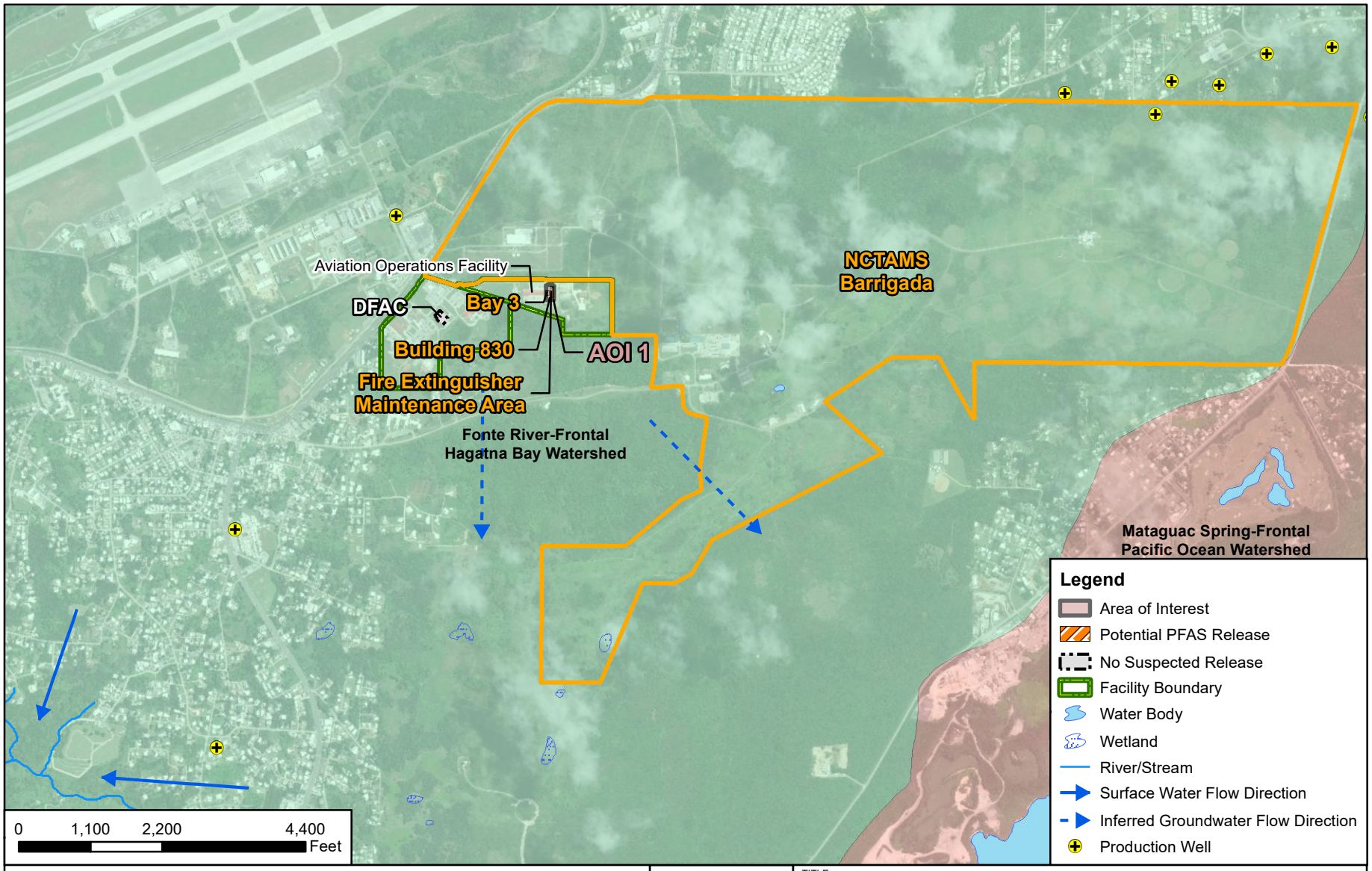
Human exposure via the dermal contact pathway may occur, and current risk practice suggests it is an insignificant pathway compared to ingestion; however, exposure data for dermal pathways are sparse and continue to be the subject of PFAS toxicological study (National Ground Water Association, 2018). Receptors at Barrigada Readiness Center include site workers, construction workers, trespassers, and off-facility residents. The preliminary CSM for Barrigada Readiness Center indicates which specific receptors could potentially be exposed to PFAS. The preliminary CSM for AOI 1 is shown in **Figure 6-2**.

6.1 AOI 1: Fire Extinguisher Maintenance Area

AOI 1 contains the Tri-Max™ training area, Building 830, and Bay 3, where AFFF was stored and/or may have been released during filling and emptying of the Tri-Max ™ CAFSs. The area where the Tri-Max™ training was conducted is grassy, while Building 830 and Bay 3 are paved. Ground-disturbing activities in release areas could result in site worker, construction worker, and trespasser exposure to potential PFAS contamination via inhalation of dust or ingestion of surface soil. PFAS may have also infiltrated from surface soil to the subsurface, and ground-disturbing activities to subsurface soil could result in construction worker exposure.

The surface water/ sediment exposure pathway is considered incomplete because there are no perennial streams or wetlands at the facility. The facility overlies a highly porous limestone plateau, so all surface water runoff from precipitation percolates into the ground (Earth Tech, Inc., 2000).

PFAS are water soluble and can migrate readily from soil to groundwater via leaching. No drinking water wells exist at the facility; however, drinking water at Barrigada Readiness Center is resourced from several public drinking water wells that may be located hydraulically downgradient from the facility. Based on the UCMR3 data, a public water system (GU Waterworks Authority – Northern System) exceeded the HA of 70 parts per trillion for PFOS in groundwater wells within 5 miles of the facility (**Appendix A**). Therefore, site workers and off-facility residents may be potentially exposed to contaminated groundwater attributable to the facility. The groundwater depth is at least 250 feet below ground surface, so construction workers are unlikely to encounter shallow groundwater (Earth Tech, Inc., 2000).



CLIENT	ARNG			
PROJECT	Preliminary Assessment for PFAS at Barrigada Readiness Center, Guam			
REVISED	10/16/2020	GIS BY	MS	10/16/2020
SCALE	1:26,400	CHK BY	CR	10/16/2020
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	RG	10/16/2020

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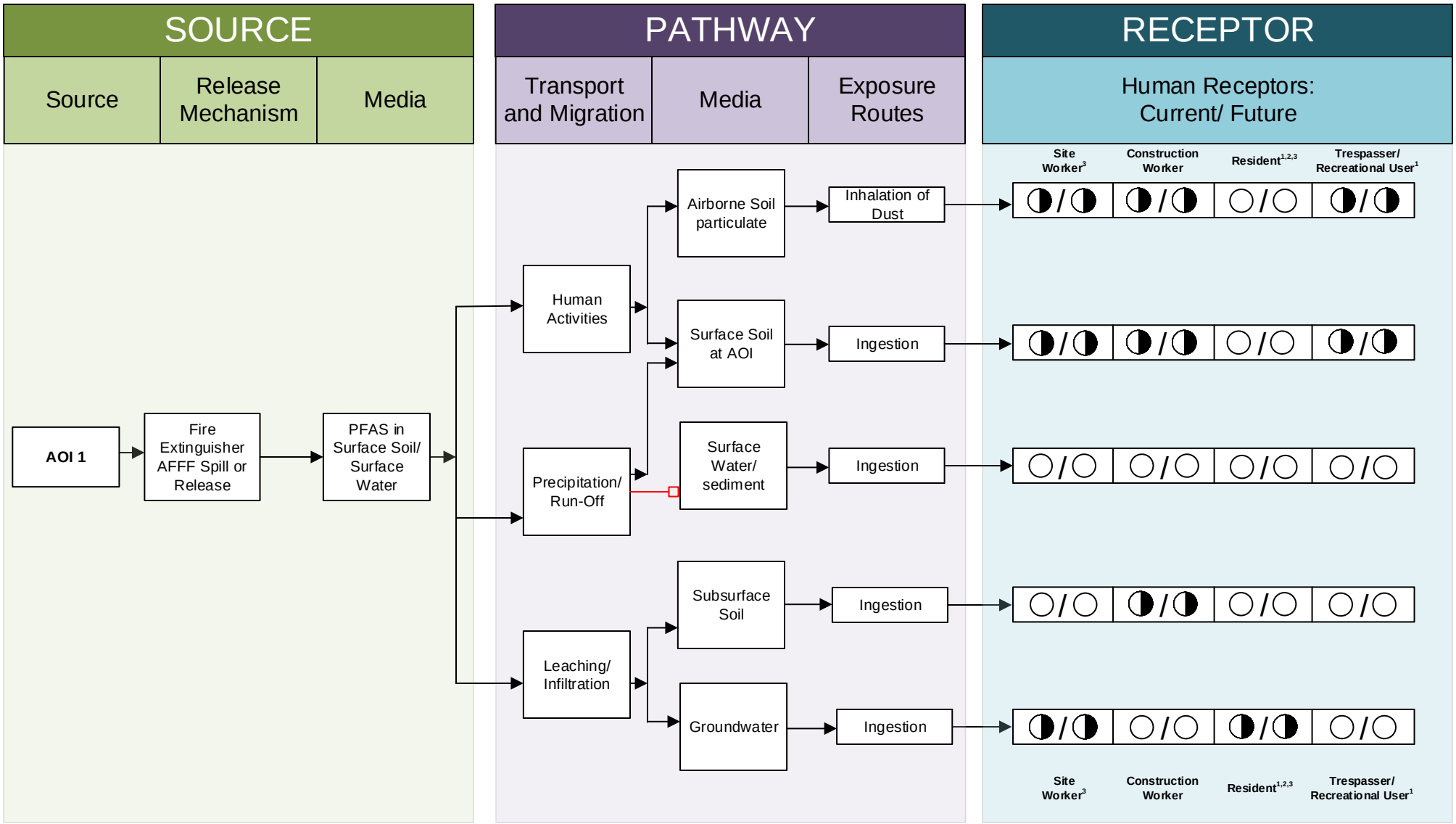
TITLE

Area of Interest

AECOM

12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-1



LEGEND

- Flow-Chart Stops
- Flow-Chart Continues
- Partial / Possible Flow
- Incomplete Pathway
- Potentially Complete Pathway
- Complete Pathway

NOTES

1. The resident and recreational users refer to off-site receptors.
2. Inhalation of dust for off-site receptors is likely insignificant.
3. UCMR3 data for municipal drinking water exceeded the HA of 70 parts per trillion for PFOS.

Figure 6-2
Preliminary Conceptual Site Model
Barrigada Readiness Center, Guam

7. Conclusions

This report presents a summary of available information gathered during PA efforts on the use and storage of AFFF and other PFAS-related activities at the Barrigada Readiness Center. The PA findings are based on the information presented in **Appendix A** and **Appendix B**.

7.1 Findings

One AOI related to potential PFAS releases was identified at the Barrigada Readiness Center during the PA. **Figure 7-1** and **Table 7-1** present a summary of PA findings.

Table 7-1: AOIs at Barrigada Readiness Center

Area of Interest	Name	Used by	Potential Release Dates
AOI 1	Fire Extinguisher Maintenance Area	GUARNG	Between 01-17 June 2016 and early 2019

Based on the storage and potential AFFF release at the AOI, there is potential for exposure to PFAS contamination in media at or near the facility. The preliminary CSM for Barrigada Readiness Center, which presents the potential receptors and media impacted, is shown on **Figure 6-2**.

7.2 Uncertainties

A number of information sources were investigated during this PA to determine the potential for PFAS-containing materials to have been present, used, or released at the facility. Historically, documentation of PFAS use was not required because PFAS were considered benign. Therefore, records were not typically kept by the facility or available during the PA on the use of PFAS in training, firefighting, or other non-traditional activities, or on its disposition.

The conclusions of this PA are based on all available information including: previous environmental reports, EDRs™, observations made during the VSI, and interviews. Interviews of personnel with direct knowledge of a facility generally provided the most useful insights regarding a facility's historical and current PFAS-containing materials. Gathered information has a degree of uncertainty due to the absence of written documentation, the limited number of personnel with direct knowledge due to staffing changes, the time passed since PFAS were first used (1969 to present), and a reliance on personal recollection. Inaccuracies may arise in potential PFAS release locations, dates of release, volume of releases, and the concentration of AFFF used. Comprehensive information on all industrial practices that may potentially be sources of PFAS is incomplete. Therefore, this PA may not identify all potential PFAS sources.

In order to minimize the level of uncertainty, readily available data regarding the use and storage of PFAS were reviewed, retired and current personnel were interviewed, multiple persons were interviewed for the same potential source area, and potential source areas were visually inspected.

Table 7-2 summarizes the uncertainties associated with the PA.

Table 7-2: Summary of Uncertainties

Location	Source of Uncertainty
AOI 1 – Fire Extinguisher Maintenance Area	The exact details of the training practice with the extinguisher were not definitive. It is unclear when the Tri-Max™ CAFSs were filled with AFFF and whether training was conducted with AFFF or soap.
General	The personnel interviewed had institutional knowledge spanning from 2015 to present. Information regarding the timespan between 2001 (beginning of property lease) and 2015 was not available.

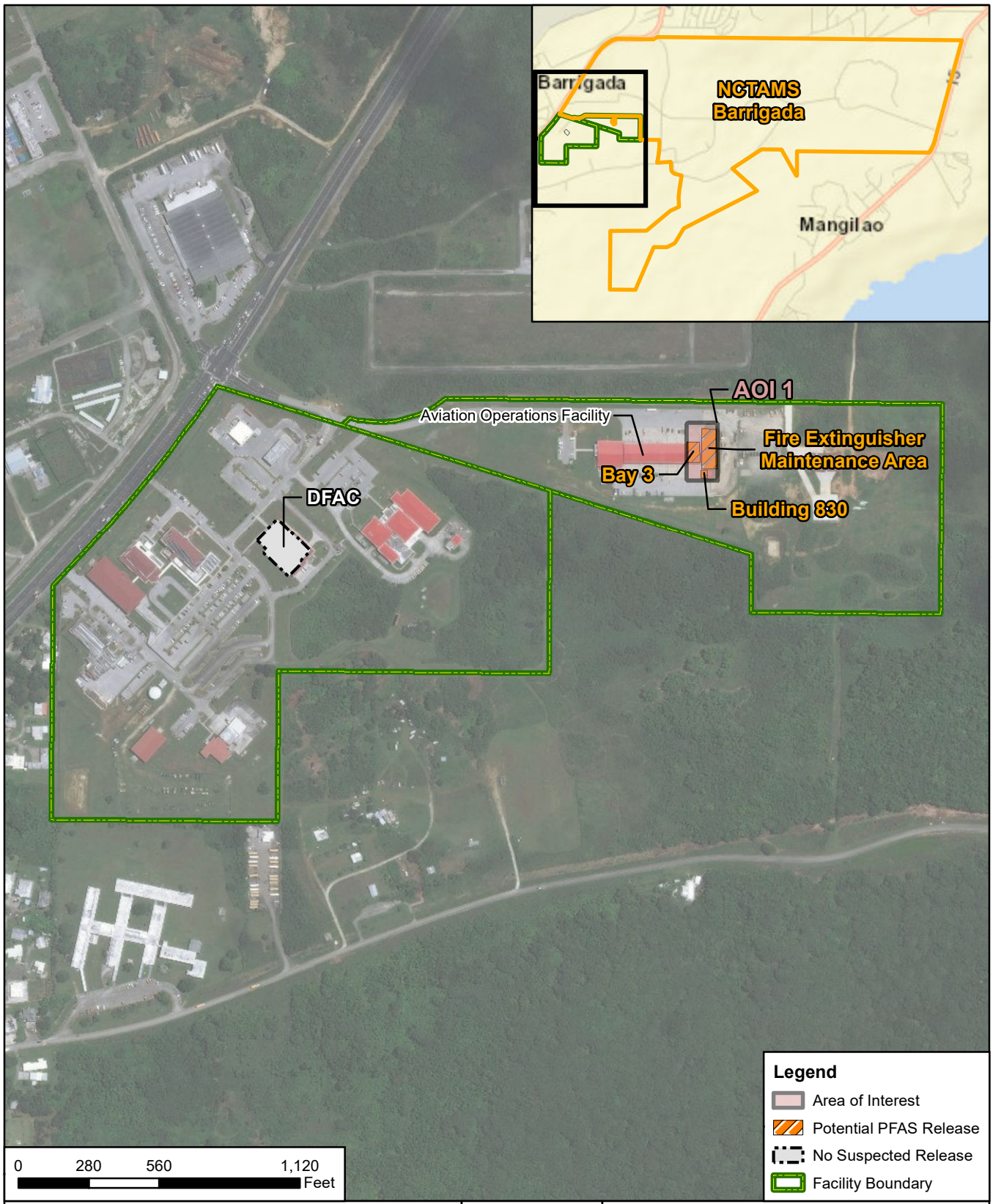
7.3 Potential Future Actions

The degree of uncertainties associated with the interviews and data collected during the PA indicates that former GUARNG activities may have resulted in potential PFAS releases at the one AOI identified during the PA. Based on the preliminary CSM developed for the AOI, there is potential for receptors to be exposed to PFAS contamination in soil, subsurface soil, and groundwater at this AOI. **Table 7-3** summarizes the rationale used to determine if the AOI should be considered for further investigation under the CERCLA process and undergo an SI.

Table 7-3: PA Findings Summary

Area of Interest	AOI Location	Rationale	Potential Future Action
AOI 1 – Fire Extinguisher Maintenance Area	13°28’33.78”N and 144°48’53.11”E	Training and maintenance of Tri-Max ™ CAFSs.	Proceed to an SI; focus on soil and groundwater.

ARNG will evaluate the need for an SI at Barrigada Readiness Center based on the potential presence of a PFAS release, possible receptors, and the migration potential of PFAS contamination to receptors.



CLIENT	ARNG			
Preliminary Assessment for PFAS at Barrigada Readiness Center, Guam				
REVISED	10/16/2020	GIS BY	MS	10/16/2020
SCALE	1:6,720	CHK BY	CR	10/16/2020
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	RG	10/16/2020

N

Summary of Findings

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 7-1

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Appendix A
Data Resources

Data Resources will be provided separately on CD. Data Resources for Barrigada Readiness Center, Guam include:

Barrigada Readiness Center UCMR3

- 2015-2017 Barrigada Readiness Center UCMR3 Data

Barrigada Readiness Center EDR™ Report

- 2020 EDR Aerial Photo Decade Package
- 2020 EDR ZIP/PLUS™ Report
- 2020 EDR Historical Topo Map Report

Barrigada Readiness Center Environmental Reports

- 1996 Environmental Baseline Survey
- 1998 Environmental Baseline Survey Addendum Report
- 2000 Technical Memorandum Phase 2B Soil Sampling, Abbreviated Remedial Investigation POI-03
- 2003 Abbreviated Remedial Investigation Former NCTAMS Barrigada Disposal Areas

Appendix B

Preliminary Assessment Documentation

Appendix B.1
Interview Records

PA Interview Questionnaire - Other

Facility: Barrigada Readiness Center
Interviewer:
Date/Time: 11-20-19

Interviewee: [redacted] **Title:** ISD **Phone Number:** [redacted] **Email** [redacted]	Can your name/role be used in the PA Report? Y or (N) Can you recommend anyone we can interview? Y or (N) _____

Roles or activities with the Facility/Years working at the Facility:

Aircraft maintenance

PFAS Use: Identify accidental/intentional release locations, time frame of release, frequency of releases, storage container size (maintenance, fire training, firefighting, buildings with suppression systems (as builts), fueling stations, crash sites, pest management, recreational, dining facilities, metals plating, or waterproofing). How are materials ordered/purchased/disposed/shared with others?

2016 training of Trimax → observer
→ described how to load + different system parts
→ didn't see any residual foam

Early 2019 → no pressure in system
→ more than 3/4 full of AFFF
→ syphoned in the hangar
→ used shop vac
→ filled 55 gal + one 5.5
→ started foaming
→ removal occurred in Hangar
→ cut-up airhose to siphon through hose away
→ Mats in spill-drum w/ pig mats
→ cleaned shop-vac bg picked on flightline

Known Uses	
Use	
Procurement	
Disposition	
Storage (Mixed)	
Storage (Solution)	
Inventory, Off-Spec	
Containment	
SOP on Filling	
Leaking Vehicles	
Nozzle and Suppression System Testing	
Dining Facilities	
Vehicle Washing	
Ramp Washing	
Fuel Spill Washing and Fueling Stations	
Chrome Plating or Waterproofing	

PA Interview Questionnaire - Other

Facility: Barrigada Readiness Cent
Interviewer:
Date/Time: 11-20-19

Interviewee: Chief CW4 [redacted]	Can your name/role be used in the PA Report? Y or N
Title: State Aviation Safety Officer	Can you recommend anyone we can interview?
Phone Number: [redacted]	(Y) or N
Email: [redacted]	

Roles or activities with the Facility/Years working at the Facility:

2015, January → Medivac program setup

PFAS Use: Identify accidental/intentional release locations, time frame of release, frequency of releases, storage container size (maintenance, fire training, firefighting, buildings with suppression systems (as builts), fueling stations, crash sites, pest management, recreational, dining facilities, metals plating, or waterproofing). How are materials ordered/purchased/disposed/shared with others?

	Known Uses
Training of fire extinguishers → not sure whether AFFF was used, Aug 2016	Use
fuelers a couple yrs ago	Procurement
AFFF located in Bldg 830, previously in Bay 9	Disposition
	Storage (Mixed) X
Syphon Pump to remove AFFF into 55-gal drum	Storage (Solution) X
	Inventory, Off-Spec
Wash pan for military vehicles	Containment
Tri-Max → loaners from Air Force	SOP on Filling
→ Caf system, came empty	Leaking Vehicles
→ sprayed outside	Nozzle and Suppression System Testing
	Dining Facilities
	Vehicle Washing
	Ramp Washing
	Fuel Spill Washing and Fueling Stations
	Chrome Plating or Waterproofing

PA Interview Questionnaire - Other

Facility: Barrigada RC
Interviewer:
Date/Time: 11-20-19

Interviewee: [redacted] **Title:** 92F **Phone Number:** [redacted] **Ema** [redacted]	Can your name/role be used in the PA Report? Y or N Can you recommend anyone we can interview? Y or N SGT [redacted]

Roles or activities with the Facility/Years working at the Facility:

I am the petroleum specialist full-time technician. I refuel the aircrafts.

PFAS Use: Identify accidental/intentional release locations, time frame of release, frequency of releases, storage container size (maintenance, fire training, firefighting, buildings with suppression systems (as builts), fueling stations, crash sites, pest management, recreational, dining facilities, metals plating, or waterproofing). How are materials ordered/purchased/disposed/shared with others?

	Known Uses
2016 → Training	Use
Went to train site → Ft Lee, Virginia	Procurement
No training w/ Tri-Max in Guam	Disposition
Only training w/ ABC on base	Storage (Mixed)
Maintainers doing.	Storage (Solution)
In area of training, noticed foam	Inventory, Off-Spec
fuel from Andersen AFB	Containment
2 Hemits to get fuel & refuel	SOP on Filling
Helicopters	Leaking Vehicles
	Nozzle and Suppression System Testing
	Dining Facilities
	Vehicle Washing
	Ramp Washing
	Fuel Spill Washing and Fueling Stations
	Chrome Plating or Waterproofing

PA Interview Questionnaire - Other

Facility: Barrigada RC
Interviewer: _____
Date/Time: 11-20-19

Interviewee: CW2 [redacted] **Title:** aircraft pilot **Phone Number:** [redacted] **Email:** [redacted]	Can your name/role be used in the PA Report? Y or N Can you recommend anyone we can interview? or N _____

Roles or activities with the Facility/Years working at the Facility:

2015, aircraft pilot

PFAS Use: Identify accidental/intentional release locations, time frame of release, frequency of releases, storage container size (maintenance, fire training, firefighting, buildings with suppression systems (as builts), fueling stations, crash sites, pest management, recreational, dining facilities, metals plating, or waterproofing). How are materials ordered/purchased/disposed/shared with others?

	Known Uses
2015 Training → Maintaining + using	Use
→ 99.9% sure it was soap	Procurement
→ No Afff yet arrived	Disposition
→ No CO_2 either	Storage (Mixed)
→ Pretty foamy → 10ft x 10ft area	Storage (Solution)
→ Does not remember anyone hosing down the pad	Inventory, Off-Spec
→ No other training	Containment
	SOP on Filling
	Leaking Vehicles
	Nozzle and Suppression System Testing
	Dining Facilities
	Vehicle Washing
	Ramp Washing
	Fuel Spill Washing and Fueling Stations
	Chrome Plating or Waterproofing

Appendix B.2
Visual Site Inspection Checklists

Visual Site Inspection Checklist

Names(s) of people performing VSI: [redacted]

Recorded by:

ARNG Contact:

Date and Time: 11-20-19; 0830

Method of visit (walking, driving, adjacent): walking

Source/Release Information

Site Name / Area Name / Unique ID: AOE 1, Barrigada Training Center

Site / Area Acreage:

Historic Site Use (Brief Description): Radio Area for Navy

Current Site Use (Brief Description): Medivac Unit

Physical barriers or access restrictions: Fencing

1. Was PFAS used (or spilled) at the site/area? (Y) / N

1a. If yes, document how PFAS was used and usage time (e.g., fire fighting training 2001 to 2014):
Transferred AFFF to + from CAFs, spillage during transfer

2. Has usage been documented? (Y) / N

2a. If yes, keep a record (place electronic files on a disk):

3. What types of businesses are located near the site? **Industrial / Commercial / Plating / Waterproofing / Residential**

3a. Indicate what businesses are located near the site
FEMA warehouse, Army Reserve Center, Post office, US Navy Radio transmitter

4. Is this site located at an airport/flightline? Y / (N)

4a. If yes, provide a description of the airport/flightline tenants:

Visual Survey Inspection Log

Other Significant Site Features:

1. Does the facility have a fire suppression system? Y (N)

1a. If yes, indicate which type of AFFF has been used:

1b. If yes, describe maintenance schedule/leaks:

1c. If yes, how often is the AFFF replaced:

1d. If yes, does the facility have floor drains and where do they lead? Can we obtain an as built drawing?

Transport / Pathway Information

Migration Potential:

1. Does site/area drainage flow off installation? (Y) N

1a. If so, note observation and location:

2. Is there channelized flow within the site/area? (Y) N

2a. If so, please note observation and location:

3. Are monitoring or drinking water wells located near the site? Y (N)

3a. If so, please note the location:

4. Are surface water intakes located near the site? Y (N)

4a. If so, please note the location:

5. Can wind dispersion information be obtained? Y (N)

5a. If so, please note and observe the location.

6. Does an adjacent non-ARNG PFAS source exist? Y (N)

6a. If so, please note the source and location.

6b. Will off-site reconnaissance be conducted? (Y) N

Visual Survey Inspection Log

Significant Topographical Features:

1. Has the infrastructure changed at the site/area? Y / (N)

1a. If so, please describe change (ex. Structures no longer exist):

2. Is the site/area vegetated? (Y) / N

2a. If not vegetated, briefly describe the site/area composition:

3. Does the site or area exhibit evidence of erosion? Y / (N)

3a. If yes, describe the location and extent of the erosion:

4. Does the site/area exhibit any areas of ponding or standing water? Y / (N)

4a. If yes, describe the location and extent of the ponding:

Receptor Information

1. Is access to the site restricted? (Y) / N

1a. If so, please note to what extent: Passes to get on-base

2. Who can access the site? **Site Workers / Construction Workers / Trespassers / Residential / Recreational Users / Ecological**

2a. Circle all that apply, note any not covered above:

3. Are residential areas located near the site? Y / (N)

3a. If so, please note the location/distance:

4. Are any schools/day care centers located near the site? Y / (N)

4a. If so, please note the location/distance/type:

5. Are any wetlands located near the site? Y / (N)

5a. If so, please note the location/distance/type:

Appendix B.3
Conceptual Site Model Information

Preliminary Assessment – Conceptual Site Model Information

Site Name: Barrigada Training Center

Why has this location been identified as a site?

Yes

Are there any other activities nearby that could also impact this location?

No

Training Events

Have any training events with AFFF occurred at this site? Yes

If so, how often? Once

How much material was used? Is it documented?, Soap no AFFF at base during training

Identify Potential Pathways: Do we have enough information to fully understand over land surface water flow, groundwater flow, and geological formations on and around the facility? Any direct pathways to larger water bodies?

Surface Water:

Surface water flow direction? Southeast

Average rainfall? 80 inches

Any flooding during rainy season? No

Direct or indirect pathway to ditches? Yes

Direct or indirect pathway to larger bodies of water? Yes

Does surface water pond any place on site?

Any impoundment areas or retention ponds? ~~No~~ Yes, sinkholes previously identified

Any NPDES location points near the site? NO

How does surface water drain on and around the flight line?

Preliminary Assessment – Conceptual Site Model Information

Groundwater:

Groundwater flow direction? South

Depth to groundwater? ~200 ft

Uses (agricultural, drinking water, irrigation)? DW,

Any groundwater treatment systems? No

Any groundwater monitoring well locations near the site? yes

Is groundwater used for drinking water? Yes

Are there drinking water supply wells on installation? No

Do they serve off-post populations? N/A

Are there off-post drinking water wells downgradient Yes

Waste Water Treatment Plant:

Has the installation ever had a WWTP, past or present? No

If so, do we understand the process and which water is/was treated at the plant?

Do we understand the fate of sludge waste?

Is surface water from potential contaminated sites treated?

Equipment Rinse Water

1. Is firefighting equipment washed? Where does the rinse water go?

No trucks, only 2 CAFs

2. Are nozzles tested? How often are nozzles tested? Where are nozzles tested? Are nozzles cleaned after use? Where does the rinse water flow after cleaning nozzles?

No testing of CAFs

3. Other?

Preliminary Assessment – Conceptual Site Model Information

Identify Potential Receptors:

Site Worker → current, future

Construction Worker → Current, future

Recreational User → Trespasser (current, future)

Residential → future

Child → future

Ecological → current, future

Note what is located near by the site (e.g. daycare, schools, hospitals, churches, agricultural, livestock)?

FEMA warehouse, Army Reserve Center, Navy Communications, post office

Documentation

Ask for Engineering drawings (if applicable).

Has there been a reconstruction or changes to the drainage system? When did that occur?

Appendix C
Photographic Log

APPENDIX C – Photographic Log

Army National Guard, Preliminary Assessment for PFAS	Barrigada Readiness Center	Guam

Photograph No. 1

Description:

Two CAFS fire extinguishers located in Bay 3.

Date Taken:

19 November 2019

Photograph No. 2

Description:

CAFS canister placard

Date Taken:

19 November 2019

APPENDIX C – Photographic Log

Army National Guard, Preliminary Assessment for PFAS	Barrigada Readiness Center	Guam

Photograph No. 3

Description:

CAFS label

Date Taken:

19 November 2019

Photograph No. 4

Description:

Bldg. 830, currently stores Hazardous Waste including one 55-gallon drum on AFFF and AFFF soaked absorbent pads.

Date Taken:

19 November 2019

APPENDIX C – Photographic Log

Army National Guard, Preliminary Assessment for PFAS	Barrigada Readiness Center	Guam

Photograph No. 5

Description:

AFFF from the CAFS, stored in Bldg. 830.

Date Taken:

19 November 2019

Photograph No. 6

Description:

5 gallons of used AFFF. Located in Bldg. 830.

Date Taken:

19 November 2019

APPENDIX C – Photographic Log

Army National Guard, Preliminary Assessment for PFAS	Barrigada Readiness Center	Guam

Photograph No. 7

Description:

Drum with used absorbent pads.

Date Taken:

19 November 2019

Photograph No. 8

Description:

Area of CAFS training, and where AFFF spilled during transfer of AFFF from CAFS to drums.

Date Taken:

19 November 2019

APPENDIX C – Photographic Log

Army National Guard, Preliminary Assessment for PFAS	Barrigada Readiness Center	Guam

Photograph No. 9

Description:

Unused AFFF located inside Bay 3 of Bldg.

Date Taken:

19 November 2019

Photograph No. 10

Description:

Fire suppression system in DFAC, Ansul R-102.

Date Taken:

19 November 2019