PRELIMINARY ASSESSMENT OF PER- AND POLYFLUOROALKYL SUBSTANCES AT HAMILTON ARMY AIRFIELD, NOVATO, CALIFORNIA

Prepared for:

U.S. ARMY

ODCS, G-9, ISE BRAC

Final
October 2023

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LIST OF ACRONYMS AND ABBREVIATIONS

AFB	Air Force Base
AFFF	Aqueous Film-Forming Foam
AOPI	Area of Potential Interest
ARFF	Aircraft Rescue and Firefighting
Army	U.S. Army
AST	Aboveground Storage Tank
bgs	Below Ground Surface
BRAC	Base Realignment and Closure
CA SLC	California State Lands Commission
CA SSC	California State Coastal Conservancy
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CSM	Conceptual Site Model
DERP	Defense Environmental Restoration Program
DoD	U.S. Department of Defense
ECOS	Environmental Conservation Online System
EDR	Environmental Data Resources, Inc.
FTA	Fire Training Area
FUDS	Formerly Used Defense Site
GSA	Government Services Administration
HAFF	Hamilton Army Airfield
HFPO-DA	Hexafluoropropylene Oxide Dimer Acid (aka GenX)
HQ	Hazard Quotient
HWRP	Hamilton Wetlands Restoration Project
IPaC	Information for Planning and Consultation
JP-4	Jet Propulsion Fuel No. 4
LHA	Lifetime Health Advisory
NAF	North Antenna Field
NAVD88	North American Vertical Datum of 1988
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NSD	Novato Sanitation District
NWI	National Wetlands Inventory
OSD	Office of the Secretary of Defense
PA	Preliminary Assessment
PAL	Project Action Limit
PCB	Polychlorinated Biphenyl
PFAS	Per- and Polyfluoroalkyl Substances
PFBA	Perfluorobutanoic Acid
PFBS	Perfluorobutane Sulfonate
PFHpA	Perfluoroheptanoic Acid
PFHxA	Perfluorohexanoic Acid
PFHxS	Perfluorohexane Sulfonate
PFNA	Perfluorononanoic Acid
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctane Sulfonate
POL	Petroleum, Oil, and Lubricants

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

ppb	Parts per Billion
ppt	Parts per Trillion
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
RfD	Reference Dose
RI	Remedial Investigation
RSL	Regional Screening Level
SDS	Safety Data Sheet
SDWA	Safe Drinking Water Act
SI	Site Inspection
STP	Sewage Treatment Plant
SWRCB	State Water Resources Control Board
T&E	Threatened and Endangered
TDS	Total Dissolved Solids
U.S.C.	United States Code
UCMR3	Third Unregulated Contaminant Monitoring Rule
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
UST	Underground Storage Tank
WWII	World War II
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

The U.S. Army (Army) is initiating a Preliminary Assessment (PA) under the Comprehensive Environmental Response, Liability and Compensation Act (CERCLA) of 1980 at the former Hamilton Army Airfield (HAAF) to assess the potential for a release of emerging contaminants related to former Army activities. The objective of a PA is to identify areas of potential interest (AOPIs) based on whether use, storage, or disposal of potential per- and polyfluoroalkyl substances (PFAS)-containing materials, including aqueous film-forming foam (AFFF), occurred. The PA is being conducted in accordance with the 2018 Army *Guidance for Addressing Releases of Per- and Polyfluoroalkyl Substances* (U.S. Army 2018). A PA for PFAS-containing materials with a focus on perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), perfluorobutanoic acid (PFBA), perfluorobutane sulfonate (PFBS), perfluorononanoic acid (PFNA), perfluorohexanoic acid (PFHxA), perfluorohexane sulfonate (PFHxS), and hexafluoropropylene oxide dimer acid (HFPO-DA) and its ammonium salt ("GenX" chemicals) was completed for the Base Realignment and Closure (BRAC) property at the former HAAF to assess potential PFAS release areas and exposure pathways. The entire former HAAF (herein referred to as HAAF), which is located approximately 4 miles southeast of downtown Novato in Marin County, California, was selected for closure under BRAC. The completion of this PA included the execution of the following tasks:

- Conducted a kickoff meeting with the BRAC Office and U.S. Army Corps of Engineers (USACE) on February 1, 2023, to present all parties' preliminary knowledge of HAAF to provide information to guide the PA and site visit.
- Reviewed available records (e.g., aerial photography, historical maps, technical reports, previous studies, investigations) from online sources (i.e., Internet-based searches), environmental investigations and/or regulatory programs (e.g., CERCLA), and internal Army documents from the Administrative Record. In addition, an Environmental Data Resources, Inc. (EDR) Report was generated for HAAF and included any listed sites within and up to a 2-mile search distance.
- Conducted a 2-day site visit on February 14 and 15, 2023, to identify potential sources of PFAS and gather information for developing conceptual site models (CSMs) at AOPIs.
- Interviewed individuals with historical and present-day knowledge of operations on the BRAC property.

In conducting the PA of the BRAC property at HAAF, four areas were identified where a potential for release of PFAS exists resulting from site operational history. However, these areas have not been retained as AOPIs due to historical soil removal actions, the absence of soil and groundwater exposure pathways, and the potential for cross contamination with off-post PFAS-impacted materials from San Pablo Bay. This PA focused on the identification of potential PFAS-release locations on the BRAC property only.

Despite the potential PFAS releases, there is unlikely exposure to PFAS contamination in soil or groundwater. In addition, the potential for off-post migration of PFAS in groundwater is unlikely, and impact to downgradient drinking water sources would not occur. Given the findings of this PA, further evaluation in a Site Inspection (SI) is not warranted.

1. INTRODUCTION

The U.S. Army (Army) conducted this Preliminary Assessment (PA) to investigate the potential presence of per- and polyfluoroalkyl substances (PFAS) at the former Hamilton Army Airfield (HAAF), Novato, California, in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, 42 United States Code [U.S.C.] §9601 et seq.); the Defense Environmental Restoration Program (DERP, 10 U.S.C. §2701 et seq.); the National Oil and Hazardous Substances Pollution Contingency Plan (NCP, 40 Code of Federal Regulations [CFR] Part 300); and guidance documents developed by the U.S. Environmental Protection Agency (USEPA) and the Department of the Army. The former HAAF, which is herein referred to as HAAF, is not on the National Priorities List (NPL), and the Army is responsible for compliance with CERCLA in accordance with the delegated authorities of Executive Order 12580, as amended.

The purpose of this PFAS PA is to identify locations that are areas of potential interest (AOPIs) on HAAF based on the use, storage, and/or disposal of potential PFAS-containing materials, in accordance with the *Army Guidance for Addressing Releases of Per- and Polyfluoroalkyl Substances* (U.S. Army 2018). The PA was conducted in general accordance with 40 CFR §300.420(b), the USEPA *Guidance for Performing Preliminary Assessments Under CERCLA* (USEPA 1991), and the Army *Guidance for Addressing Releases of Per- and Polyfluoroalkyl Substances* (U.S. Army 2018). This report presents findings from research conducted to assess past use of PFAS-containing materials and identify areas where these materials were stored, handled, used, or disposed of at HAAF.

The entire HAAF Base Realignment and Closure (BRAC) property was evaluated, along with an area of adjacent coastal salt marsh to the east that was former Army land conveyed to the California State Lands Commission (CA SLC) in 1984 (Army, DTSC, and RWQCB 2003), and will be herein referred to as HAAF. HAAF is located in Marin County, California, as shown in Figure 1-1.

1.1 PFAS BACKGROUND INFORMATION

PFAS are a group of synthetic compounds that have been manufactured and used extensively worldwide since the 1950s for a variety of purposes. PFAS are stable, man-made fluorinated organic chemicals that repel oil, grease, and water. Common industrial uses of PFAS include paints, varnishes, sealants, hydraulic fluid, surfactants, and firefighting foams. PFAS include both per- and polyfluorinated compounds. Perfluorinated compounds, such as perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), perfluorobutanoic acid (PFBA), perfluorobutanesulfonic acid (PFBS), perfluorononanoic acid (PFNA), perfluorohexanoic acid (PFHxA), perfluorohexane sulfonate (PFHxS), and hexafluoropropylene oxide dimer acid (HFPO-DA or Gen X) are a subset of PFAS with completely fluorinated carbon chains, while polyfluorinated compounds have at least one carbon chain atom that is not fully fluorinated. These eight PFAS together, and for the purposes of this PA, are referred to in this report as "Target PFAS."

HAAF was evaluated for all potential use, storage, and/or disposal of PFAS-containing materials. A variety of PFAS-containing materials are used in relation to current and historical Army operations. However, the use, storage, and/or disposal of aqueous film-forming foam (AFFF) is the most common potential source of PFAS at U.S. Department of Defense (DoD) facilities. As such, this section is organized to summarize the AFFF-related sources first followed by all of the remaining potential PFAS-containing materials. AFFF is used as a firefighting agent to suppress petroleum hydrocarbon fires and vapors. Firefighting foams like AFFF were developed in the 1960s (ITRC 2020a), but AFFF did not see widespread DoD use until the early 1970s. Older fire training facilities often were unlined and not constructed to prevent infiltration of firefighting foams and combustion products leaching into the subsurface. Large quantities of AFFF may have been released into the environment as a result of fire training exercises, fire responses, fire suppression system activations, and tank and pipeline leaks/spills.

Other potential PFAS sources considered include installation storage warehouses, some pesticide use, automobile maintenance shops, photographic processing facilities, laundry/waterproofing facilities, car washes, stormwater or sanitary sewer components, and biosolid application areas.

Many PFAS are highly soluble in water and have low volatility due to their ionic nature. The specific gravity/relative density for PFOS and PFOA is 1.8 (ITRC 2020c). Long-chain perfluorinated compounds have low vapor pressure and are expected to persist in aquatic environments. These compounds do not readily degrade by most natural processes. They are thermally, chemically, and biologically stable, and are resistant to biodegradation, atmospheric photooxidation, direct photolysis, and hydrolysis. The structure of these compounds increases their resistance to degradation; the carbon-fluorine bond is one of the strongest in nature, and the fluorine atoms shield the carbon backbone.

When PFAS are released to the environment, they can readily migrate into soil, groundwater, surface water, and sediment. Once in the environment, the compounds are persistent and may continue to migrate through airborne transport, surface water, groundwater, and/or biologic uptake. The amount of PFAS entering the environment depends on the type and amount of the PFAS material that may have been released, where and when it was used, the type of soil, and other factors. If private or public wells are located nearby, they potentially could be affected by PFAS. Similarly, surface water features may be impacted and may convey PFAS to downgradient receptors.

Of the thousands of PFAS, some are considered precursor compounds (typically polyfluoroalkyl substances). Precursor compounds can abiotically or biotically transform into PFOS and PFOA. PFOS and PFOA are referred to as terminal PFAS, meaning no further degradation products will form from them (ITRC 2020b).

1.2 PURPOSE AND OBJECTIVES

The purpose of a PA under the NCP is to 1) eliminate from further consideration those sites that pose no threat to public health or the environment; 2) determine if any potential need for removal action exists; 3) set priorities for Site Inspections (SIs); and 4) gather existing data to facilitate evaluation for the release pursuant to the Hazard Ranking System, if warranted (40 CFR §300.420(b)(1)).

The primary objective of the PA is to identify locations at HAAF where PFAS-containing materials were used, stored, or disposed of, resulting in a potential release of PFAS to the environment, and conduct an initial assessment of possible migration pathways of potential contamination.

1.3 PFAS REGULATORY OVERVIEW AND SCREENING CRITERIA

In May 2016, USEPA issued lifetime health advisories (LHAs) for PFOA and PFOS under the Safe Drinking Water Act (SDWA). To provide Americans, including the most sensitive populations, with a margin of protection from a lifetime of exposure to PFOS and PFOA in drinking water, USEPA established a health advisory (HA) level for PFOS and PFOA (individually or combined) of 70 ng/L (USEPA 2016).

In October 2019, the Office of the Secretary of Defense (OSD) issued guidance on investigating PFOS, PFOA, and PFBS at DoD restoration sites. The OSD guidance provided risk screening levels for PFOS, PFOA, and PFBS in groundwater, tap water, and soil, based on the USEPA regional screening level (RSL) calculator for residential and industrial reuse and using the oral reference dose of 2E-05 mg/kg-day. These screening levels are used during an SI to determine if further investigation in a Remedial Investigation (RI) is warranted.

In April 2021, USEPA issued an updated toxicity assessment for PFBS. USEPA developed chronic (0.0003 mg/kg-day) and subchronic (0.001 mg/kg-day) oral reference doses (RfDs) for PFBS as part of USEPA's toxicity assessment. The RSL for PFBS was previously calculated using the RfD of 0.02 mg/kg day. New toxicity values resulted in revisions to the RSLs for PFBS in May 2021 (USEPA 2021).

In September 2021, OSD issued a revision to *Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program* (DoD 2021). The revised memorandum accounts for the updated PFBS screening levels attributable to USEPA's reassessment of PFBS toxicity in 2021. Based on USEPA research, the RSLs for PFOS and PFOA are calculated using an RfD of 2E-05 mg/kg-day. The RSL for PFBS is calculated using an RfD of 3E-04 mg/kg-day. When multiple PFAS are encountered at a site, a 0.1 factor is applied to the screening level when it is based on noncarcinogenic endpoints.

In May 2022, based on continued evaluation of Target PFAS by the Agency for Toxic Substances and Disease Registry and the USEPA Office of Water, USEPA provided new screening levels for PFOA, PFOS, PFNA, PFHxS, and HFPO-DA.

In July 2022, OSD issued a policy memorandum adopting these new screening levels to be used during the SI phase to determine whether further investigation in an RI is warranted. This revised guidance was in effect as of July 2022 and was applicable to investigating PFOS, PFOA, PFBS, PFNA, PFHxS, and HFPO-DA at DoD restoration sites, including BRAC sites (DoD 2022). In August 2023, OSD issued a memorandum to account for the May 2023 USEPA RSLs for PFBA and PFHxA in addition to the RSLs for the other six PFAS (DoD 2023). The screening levels for Target PFAS are listed in Table 1-1. Currently, no legally enforceable Federal standards exist for PFAS in groundwater, surface water, soil, or sediment.

Table 1-1. Screening Levels from the 2023 OSD Memorandum

Chemical	Residential Tap Water HQ = 0.1 (ng/L or ppt)	Residential Soil HQ = 0.1 (µg/kg or ppb)
HFPO-DA (GenX)	6	23
PFBA	1,800	7,800
PFBS	600	1,900
PFHxA	990	3,200
PFHxS	39	130
PFNA	5.9	19
PFOA	6	19
PFOS	4	13

Note: The Residential Tap Water Screening Levels are used to evaluate groundwater and surface water data. The Residential Soil Screening Levels are used to evaluate soil and sediment data.

The Army's strategy is to continue to assess and investigate potential releases and implement necessary response actions in accordance with CERCLA to ensure that no human health-based exposures are above the CERCLA risk-based values in drinking water. Therefore, sites where human exposure to contaminated drinking water exists will be addressed first and as quickly as possible to eliminate the exposure, and then other sites will be subsequently prioritized and sequenced to conduct the investigations and response actions necessary to characterize and, if necessary, remediate the source of PFAS contamination (U.S. Army 2018).

1.4 PA METHODOLOGY

The PA for HAAF included a site visit, aerial photographic analysis, records review, and interviews that were conducted in accordance with the methods detailed in the Programmatic PA Work Plan (Leidos 2021). The Programmatic PA Work Plan outlines the approach and methodology for conducting the PFAS PA. As detailed in the Programmatic PA Work Plan, the PA activities focused on ascertaining and documenting the following information regarding PFAS history and use, storage, or disposal at HAAF:

- On-post fire training activities
- Use of PFAS-based AFFF in fire suppression systems or other systems
- AFFF stored, used, and/or disposed of at buildings and crash sites
- Activities or use of materials that are likely to contain PFAS, such as metal plating operations

- Wastewater treatment plants (WWTPs) and landfills that may have received PFAS-containing materials
- Studies conducted to assess environmental impacts at the facility
- Potential PFAS use at parcels post transfer
- Potential off-post sources that may impact HAAF.

The data gathered during PA activities are summarized in Section 3.

1.5 REPORT ORGANIZATION

The contents of this PA Report are summarized below:

- ***Section 2. Site Background***—This section presents site-specific information related to operational history and discusses the environmental setting. Demographics, land use, topography, geology, hydrogeology, hydrology, groundwater, potable wells, ecological receptors, and climate are described.
- ***Section 3. PA Analysis***—This section provides observations and results from the PA site visit, aerial photographic analysis, records review, and interviews.
- ***Section 4. Summary of PA Data***—This section provides an overview of the data collected during the PA for the different potential PFAS sources.
- ***Sections 5. Summary of PA Results***—This section synthesizes all of the data gathered during the PA activities and determines whether each area evaluated during the PA is an AOPI or was not retained as an AOPI.
- ***Section 6. Conclusions***—This section presents conclusions of the PA.
- ***Section 7. References—***This section lists the references that were used in the preparation of this report.
- ***Appendices***—Appendices A through F include data from field activities or related assessments:
  - Appendix A. Final HAAF Kickoff Meeting Minutes
  - Appendix B. Documents/Sources Reviewed During PA
  - Appendix C. Aerial Photographs
  - Appendix D. Site Visit Photographs
  - Appendix E. Questionnaire Responses and Interview Notes
  - Appendix F. Environmental Data Resources, Inc. (EDR) Report.

2. SITE BACKGROUND

2.1 SITE LOCATION

HAAF is located approximately 4 miles southeast of downtown Novato in Marin County, California. It is located on the western side of the San Pablo Bay, to the east of U.S. Highway 101 (Figure 1-1). The Army BRAC portion of HAAF was approximately 659.4 acres and is composed of five non-contiguous parcels: the former airfield (631 acres); the Petroleum, Oil, and Lubricants (POL) Area/Levee (19 acres); Hospital Hill (3.4 acres); and Parcels A2 and A3 (6 acres). HAAF is bound to the east by San Pablo Bay, to the north and south by agricultural lands, and to the west by residential and commercial developments and state-owned land (USACE 2019). The majority of the BRAC property has been restored into wetlands, known as the Hamilton Wetlands. Figure 2-1 depicts the HAAF site features. The HAAF BRAC property does not include the adjacent Formerly Used Defense Site (FUDS) property, which was transferred prior to any BRAC action at HAAF.

2.2 SITE OPERATIONAL HISTORY

HAAF was constructed on former wetlands and mudflats bordering San Pablo Bay. In the late 1800s, the land was reclaimed for agriculture using a system of levees and drainage ditches (Army, DTSC, and RWQCB 2003). The Army Air Corps constructed HAAF in 1932 on the land acquired from Marin County and private landowners. In December 1932, military operations began, and the airfield was used as a base for fighter, bomber, and transportation aircraft. During World War II (WWII), the airfield served as a training and staging area for Pacific operations. HAAF also served as a hospital for acute care and rehabilitation for war casualties in the mid-1940s (USACE 2019).

After WWII in 1947, the airfield was transferred to the Air Force and renamed Hamilton Air Force Base (AFB). Hamilton AFB was decommissioned in 1974 after DoD declared the airfield surplus property (USACE 2019). Land and buildings on and surrounding HAAF were transferred to the U.S. Navy, Army, and U.S. Coast Guard (USCG). Tracts of land that were surplus by DoD were transferred to the Government Services Administration (GSA) for public sale (NPS 1998). The GSA sale parcels are not part of the BRAC properties (Earth Tech 1994). In 1976, the Army began using the runway and ancillary facilities and several other buildings for Army and Army Reserve operations (CH2M Hill 2001). The coastal salt marsh east of the main levee and the North Antenna Field (NAF) were transferred from the Federal Government to the CA SLC in 1982 (USACE 1997). The Army continued to use portions of Hamilton AFB on permit basis until 1984. In 1984, the airfield was officially acquired by the Army, responsibility for the airfield was changed to the Army post at the Presidio of San Francisco, and the base was renamed HAAF. The Army was directed under the BRAC Act of 1988 to close and dispose of its property at HAAF (CH2M Hill 2001).

2.3 DEMOGRAPHICS, PROPERTY TRANSFER, AND LAND USE

HAAF is located southeast of the city of Novato and is in Marin County, California. The 2021 estimated population of the city of Novato and Marin County is 52,708 and 260,206, respectively (U.S. Census Bureau 2021).

In 1988, HAAF was placed on the list of facilities scheduled for realignment under the BRAC program. The BRAC property was divided into a total of eight parcels, five of which were non-contiguous, and all land was conveyed to public or private entities. Hospital Hill (3.4 acres) and the POL Area (19 acres) were transferred to the city of Novato in 2003 and 2004, respectively. Hospital Hill was previously used for a hospital and medical clinics and is currently an assisted living facility, and the POL Area is currently open space with a walking trail (Earth Tech 1994). Parcels A2 and A3 consist of 6 acres and were sold into private ownership in 1995. Parcel A2 was formerly occupied by Buildings 442 (administration), 443 (kitchen), 445 (book storage), and 449 (electrical vault), and Parcel A3 was occupied by Building 467 (administration

and training). The former airfield itself (approximately 631 acres) was transferred to the California State Coastal Conservancy (CA SCC) by public benefit conveyance in 2003 and has been restored to wetlands (Earth Tech 1994). Parcel A4 (4 acres) consisted of former Buildings 138 and 140, which were previously used for administration, training, and minor electronic repair, and were sold to a private owner in 2003. Parcels A5 and A6 (3.9 acres) were transferred to private ownership in 1996. Parcel A5 was formerly an aircraft wash rack, and Parcel A6 was formerly part of the airfield (Earth Tech 1994). Parcels A2, A3, A4, A5, and A6 are currently residential housing. The HAAF transferred property and the property recipients are shown in Figure 2-2.

The land surrounding HAAF is currently occupied by Navy and Lanham housing developments, the Novato School District, USCG, residential housing, industrial and commercial businesses, and the CA SCC land consisting of coastal salt marshes (USACE 2019). The area is zoned for residential, commercial, and open space use. A deed restriction associated with the airfield parcel prohibits use of the property for residences, schools, daycare facilities, hospitals, hospices, or similar sensitive uses. A deed restriction is also in place for the POL Area that prohibits residential use of the property.

2.4 TOPOGRAPHY

Prior to 2007, the former airfield and surrounding parcels were deeply subsided due to more than 100 years of separation from tidal inundation by dikes and levees. This allowed the Bay Mud underlying the nearly level former wetlands and mudflats to dry and consolidate (PWA 2008). During active operations at HAAF, ground elevations ranged from 9.6 to -4.4 feet North American Vertical Datum of 1988 (NAVD88), with an average elevation of -2.4 feet NAVD88 (PWA and LSA 1988). This is generally below the mean tide level in this region of 3.49 feet NAVD88. The bottom elevation of drainage ditches at the site typically ranged from -8 to -10 feet NAVD88, and the coastal salt marsh east of the levee was at an elevation of approximately 6 feet NAVD88.

Between 2007 and 2010 approximately 6.1 million yd^3 of dredged material from the Bel Marin Keys lagoon and Port of Oakland was brought onto the site to raise elevations and create a tidal wetland system at HAAF as part of the Hamilton Wetlands Restoration Project (HWRP). The wetland features for HWRP are shown in Figure 2-3. The bayfront levee at the HWRP site was breached on April 25, 2014, reconnecting the San Pablo Bay to a mix of tidal and seasonal wetland, transitional ecotone, and upland habitats at HAAF (Tetra Tech and ESA 2021). Dredge material was placed within the large central portion of the former airfield to achieve elevations that promote full tidal wetlands. Seven intertidal berms were also created within this area, and interior dykes were breached to promote tidal exchange. Interior berms and breaches were designed to both dampen wind wave fetch across the site and to train channel development (Tetra Tech and ESA 2021). Higher elevation seasonal wetlands were constructed in the northern and southern areas of the site, and a broad transitional slope along the southwestern border of the airfield was created as a Wildlife Corridor. Elevations within HWRP will continue to change as the wetlands develop and promote additional sedimentation. The dredged material used for site rehabilitation was not tested for PFAS prior to placement.

Higher topography exists at the POL Area and Hospital Hill parcels. The POL/Levee consists of three subareas. The first is a lower relief area, approximately 40 feet in elevation, that lies along the northeastern flank of Reservoir Hill and was the site of a former tank farm and extensive excavation and fill activities. The second subarea lies west of Reservoir Hill and consists of a broad, low-relief area that was formerly partially paved with asphalt and the ground gently slopes northward. The elevation for the second subarea is approximately 80 feet. The third subarea consists of the northwestern corner of Reservoir Hill, which has an elevation of approximately 120 feet, and was formerly the site of a large aboveground storage tank (AST). The Hospital Hill parcel is located on the northeastern side of a small hill west of the airfield. Elevations range from approximately 25 feet at the base of the hill along Escolta Avenue to approximately 75 feet at the southwestern corner of the property (Earth Tech 1994).

2.5 GEOLOGY

HAAF is located on the western side of San Pablo Bay, a tributary bay north of the San Francisco Bay. HAAF is in the Coastal Range Province, which is dominated by northwest to southeast trending mountain ranges and valleys. The San Pablo Bay, just as the San Francisco Bay, formed in a structural depression, known as "Bay Block." The bay lies between two active faults: San Andreas Fault to the west and Hayward Fault to the east (EEG 2018).

Bedrock beneath HAAF consists of the late Jurassic and Cretaceous age Franciscan Group, a tectonic mixture of deformed sedimentary, volcanic, and metamorphic rocks. Outcrops of the Franciscan Group are observed on adjacent properties on the western side of the former airfield. Within the former HAAF area, the Franciscan Group consists of sandstone and shale members (USGS 2017). Areas on the eastern side of HAAF have significant thickness of alluvial deposits that can be 100 feet or greater before bedrock is encountered (EEG 2018, USGS 2017).

HAAF is constructed of artificial fill overlying estuarine sediments and young bay mud. The bay mud is poorly consolidated marine mud sediments deposited during the most recent sea-rise event. The mud is generally less than 150 feet thick and is most often found along shorelines and in tidal marshes. The mud is generally moderate to highly plastic silty clay of various colors and can have a moderate to high organic content (EEG 2018).

Soil information obtained from the Natural Resources Conservation Service website indicates soils are primarily urban land and xerorthents and similar soils. Xerorthents consist of variable soil from 0 to 30 inches and are most often found on tidal flats. General slope ranges are from 0 to 9 percent, and the soils are not well drained. The Urban Land series consists of unclassified materials that can vary in composition but are generally consistent with other soils in the area (NRCS 2022).

2.6 HYDROGEOLOGY

Three shallow hydrogeologic units are present at HAAF: fill, soft Bay Mud, and desiccated Bay Mud. The "fill" was originally used to reclaim the bay margin lowlands for agriculture use and has similar content and hydrogeological properties to the Bay Mud. A second type of "fill" consisting of imported construction material was used for geotechnical applications and is not part of the hydrogeologic unit. This type of "fill" may have been found in pipeline trenches and as a bridging layer beneath some of the formerly developed areas (e.g., runways, revetment areas). This fill will be referred to as "imported fill" when used. Permeabilities and groundwater flow characteristics are summarized below:

- Fill materials have moderate to low hydraulic conductivities. Preferential groundwater flow through the fill may be controlled by the distributions of different fill types.
- Soft Bay Mud generally has low hydraulic conductivity. Preferential flow, if existent, is probably horizontal and confined to peat layers or shell lenses, which are discontinuous and limited in aerial extent.
- Desiccated Bay Mud has low hydraulic conductivity with some fracture permeability. The desiccation cracks are potentially transient in nature and may heal or infill during periods of saturation (Army, DTSC, and RWQCB 2003).

HAAF is not underlain by any major aquifer system. Tidal water of the San Pablo Bay inundates HAAF, along with being surrounded by the San Pablo Bay to the east and the mountains of the northern California Coast Range to the west (Parsons 2010). Groundwater at HAAF is uniformly present throughout the saturated Bay Mud clay formation in the former airfield and coastal salt marsh. Groundwater levels at the former airfield vary according to seasonal rainfall and evapotranspiration rates. Groundwater levels and saturation of the coastal salt marsh vary with the diurnal fluctuations of tide elevations and inundation during storm events. The Bay Mud clay limits movement of groundwater without significant applied

hydraulic pressure differences (Army, DTSC, and RWQCB 2003). Information provided in historical investigations indicates the depth to groundwater ranges from near the surface at the tidal marshes to nearly 10 feet below ground surface (bgs). The depth to groundwater can vary due to tidal fluctuations. Groundwater generally flows from west to east across much of the HAAF, although the precise direction depends on groundwater flow through permeable geologic units (Shaw 2006). The near surface groundwater tends to be brackish due to the proximity of San Pablo Bay and is not used for potable sources (U.S. Navy 1997, EEG 2018).

2.7 SURFACE WATER HYDROLOGY

HAAF is situated within the southeastern portion of the Novato Creek Watershed. The Novato Creek Watershed is 44 square miles, the largest in eastern Marin County (SFEI 2016). Pacheco Creek and Arroyo San Jose carry surface water from areas west of the HAAF along the northwestern boundary of the former airfield (Army, DTSC, and RWQCB 2003). These streams flow into Pacheco Pond, located directly northwest of the former airfield property. Pacheco Pond was deeded to Marin County Flood Control and Water Conservation District as a detention basin for flows from Pacheco Creek and Arroyo San Jose (Jones and Stokes 2023). Pacheco Pond discharges into the Novato Creek and is then discharged into the San Pablo Bay (Army, DTSC, and RWQCB 2003). The majority of Novato Creek surface water flow is from the upland areas in the northwestern portion of the watershed and then flows east toward the San Pablo Bay (SFEI 2016).

During active operations, stormwater drainage systems collected surface water runoff from several subareas at HAAF. The network of drainage lines conveyed water to a perimeter ditch system and then to three stormwater pumping stations on the eastern levee that outlet to San Pablo Bay. Runoff water from the CA SLC property to the north was also historically conveyed to the HAAF perimeter drainage ditches, as was runoff from several adjacent areas to the west and south, including POL Hill (CH2M Hill 2001). In 1998, the perimeter drainage ditches were dewatered and accumulated sediment was removed (IT 2000). According to a personnel interview, the new levees constructed along the boundary of HAAF for flood protection were built on top of the former perimeter drainage ditches.

The breach of the bayfront levee in 2014 was part of the 648-acre HWRP tidal marsh restoration project and restored tidal inflow to HAAF from San Pablo Bay (Tetra Tech and ESA 2021). The bayfront levee was also graded lower to permit overtopping of the levee during the highest high tides and encourage marsh vegetation growth. San Pablo Bay experiences mixed semidiurnal tides, with two unequal high tides and two unequal low tides occurring each day. The spring tide range is slightly greater than 6 feet (PWA 2008). Post construction monitoring results indicate that 5 years after the restoration of tidal inflow, nearly the full tidal range has been restored near the breach and the tidal connection is strong throughout the site, with the full tide range at the back of the site only 1 foot less than that of the breach (Tetra Tech and ESA 2021).

2.8 WATER USAGE

Marin Water provides water to more than 191,000 people in central and southern Marin County. Marin Water supplies water from seven reservoirs located throughout the county. The water originates from rainfall in the Mt. Tamalpais watershed in west Marin and flows into one of the reservoirs, which include the Alpine, Bon Tempe, Kent, Lagunitas, Nicasio, Phoenix, and Soulajule. Marin County supplements the supply with water from the neighboring county's water agency, the Sonoma County Water Agency, which originates from rainfall that flows into Lake Sonoma and Lake Mendocino, north of Marin County (Marin Water 2022). No groundwater supply wells are located on HAAF. The closest domestic water wells are approximately 1 mile from HAAF (CANRA 2022). Figure 2-4 shows the water wells located within 4 miles of the property.

Groundwater beneath the HAAF and adjacent marsh areas is not currently used for drinking water, nor is it anticipated that groundwater will be used for drinking water in the future. A notice of groundwater condition

is included with the deeds for the airfield parcel and Parcels A2, A3, A5, and A6, which states that the groundwater beneath these properties is not considered to have any beneficial use as it is not a suitable source of drinking water in accordance with California State Water Resources Control Board (SWRCB) Resolution 88-63. This is due to total dissolved solids (TDS) greater than 3,000 mg/L, which renders groundwater unsuitable for drinking (SWRCB 1988). The TDS concentrations in groundwater from monitoring wells across the airfield property range from 819 to 18,270 mg/L, with an average TDS concentration of 4,898 mg/L (Army, DTSC, and RWQCB 2003). In addition, sustained well yields for these wells are estimated at less than 5 gallons per day, where 200 gallons per day are typically required for domestic potable use. These conditions also make the properties an unlikely shallow water source for industrial or irrigation uses. A deed restriction is in place prohibiting groundwater access and use for the POL Area parcel for any purpose.

2.9 ECOLOGICAL PROFILE

In the early 1800s, the property was wetlands. Prior to construction of HAAF in the early 1930s, the property was used for agriculture (Keller 2015). After closure of HAAF, the majority of the property was restored to the 630-acre Hamilton Wetlands, which is part of a larger complex of wetlands that are or are being restored (Army, DTSC, and RWQCB 2003). The remainder of the BRAC property was reused for commercial space (wetlands nursery) and residential neighborhoods or assisted living.

As the National Wetlands Inventory (NWI) wetland classification is based on 2009 imagery, the wetlands were predominantly classified by NWI as permanently flooded/diked lake or pond habitat created by water being diked or impounded (NWI 2023). Since that time, restoration efforts have continued, the levee used to impound the water was breached in 2014, and the wetland is transitioning to a wildlife corridor and seasonal wetland and tidal marsh habitat (Johnck 2020). Walking trails are also present for hiking and wildlife viewing. Currently, there are approximately 380 acres of tidal wetlands, 150 acres of seasonal wetlands and open space, and 100 acres of wildlife corridors connecting the restoration site to existing riparian areas (Keller 2015). Pickleweed (*Salicornia pacifica*) and cordgrass (*Spartina foliosa*) have developed nearly continuously along the wetland margins and on top of the intertidal berms. Saltgrass (*Distichlis spicata*) and alkali heath (*Frankenia salina)* have been observed in many areas of the marsh (Tetra Tech and ESA 2021). This wetland complex is bordered by San Pablo Bay to the east.

HAAF is frequented by a diverse assemblage of bird species, including shorebirds, waterfowls, and raptors. In the tidal and seasonal wetlands, 95 waterbird species have been documented over monitoring seasons from 2014 to 2020 (Tetra Tech and ESA 2021). Commonly observed species included dunlins (*Calidris alpina*), Western sandpipers (*Calidris mauri*), least sandpipers (*C. minutila*), and American avocets (*Recurvirostra americana*) (Wild Birds Unlimited 2018). Mammals and reptiles that are expected to be in the upland and seasonal wetlands include mule deer (*Odocoileus hemionus*), jack rabbit (*Lepus townsendii*), California vole (*Microtus californicus*), fox (*Urocyon cinereoargenteus*), raccoon (*Procyon lotor*), coyote (*Canis latrans)*, and common garter snakes (*Thamnophis sirtalis)* (USACE 1998). From 2015 to 2020, 28 different species of fish were captured during biological monitoring. Species included the bat ray (*Myliobatis californica*), California halibut (*Paralichthys californicus*), leopard shark (*Triakis semifasciata*), yellowfin goby (*Acanthogobius flavimanus*), and striped bass (*Morone saxatilis*) (Tetra Tech and ESA 2021).

The U.S. Fish and Wildlife Service (USFWS) Environmental Conservation Online System (ECOS) Information for Planning and Consultation (IPaC) tool identifies 11 federally listed (1 mammal, 4 birds, 1 reptile, 1 amphibian, 2 fish, 1 crustacean, and 1 flowering plant) threatened and endangered (T&E) species as potentially occurring (i.e., known or expected to be on or near) at HAAF (USFWS 2023). The federally listed T&E species include species such as the salt marsh harvest mouse (*Reithrodontomys raviventris*), ridgeway's rail (*Rallus longirostris obsoletus*), northern spotted owl (*Strix occidentalis caurina*), and longfin smelt (*Sprinchus thaleichthys*). One candidate species, the monarch butterfly (*Danaus plexippus*), was identified by IPaC as potentially occurring at HAAF (USFWS 2023). The potential for these T&E

species to occur does not mean the species are present at HAAF. For example, the northern spotted owl prefers old growth forest, which is not present at HAAF. T&E species known to be present at HAAF include the western snowy plover (*Charadrius nivosus nivosus*) (Tetra Tech and ESA 2021). Although not observed during the biological monitoring for the period from 2015 to 2020, the tidal wetlands were designed to support the Ridgway's rail (*Rallus obsoletus*) and the salt marsh harvest mouse (*Reithrodontomys raviventris*) (ERDC 2021).

Twenty-eight migratory birds of particular concern are identified by the IPaC tool as potentially occurring at HAAF (USFWS 2023). These birds include the bald eagle (*Haliaeetus leucocephalus*), Allen's hummingbird (*Selasphorus sasin*), Nuttall's woodpecker (*Picoides nuttallii*), and willet (*Tringa semipalmata*) (USFWS 2023). Fourteen of the 28 migratory birds of particular concern have been observed at the Hamilton Wetlands during the 2015 to 2020 monitoring (Tetra Tech and ESA 2021).

2.10 CLIMATE

The climate is characterized by long warm summers and short, cold, and wet winters. Rainfall occurs throughout the year but typically experiences the highest totals in February with an average of 4.7 inches. Snowfall does not typically occur in Novato. The temperature in Novato typically varies between 40 and 81°F annually, with the warmest temperatures occurring in July at average highs of 80°F. January is typically the coldest month, with average high and low temperatures of 56 and 40°F, respectively (Weather Spark 2022).

Table 2-1. Average High and Low Temperatures for Novato, California

Average	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High	56°F	61°F	64°F	68°F	72°F	77°F	80°F	81°F	80°F	75°F	64°F	56°F
Temp	47°F	50°F	53°F	55°F	59°F	62°F	63°F	63°F	63°F	59°F	52°F	47°F
Low	40°F	42°F	44°F	46°F	48°F	50°F	52°F	52°F	51°F	48°F	43°F	40°F

Source: Weather Spark 2022

3. PA ANALYSIS

The primary components of the PA are records reviews, analysis of aerial photographs, a site visit, and interviews. The following sections summarize the methods used and activities conducted for the HAAF PA. References to on-post and off-post within this PA refer to the portion of the original HAAF property boundary selected for closure under BRAC.

3.1 RECORDS REVIEW

Prior to the records review, site visit, and interviews, a kickoff meeting was held between the BRAC Office, USACE, and Leidos on February 1, 2023. The kickoff meeting was conducted to present all parties' preliminary knowledge of HAAF and provide information to guide the PA and site visit. The final kickoff meeting minutes are presented in Appendix A.

Preliminary research was conducted prior to the site visit to determine if any of the following activities were conducted at HAAF, which may indicate whether there was use, storage, or disposal of PFAS-containing materials at HAAF:

- On-post fire training
- Use of PFAS-based AFFF in fire suppression systems or other systems
- AFFF used, stored, or disposed of at buildings and emergency response sites
- Activities or materials used that are likely to include PFAS-containing materials
- Studies conducted to assess the environmental impacts of PFAS-containing materials
- Review of potential off-post sources.

The records review included a combination of Internet-based searches and reviews of aerial photography, historical maps, technical reports, previous studies, and investigations available online. In addition, an EDR search of state and Federal environmental databases for HAAF and any listed sites within an up to 1-mile search distance was conducted (EDR 2023).

A records review was conducted of available environmental investigations conducted under CERCLA and Resource Conservation and Recovery Act (RCRA) regulatory programs. Additional documents discovered in the Administrative Record managed by the Civic Center Library were also reviewed, which included hard copies of newspaper articles, hard copies of installation maps, and regulatory correspondence. Documents such as newspaper articles and old photographs were also reviewed at the Hamilton Field History Museum. Table 3-1 lists the documents reviewed that are relevant to the evaluation of AOPIs in this PA. A complete list of sources reviewed is provided in Appendix B.

Table 3-1. Summary of Relevant Records Reviewed

Document Title	Author	Date	Relevance
Hamilton Airport Layout Plan	Compton	March 1, 1977	Historical map
Hamilton Air Force Base Properties Map	USACE	February 1988	Historical map
Task Order 2 Enhanced Preliminary Assessment	Weston	January 1990	Background information, previous investigation information, property ownership information
Community Environmental Response Facilitation Act (CERFA) Report Hamilton Army Airfield Novato, California	Earth Tech	April 1994	Background information, information for AOPIs, physical setting
1998 Interim Removal Action Data Report BRAC Property Hamilton Army Airfield Novato, California	USACE Sacramento	April 2000	Removal actions

Table 3-1. Summary of Relevant Records Reviewed (Continued)

Document Title	Author	Date	Relevance
Inboard Area Focused Feasibility Study Report	CH2M Hill	August 14, 2001	Background information, previous investigation information, environmental setting
Final Coastal Salt Marsh Focused Feasibility Study Report Hamilton Army Airfield Novato, California	CH2M Hill	May 2003	Previous investigation information, environmental setting
Draft Subsequent Environmental Impact Report Main Airfield Parcel Record of Decision/Remedial Action Plan for Hamilton Army Airfield	Jones and Stokes	June 2003	Previous investigation information, environmental setting
Main Airfield Parcel Record of Decision/Remedial Action Plan Hamilton Army Airfield Novato, California	DA, DTSC, and RWQCB	August 2003	Previous investigation information, environmental setting
Final Remedial Investigation Report North Antenna Field Hamilton Army Airfield, Novato, California	Shaw Environmental	January 2006	Background information, previous investigation information, environmental setting
Draft Final Disposal Completion Report for Coastal Salt Marsh Excavation, Class II Material Disposal Hamilton Army Airfield, Novato, CA	Cerrudo Services	February 2006	Removal actions
Final Site Inspection Report, Former Hamilton Army Airfield, Marion County, California	Parsons	April 2010	Background information, previous investigation information, environmental setting
Second Five-Year Review Report Landfill 26 Hamilton AAF, Novato California	USACE Sacramento	December 2014	Background information, information for AOPIs, previous investigation information
Hamilton Wetlands Restoration Project Year 5- 2019/20 Monitoring Report	Tetra Tech and ESA	January 2021	Wetlands restoration

Information gathered during the records reviews helped identify data gaps and enabled elimination of several areas based on their historical use. Data gaps associated with facility operations; PFAS-containing material use, storage, or disposal; and current exposure receptors at HAAF contributed to a conservative approach for identifying AOPIs. However, areas with little potential to result in a PFAS release, such as residential buildings, hospitals, cafeterias, and recreational areas, were eliminated from further evaluation early on in the PA process.

Areas identified to have potentially used, stored, or disposed of, or had recorded the potential for a release of PFAS-containing materials, including AFFF, were further evaluated.

3.2 AERIAL PHOTOGRAPHIC ANALYSIS

The PA included review of 14 historical aerial photographs provided in the EDR report spanning from 1947 through 2020 (EDR 2023). Thirteen aerial photographs from 1948 to 2020 available from historicaerials.com were also reviewed. The aerial photographs were analyzed to identify activities or developments that may suggest the potential use, storage, or disposal of PFAS-containing materials, including AFFF, at HAAF (e.g., evidence of fire training activities, such as fire pits or burn scars); however, no conclusions on AFFF use, storage, or disposal were drawn from the aerial photograph review. The EDR aerial photographs are presented in Appendix C; aerial photographs from historicaerials.com are not included in the appendix. The aerial photographic analysis is summarized as follows:

- **1947 and 1948:** The runway is present along with the revetment areas north of the runway. The sewage treatment plant (STP) and stormwater pumping station are visible along the levee.

Buildings and BRAC Parcels A2, A3, and A4 are visible at Hospital Hill. The hangars (not on BRAC property) are visible southwest of the runway.

- **1952:** Clearing around the POL Area is visible. No significant changes to the airfield.
- **1958:** The aerial image of the western portion of HAAF is not available. The visible area of runway on the eastern side of HAAF is overrun.
- **1963:** The 840,000-gallon AST is visible in the POL Area.
- **1968:** A maintenance hangar (Building 86) is visible in the southeastern corner of HAAF, south of the runway. Vegetation is no longer visible at the East Levee Construction Debris Landfill, and a road is present out to the East Levee Construction Debris Burn Pit.
- **1970 and 1973:** No significant changes.
- **1982 and 1983:** Black scarring is visible at concrete burn pit located at Revetment Number 10, north of the airfield. The former fire crash rescue station (Building 92) just south of the airfield and Building 86are visible.
- **1983:** No significant changes.
- **1987:** The AST at the POL Area has been removed.
- **1993:** The STP is no longer visible. No changes to structures or the runway are visible.
- **2002:** The runway is no longer in a usable condition. Soil was piled up on the runway and allowed to bioremediate during remediation of petroleum release areas. The piles were seeded to grow a grass cover to prevent erosion of the soils; these areas of grass growing on the runway are visible in the 2002 aerial photograph. A triangular area directly northeast of the runway is very green (possibly new grass) and has water and a sludge bed. Hangars/buildings in the southeastern corner of HAAF, south of the runway, are gone and partially replaced with homes. The northern end of the runway and the runway overrun have been buried to create a habitat as mitigation for the landfill cap construction. The former firefighter practice burn pit at Revetment Number 10 appears to have been excavated. Building 86 has been removed. The buildings previously at Parcels A2 and A3 have been demolished and residential housing is visible. Parcel A4 appears to be under construction, with no structures present. Residential housing is also visible on Parcels A5 and A6.
- **2005 and 2006:** Soil piles from the remediation of the petroleum release areas are still visible. Areas within the runway were excavated for borrow material and filled in with water. Activities for the wetland restoration project are ongoing, which included covering portions of the runway and creating berms. Development of residential areas around the base has increased. The concrete pad around Building 92 is visible but not the structure itself.
- **2009:** Portions of the former airfield are inundated with water, which was to ensure the imported dredged material used to create the tidal wetlands would not dry out and harden. Structures surrounding the base are generally consistent with the 2005 aerial photograph. A new parking lot is visible at the northernmost hangar.
- **2010 and 2012:** No significant changes are visible.
- **2014:** The levee between HAAF and the San Pablo Bay has been breached.
- **2016, 2018, and 2020:** HAAF is almost completely inundated with water. No other significant changes are visible.

3.3 PA SITE VISIT

Prior to the site visit, the site visit team corresponded with Army personnel to coordinate dates and access to the facility and to identify potential interviewees. The HAAF PA site visit was conducted on February 14 and 15, 2023. The site visit included a site walk and visual inspection of all readily accessible areas at HAAF to identify potential sources of PFAS and gather information for developing CSMs if needed. In addition, visits were made to the Novato Library, the Marin Center California Library, and the Navato Fire Department. A records request was submitted at the Novato Fire Department for historical training records and purchasing records. Appendix D contains photographs from the PA site visit.

3.4 SUMMARY OF INTERVIEWS

A PFAS PA questionnaire for gathering information related to PFAS usage at HAAF from key personnel was developed and distributed prior to the site visit. The Army BRAC Environmental Coordinator responded to the questionnaire; the questionnaire responses are presented in Appendix E. The primary goal of the questionnaire was to identify whether PFAS-containing materials, including AFFF, were used on-post in the past or are currently being used.

Telephone and in-person interviews were conducted with a former HAAF aircraft refueler and maintenance mechanic and former firefighters at Novato Fire Department with historical knowledge of the operations and environmental investigations conducted at HAAF. The former aircraft refueler and maintenance mechanic indicated that AFFF was historically stored at HAAF. No current uses of PFAS-containing materials were identified during the interviews. Table 3-2 summarizes the interviews conducted and the pertinent information provided, and interview notes are included in Appendix E.

Table 3-2. Interviews Conducted for PA

Title (Years of Experience)	Date	Information Provided
Former Aircraft Refueler and Maintenance Mechanic (16 years of experience at HAAF)	Telephone interview on February 8, 2023	The former HAAF reservist and employee worked as an aircraft refueler and aircraft maintenance mechanic. He was on-post as a reservist from 1979 to 1995 and as a HAAF employee from 1986 to 1995. He provided the following information: • The only fire training activities he participated in was discharging fire extinguishers, which were presumed to be ABC type (i.e., non-PFAS). • An FTA was present at HAAF. Drums would be cut in half lengthwise and JP-4 would be put inside. It is unknown how the fires were put out. He assumed if they would have used AFFF they would have needed to call a Fire Department. • He did not recall any fires while he was on-post. • He was not aware of any AFFF fire suppression systems in the buildings, only water. • AFFF was stored in the crash rescue station (Building 92) along with an ARFF truck. There was only one ARFF truck. Employees would perform light maintenance on the truck in or in front of Building 92, but if heavy maintenance needed to be completed, the truck was sent to the Presidio of San Francisco. He does not recall AFFF being discharged from the ARFF truck while on-post. It is unknown if calibration/pump checks were conducted. • The fixed Army flight detachment was responsible for hazardous waste. The waste had manifests, and a subcontractor vendor came and picked it up. It was stored in a small building southeast of the apron. The building was divided into two sections, one for POL and the other hazardous waste.

Table 3-2. Interviews Conducted for PA (Continued)

Title (Years of Experience)	Date	Information Provided
Former Volunteer Firefighter at Novato Fire Department (31 years of experience as a Volunteer Firefighter)	Interview on February 15, 2023	The former volunteer firefighter for Novato Fire Department in Marin County volunteered for 31 years and provided the following information: • He did not recall ever going to Hamilton to train with the Fire Department at the Base. • The current Hamilton Field History Museum was the original Fire Station from 1935 to 1958. • A new Fire Station called the Flight Line Fire Station was constructed on the northwestern side of the hangars. It is unknown how long this Fire Station was used or if AFFF was stored there.
Former Volunteer Firefighter at Novato Fire Department (27 years of experience as a Volunteer Firefighter)	Telephone interview on February 15, 2023	The former volunteer firefighter for Novato Fire Department in Marin County volunteered for 27 years and provided the following information: • He did not recall ever going to Hamilton to train with the Fire Department at HAAF. • During his tenure, he did not recall ever responding to any fires at HAAF.
BRAC Environmental Coordinator (26 years of experience)	Questionnaire returned on January 31, 2023, and in-person interviews on February 14, 2023, and February 15, 2023	The BRAC Environmental Coordinator provided the following information: • The lined portion of the drainage ditch was built in the 1930s and drained the entire airfield to the stormwater pumping station. The current levees were built up over the drainage ditches. • The stormwater pumping station ran consistently due to the airfield being below sea level. When the stormwater pumping station was removed, it was excavated to approximately 8 to 10 feet bgs. • The former firefighter practice burn pit was excavated to approximately 8 to 9 feet bgs. • BRAC Parcel A4 was cleaned up to commercial standards and was transferred to a developer in 2004, and cleanup to residential standards was completed. BRAC Parcels A5 and A6 were cleaned up to meet residential standards, and the property was developed in the late 1990s. • Pesticides were applied on the airfield; however, the pesticides were not stored or mixed on BRAC property. • The city of Novato's effluent discharge pipe for the WWTP runs along the northern portion of the BRAC property to the San Pablo Bay. Effluent water from the Las Gallinas Sanitary District is sprayed in an agricultural field on the southern side of the property. • No drinking water or production wells are in the area, the geology is not capable of suppling sufficient water, and the water beneath the Hamilton Wetlands is brackish. • At Landfill 26, a FUDS property, a groundwater extraction treatment system was built to treat contaminated groundwater. After years of groundwater monitoring, it was determined that the contaminants had not significantly impacted groundwater out of the Landfill 26 boundary and the treatment system was removed. • The East Levee Construction Debris Landfill area was excavated. The burn pit associated with the landfill is not on BRAC property. The East Levee Construction Debris Landfill is on BRAC property and state property. The state was given the tidal wetlands area (east of the levee) in approximately 1983.

Table 3-2. Interviews Conducted for PA (Continued)

Title (Years of Experience)	Date	Information Provided
		• The former STP on the eastern levee was excavated, as were the sludge drying beds and any other remnants from the STP. It is unknown when the STP had started accepting sanitary wastes from Hamilton. • No Army activities were conducted that would have involved plating activities on any of the BRAC parcels. Most of the heavy maintenance on equipment was conducted in the Presidio of San Francisco.

4. SUMMARY OF PA DATA

4.1 PREVIOUS PFAS INVESTIGATIONS

In 2012, USEPA published the Third Unregulated Contaminant Monitoring Rule (UCMR3), which required nationwide public water systems (i.e., waterworks) to sample for a list of 30 unregulated contaminants, including 6 chemicals of concern relevant to this PA (i.e., PFOS, PFOA, PFBS, PFNA, perfluoroheptanoic acid [PFHpA], and PFHxS). Sampling data under UCMR3 within the Marin Municipal Water District, and North Marin Water District where HAAF receives drinking water, were less than the USEPA screening levels (USEPA 2017). In December 2020, Marin Municipal Water District collected samples for about 25 PFAS at six locations including three potable water tanks and three finished water locations. The samples were analyzed and PFAS were not detected (Marin Water 2021). USEPA published the Fifth Unregulated Contaminant Monitoring Rule (UCMR5) in 2021, which expanded the list to 29 PFAS for additional sampling between 2023 and 2025. The UCMR5 sampling includes more sensitive analytical limits for PFAS detection. As part of the UCMR5 sampling, water within the Marin Municipal Water District and North Marin Water District will be sampled between 2023 and 2025 (USEPA 2023).

A PFAS PA was conducted for the USCG property on the southern side of the BRAC airfield property. The PA indicated that the USCG Pacific Strike Team Hangars did not have AFFF fire suppression systems, and AFFF storage and use have not occurred at the facility (Leidos 2022).

A PFAS investigation at Hamilton Army Landfill 26 and the NAF areas is currently underway under the FUDS program.

4.2 EVALUATED SITES

During the PA records reviews, interviews, aerial photographic analysis, and site reconnaissance, available documentation and physical evidence were examined for areas having a potential historical PFAS release. For HAAF, the sites evaluated include crash rescue stations, fire training areas (FTAs), landfills, WWTPs, hazardous waste and fuel storage areas, and aircraft maintenance shops and wash racks, as shown in Figure 4-1 and described in the following sections.

4.2.1 AFFF Use, Storage, and Disposal

The PA included a search for evidence of current or historical AFFF use, storage, or disposal at HAAF. Documentation specifying the use of AFFF at HAAF during Army ownership and operation was not identified during the records reviews and aerial photographic analysis. However, historical AFFF storage was identified through data collected during personnel interviews. HAAF has no known current AFFF use or storage. The areas identified as potential areas of historical AFFF use, storage, and/or disposal at HAAF are discussed below.

Construction of the runway at HAAF began in 1932, with most of the construction completed by 1935 (NPS 2017). The runway was approximately 8,000 feet long and oriented in a northwest/southeast direction. It was constructed of concrete, with overrun tarmac areas and concrete and tarmac taxiways (Earth Tech 1994). Initially, the Army Air Corps used the runway to train fighter and bomber pilots and to support an aircraft maintenance and repair mission for various types of aircraft. When HAAF was transferred to the U.S. Air Force in 1947, the runway was used for air defense and training for fighter squadrons. The Army received permission to use the runway and ancillary airfield facilities for Army and Army Reserve aircraft operations in 1974 (Army, DTSC, and RWQCB 2003). The Army continued to use portions of HAAF on a permit basis until July 1984, when ownership of the airfield was transferred to the Army and management of the property was transferred to the Presidio of San Francisco. As a sub installation to the Presidio of San Francisco, HAAF served as an Army Operational Airlift Support Airfield and as a training center for an Army Reserve aviation unit until these operations were discontinued in early 1994 (Earth Tech 1994).

No information about the historical use of AFFF for emergency management or fire suppression at the airfield runway was identified at the time of the PA.

Building 92 was a historical crash rescue station that was constructed in 1972 and used to store a fire/rescue truck (Earth Tech 1994). According to a personal interview, AFFF was stored on the aircraft rescue and firefighting (ARFF) truck in Building 92, and containers of excess AFFF were also stored within the building. A visual inspection of Building 92 conducted during a 1990 non-PFAS PA revealed several compressed gas cylinders and what appeared to be small drums of Purple-K (potassium bicarbonate) used in firefighting activities (Weston 1990). This visual inspection was conducted through building windows and did not include direct examination of the drums themselves. Interviews also indicated that light maintenance on the fire crash truck occurred inside and in front of the building. Soil adjacent to Building 92 (125 yd^3) was excavated in 1998 and transported off-post for disposal due to contamination with polychlorinated biphenyls (PCBs). The excavation area was filled with bunker rock over geotextile fabric to match the original grade (IT 2000). The concentration of PFAS within the fill material was not measured before placement. The former crash rescue station is no longer present at the site. Based on aerial photographs, it was demolished between 2002 and 2005, and by 2009, the area was covered by mud flats.

The former revetment area was located north of the runway and consisted of 28 circular turnouts formerly used for aircraft parking, fueling, maintenance, jet engine testing, and firefighter practice (discussed below) (Earth Tech 1994). It is unknown when use of the revetment area began, but the circular turnouts first appear on an arial photograph in 1948. The former revetment area was not actively used for aircraft after 1974 (Weston 1990). Fuels, oils, and used oils were reportedly spilled or dumped on the ground in this area (Earth Tech 1994, Weston 1990). A series of storm drains and drop inlets were located throughout the revetment area (Army, DTSC, and RWQCB 2003). No information about the historical use of AFFF for emergency management at the revetment area has been located.

A former firefighter practice burn pit was located at Revetment Number 10. The pit was used as an FTA from approximately 1975 to 1987 (Earth Tech 1994). Fuels, solvents, and vehicles were burned in the pit. According to a personnel interview, fire training activities were conducted by igniting jet propulsion fuel No. 4 (JP-4) inside half drums placed at the site. The method used to extinguish fires at the firefighter practice burn pit was unknown at the time of the PA. In 1998, approximately 2,475 yd^3 of soil at the former firefighter practice burn pit were excavated to address contamination by volatile organic compounds, PCBs, and polynuclear aromatic hydrocarbons. The concrete pad was broken and removed and an approximately 120- by 100-foot area centered on Revetment Number 10 was excavated to a depth of 5 feet bgs, with an additional 40- by 60-foot area excavated to the southwest. The excavated soil was transported off-post for disposal (IT 2000). The concentration of PFAS within the fill material used for site restoration was not measured prior to placement.

Stormwater across most of the airfield drained by sheet flow to a system of storm sewers and perimeter drainage ditches that encircled all but the western margin of HAAF (Earth Tech 1994). The storm drains and drop inlets located throughout the revetment area also drained to the perimeter ditches. The perimeter drainage ditches were 17,500 feet in length and were mostly concrete-lined, except for approximately 4,000 feet of unlined ditches that were present along the northwestern perimeter of HAAF (IT 2000). The perimeter drainage ditches were periodically cleared of vegetation and sediment as part of regular maintenance operations at HAAF, with the removed material historically stockpiled on-post (IT 2000). As part of a 1998 removal action to address metal, petroleum hydrocarbon, and pesticide contamination, the perimeter drainage ditches were dewatered and an estimated 2,800 yd^3 of vegetation and sediment were removed and transported off-post for disposal. The 1998 removal action also included the identification and removal of soils from 13 historical spoil pile locations down to the approximate original grade (IT 2000).

The perimeter drainage ditches conveyed water to three stormwater pumping stations located along the eastern bayfront levee that pumped water into an outfall drainage ditch outside the levee, which drained into tidal wetlands and San Pablo Bay (Earth Tech 1994). The stormwater pumping station area consisted

of Buildings 35, 39, 40, and 41. Building 41 contained four diesel powered pumps used for water removal from the perimeter drainage ditch and Building 40 contained a generator that supplied emergency power to Building 41. Buildings 35 and 39 contained additional high-capacity pumps for water removal from HAAF (IT 2000). The pump equipment was maintained at the pump station, which included equipment repair, painting, adding and changing oil, and battery charging/change out (Earth Tech 1994). Two separate excavations were completed at the stormwater pumping station area in 1998 and designed to remove phenanthrene and diesel contamination. South of Building 39, an approximately 15- by 20-foot area was excavated to a depth of 5 feet bgs, and approximately 100 feet south of Building 41, an approximately 45- by 30-foot area was excavated to a depth of 5 feet bgs. In total, approximately 300 yd^3 of soil were removed and transported off-post for disposal (IT 2000). In 1999, an additional 332 yd^3 of soil were excavated to a depth of 7.5 feet bgs from an area northeast of Building 35 and 490 yd^3 of soil were removed to a depth of 9 feet bgs from former tank locations northwest of Building 41 (CH2M Hill 2001). Excavations within the stormwater pumping station area were backfilled, and the concentrations of PFAS were not measured within fill material prior to placement.

The outfall drainage ditch was located on the San Pablo Bay side of the eastern bayfront levee and received stormwater runoff and drainage from the HAAF and perimeter drainage ditch (CH2M Hill 2003). Historically, the outfall drainage ditch ran parallel to the eastern levee from the stormwater pumping station area south to the historical outfall drainage ditch before draining to San Pablo Bay. When the HAAF runway was extended, the northern portion of the ditch was rerouted to the San Pablo Bay at approximately the northern edge of the East Levee Construction Debris Landfill. Based on aerial imagery, the runway extension was conducted between 1952 and 1958. The outfall drainage ditch was approximately 3 to 4 feet deep and 6 to 10 feet wide (CH2M Hill 2003). The historical outfall drainage ditch continued south parallel to the eastern levee from the southern edge of the East Levee Construction Debris Landfill to the northern edge of the former boat dock area, where it joined the boat dock channel and San Pablo Bay. Concrete building materials appeared to serve as riprap along portions of the historical outfall drainage ditch, and following abandonment, the ditch gradually filled with sediment (CH2M Hill 2003).

4.2.2 Metal Plating Operations

No current or historical metal plating operations were identified at HAAF.

4.2.3 Sewage Treatment Plants

The former STP was located on the eastern side of HAAF, between Perimeter Road and the eastern bayfront levee and immediately southwest of the stormwater pumping station area. It consisted of several buildings, a digester, and four unlined sludge drying beds that were contained within earthen berms (CH2M Hill 2001). The STP provided primary and secondary treatment of installation-generated sanitary sewage in aboveground concrete tanks (Earth Tech 1994). Unspecified chemicals, including coagulants, were used in the treatment process (Earth Tech 1994, Weston 1994). Treated effluent was discharged to San Pablo Bay through an outfall pipe that extended approximately 600 feet east from the bayfront levee into the tidal wetlands (Earth Tech 1994).

It is unknown when the STP began operations; however, the infrastructure was visible on aerial photographs as early as 1947. The STP was issued a National Pollutant Discharge Elimination System (NPDES) permit (Permit No. CA0110248) on March 20, 1979. The California Regional Water Quality Control Board cited the STP in 1980 for providing insufficient dilution of treated effluent before it discharged to the San Pablo Bay. The STP operated until November 1986, at which time sanitary sewage from HAAF was redirected to the Novato Sanitation District, and in 1987, the NPDES permit was rescinded (Earth Tech 1994). The buildings associated with the STP (Buildings 42 through 45) were demolished (Weston 1990), and the sludge, berms, and bed dikes were removed in 1987 (CH2M Hill 2001). No evidence that the STP received potentially PFAS-containing wastewater was identified during the PA.

Approximately 4,000 yd^3 of contaminated soil underlying the former digester and the former sludge drying beds were excavated during a 1998 removal action. The excavated area was approximately 100 feet wide and 205 feet long and extended to a depth of 5 feet bgs. A 30- by 40-foot area in the southeastern corner of the excavation was extended to a depth of approximately 10 feet bgs (IT 2000). In 1999, an additional 140 yd^3 of soil were excavated to a depth of 4 feet bgs to address a thin, approximately 110-foot-long black sludge-like layer that was identified in 1998 (CH2M Hill 2001). The excavated soil was transported off-post for disposal, and the site was restored with bunker rock over geotextile fabric and soil from an on-post borrow area (CH2M Hill 2001, IT 2000).

4.2.4 Landfills

This section describes waste disposal at three former landfills at HAAF: the East Levee Construction Debris Landfill, the Radiological Disposal Site, and the Antenna Debris Disposal Area:

- **East Levee Construction Debris Landfill and Burn Pit –** Located on the eastern side of HAAF, the East Levee Construction Debris Landfill was bordered by the eastern bayfront levee and San Pablo Bay. Beginning in approximately 1961, the site was used for disposal of primarily construction debris and was later capped with clay and concrete (CH2M Hill 2003, Earth Tech 1994, Weston 1990). The landfill was used until 1974. The landfill also included a burn pit that was located to the southeast, adjacent to San Pablo Bay, which had slightly higher elevations than the disposal area and surrounding coastal wetlands. The nature and quantity of the wastes burned at the site are unknown, and no waste materials were evident at the surface or in soil samples collected from the burn pit (Army, DTSC, and RWQCB 2003). Based on an analysis of aerial photography, the area appears to have been revegetated by 1982. A portion of the East Levee Construction Debris Landfill was located on state-owned property in the intertidal zone. The landfill was mostly inundated (about 90 percent underwater) during periods of high tides, and the landfill material was continually saturated. A comprehensive exploratory trenching program was conducted to characterize the contents of the landfill, but no remedial or cleanup actions were recommended (Weston 1990).
- **Radiological Disposal Site –** Located adjacent to the northern perimeter drainage ditch beyond the runway overrun, the Radiological Disposal Site is on the northwestern side of HAAF. The disposal site consisted of two corrugated-metal cylinders, approximately 18 inches in diameter and 18 to 24 feet in length. The cylinders contained electron tubes and wave guides containing exempted quantities of low-level radioactive materials (Earth Tech 1994, Weston 1990). The cylinders were removed, and the material was transported off-post to a licensed disposal site in September 1988. The Radiological Disposal Site was subsequently released for unrestricted use to USACE (Earth Tech 1994).
- **Antenna Debris Disposal Area –** The Antenna Debris Disposal Area was located at the northern end of the outfall drainage ditch, north of the pumping station area outfall basin. The period of use for this disposal area is unknown. The Antenna Debris Disposal Area consist of two areas of apparent disposal, one located east of the outfall drainage ditch and one to the west of the outfall drainage ditch. A visual inspection conducted for the Coastal Salt March Focused Feasibility Study (CH2M Hill 2003) indicated that the area contained discarded material from the former antenna facilities and building materials. At the time of the visual inspection, the area was covered with native grasses, interspersed with pickleweed.

4.2.5 Other Potential Sources of PFAS

In addition to AFFF-related PFAS sources, other potential sources of PFAS may be associated with the use of some types of pesticides, car washes, engine lubricants, paint shops, laundry or waterproofing facilities,

and photographic processing facilities. The potential non-AFFF PFAS sources at HAAF are discussed below and noted on Figure 4-1:

- **Aircraft Maintenance Areas** – Aircraft maintenance was performed in the aircraft maintenance area located near the southwestern portion of HAAF. Maintenance activities were conducted inside Buildings 86 and 90, and outside on the tarmac to the northwest and southwest of Building 86. According to installation records, aircraft maintenance activities in the southwestern portion of HAAF also were conducted in Buildings 84 and 93; however, since the exact location of these buildings is unknown, they are not shown in Figure 4-1. In addition, aircraft staging and maintenance was conducted in the revetment area, as discussed in Section 4.2.1. Aircraft maintenance activities included aircraft equipment repair, oil changing, jet and prop engine repair and service, aircraft bodywork painting and washing, and fuel testing (CH2M Hill 2001, Earth Tech 1994). The aircraft maintenance area near Building 86 was drained by dedicated storm sewers that lead into the southern perimeter drainage ditch.
- **Aircraft/Vehicle Wash Racks** – An aircraft wash rack was located on Parcel A5, which was a 1.8-acre parcel of airfield tarmac on the northern side of the building 95 aircraft hangar (Earth Tech 1994). The wash rack facilities included drums, hose racks, and a detergent pumping system. In addition, two wash racks were present along the western side of Building 90 (CH2M Hill 2001). A complete list of products used for the wash rack operations was not available at the time of the PA. Based on the available documentation, the wash racks were primarily used for aircraft maintenance (Compton 1977, Earth Tech 1994, CH2M Hill 2001), and no information has been located indicating that emergency vehicles with AFFF were washed or otherwise maintained in these areas.
- **Hazardous Material Storage** – Hazardous substances and wastes were stored in various locations within the aircraft maintenance area in the southwestern portion of HAAF. This included a storage area on the northeastern side of Building 86, an area to the northwest of Building 88, an area to the southeast of Building 94 (Conex 94B), and inside and around Building 87. In addition, Building 90 was used for a period as a storage area for hazardous substances, including 55-gallon drums of POL (Earth Tech 1994). The hazardous materials used and the substances generated as part of the aircraft maintenance activities at HAAF included stripping and degreasing solvents, oils, and other aircraft fluids, batteries and battery liquids, POL, antifreeze, and paints.
- **POL Area and JP-4 Fuel Line** – Fuel storage at HAAF included the POL Area, as well as two other POL facilities on non-BRAC property. The POL Area contained 20 25,000-gallon underground storage tanks (USTs) and several ASTs that were used to store JP-4 jet fuel. An 840,000-gallon JP-4 AST was located on a hillside bench in the POL Area and supplied the lower tank farm by gravity feed via a pipeline. The aircraft fuel distribution system at HAAF consisted of fueling stations that were fed by a JP-4 fuel hydrant system. Aircraft fueling historically occurred in the revetment areas and aircraft maintenance area via fuel truck and nine fueling stations along hanger row on the southeastern side of the airfield runway (Earth Tech 1994). JP-4 was offloaded from barges at an unloading pier located approximately 18,000 feet into the San Pablo Bay. The fuel was piped via a 12-inch fuel line onto shore to the BRAC POL Area and two other non-BRAC POL areas. A 6-inch fuel line ran underground along the southern taxiway in front of the hangar buildings to a network of fuel lines and the nine fueling stations. All USTs and ASTs were removed from the POL area in 1986, and portions of the POL Area fuel lines at HAAF were removed in 1986, 1990, and 1993 (Earth Tech 1994). The former 12-inch supply line was observed along the unloading pier during the site visit. According to personnel interviews, the JP-4 supply line from San Pablo Bay was flushed and grouted before being abandoned in place. Drainage for the POL Area was via sheet flow to the north and east into storm sewers and drainage ditches, which conveyed stormwater to the northwest end of the runway and into the northern perimeter drainage ditch.

- **Pesticides –** According to personnel interviews, pesticides were applied at HAAF; however, the mixing and storage of pesticides occurred off-post. Although Safety Data Sheets (SDSs) for a complete list of pesticides that were used, stored, and/or disposed of at HAAF were unavailable for review at the time of the PA, the use of fluorinated pesticides was infrequent until about the mid-2000s (Alexandrino et al. 2022). Given the operational period of operation for HAAF (1932 to 1988), the dates of pesticide use at the facility pre-date the use of fluorinated pesticides and the likelihood of PFAS impacts due to pesticide use, storage, or disposal is assumed to be low.
- **Photographic Processing –** No current or historical photographic processing facilities were identified at HAAF.

During the document research and site visit, no additional potential PFAS-containing material use, storage, or disposal were identified.

4.3 POTENTIAL OFF-POST AND POST TRANSFER PFAS SOURCES

The search to identify potential off-post PFAS sources (i.e., not related to the Army's operations at HAAF), although not exhaustive, included review of significant potential contributors (i.e., airports, solid waste landfills, WWTPs, car washes, and metal plating facilities). In addition, EDR conducted a search of state and Federal environmental databases for HAAF property and adjacent properties (EDR 2023). No known post-transfer use, storage, or disposal of PFAS-containing materials was identified for HAAF at the time of the PA. Figure 4-2 shows the fire stations, airports, and landfills within a 5-mile radius from HAAF.

Landfill 26, currently managed under FUDS, was located west of HAAF, adjacent to the POL Area. It was used as a refuse facility from the 1940s to 1974. Household, commercial, industrial, and construction wastes are believed to have been deposited in the landfill. The methods of disposal within Landfill 26 were not documented. Wastes observed from previous borings and trenches included wood, bottles, paper, household trash, airplane parts, scrap metal, wire, concrete, steel, other construction debris, and oily sludge. It is inferred activities that were conducted at the base, as well as from the contaminants found in the soil/refuse, that waste products (industrial/commercial) generated from aircraft maintenance and base operations were also placed within Landfill 26. Army records also had indicated that petroleum-contaminated soil obtained from the cleanup of multiple petroleum spills in the 1970s were deposited within the landfill. Landfill 26 has not been active since 1974 (USACE 2014).

The 270-acre NAF, currently managed under FUDS, is located directly north of HAAF, adjacent to San Pablo Bay. The NAF is owned by CA SLC and consists of undeveloped non-native grasslands. Plans are in place to use the property as the site for a future wetland restoration project (Parsons 2010). A historical FTA was located on the NAF property and situated on fill material (construction debris) at a topographically higher elevation than the surrounding grade. Activity at the FTA began between 1965 and 1968 and was concluded by 1980 (Shaw 2006). A former ammunition burn pit was also located on this property. It was a 5- by 5-foot pit that was brick lined and was approximately 5 feet bgs (IT 2001). PFAS-containing AFFF may have been used to extinguish fires at the FTA and ammunition burn pit.

Historically, drainage from the NAF entered the perimeter drainage ditch at HAAF (Army, DTSC, and RWQCB 2003). The interior drainage ditches at the NAF property were connected to the HAAF perimeter drainage ditch via a culvert at the southernmost point of the north-south NAF interior drainage ditch. The culvert was closed by a floodgate that was in disrepair (IT 2001). It is unknown how long the floodgate was in a state of disrepair. Water levels in the outer drainage ditch at the NAF property were also influenced by tidal exchange and the outfall from the HAAF stormwater pumping stations due to a connection with San Pablo Bay (IT 1998).

The Novato Sanitation District (NSD) discharges treated wastewater through a 54-inch reinforced concrete pipe that runs along the northern boundary of HAAF and discharges through a diffuser approximately 900 feet offshore in San Pablo Bay. The treated wastewater is discharged into San Pablo Bay during the

winter and spring and used for irrigation during the summer and fall (Jones and Stokes 2003). According to personnel interviews, the agricultural fields located south of HAAF are used by the Las Gallinas Sanitary District, where the wastewater is used for irrigation. The NSD tested the effluent from the WWTP for PFAS in November 2020. Results of this testing, which are available on the State Water Resources Control Board GeoTracker website (https://geotracker.waterboards.ca.gov/), indicate that the highest observed detections in the NSD wastewater effluent were 7.99 ng/L for PFOA and 5.56 ng/L for PFOS.

The Regional Monitoring Program for Water Quality in the San Francisco Bay, administered by the San Francisco Estuary Institute, has found that PFAS is widely detected in the surface water and sediment of San Francisco Bay and the adjacent San Pablo Bay. Stormwater and wastewater are two pathways by which PFAS enters the Bay; however, conservative tracer modeling suggests that, while these are significant pathways, they may not be the only pathways that are present (SFEI 2018). Studies of the Bay Area stormwater and wastewater also suggest that a significant fraction of the total PFAS present in wastewater discharge is composed of PFAS that are not on the standard list of PFAS analytes. Analysis of PFAS concentrations in the wastewater entering the San Francisco Bay area over time is consistent with PFAS manufacturing and use trends, including a decreasing trend in average PFOS and PFOA concentration (though not statistically significant) and a statistically significant increasing trend in the concentration of short-chain PFAS (SFEI 2018). Since the construction of the HWRP, HAAF is subject to twice daily tidal flooding by waters from San Pablo Bay (Tetra Tech and ESA 2021).

Landfill 26, NAF, NSD wastewater discharge, and tidal exchange with the San Francisco Bay area all represent potential off-post PFAS sources.

5. SUMMARY OF PA RESULTS

The areas evaluated for potential PFAS-containing material use, storage, or disposal at HAAF were further refined during the PA process and categorized either as an AOPI or an area not retained as an AOPI. Of these areas, 14 were identified but none have been identified as AOPIs.

5.1 AREAS NOT RETAINED AS AOPIs

Based on analysis of information obtained during this PA, the areas described below were not retained as AOPIs. These areas were previously identified as potential PFAS sources (e.g., AFFF storage, car washes, automobile maintenance, photographic processing, pesticide use or storage, WWTPs, landfills). However, for 10 of these areas, PA research does not indicate that PFAS-containing materials were used, stored, or disposed of at these areas. For the remaining four areas, research conducted for this PA indicates that PFAS-containing material use, storage, or disposal is potentially suspected, but they have not been retained as AOPIs due to historical soil removal actions, absence of soil and groundwater exposure pathways, and the potential for cross contamination with off-post PFAS-impacted materials in San Pablo Bay. A brief site history and the rationale for eliminating the areas as AOPIs are presented in Table 5-1.

5.2 DATA LIMITATIONS

The data limitations relevant to the development of this PA for PFAS at HAAF are discussed below.

A comprehensive well survey was not completed as part of this PA; therefore, the information reviewed regarding off-post wells is limited to the desktop survey completed. The EDR well search report (Appendix F) and online California Natural Resources Agency Well Completion Report (https://gis.data.cnra.ca.gov/datasets/DWR::i07-wellcompletionreports) were referenced when identifying potential off-post drinking water receptors.

The searches for ecological receptors and off-post PFAS sources were not exhaustive and were limited to readily identifiable and available information evaluated during the relevant documents research, Army personnel interviews, and site reconnaissance. An online database was referenced when identifying the ecological profile for the site (USFWS 2023).

Records reviewed during the PA process were limited in information regarding PFAS-containing materials, including AFFF use, procurement records, and firefighter training records. Generally, interviews were crucial to understanding past practices and identifying the potential for use, storage, or disposal of PFAS-containing materials because records are often not available after installation closure. Interviews providing information regarding potential PFAS-containing material use were limited in quantity but inclusive of personnel knowledgeable of fire, emergency response, and industrial activities over the time frame from 1979 to the present.

The PA was conducted through observation of operational periods, site usage, aerial photographs, records reviews, anecdotal evidence, and personnel interviews to evaluate the use, storage, or disposal of PFAS-containing materials. Therefore, some conclusions and recommendations presented in this report are based on available information, professional judgment, and industry best practices.

Table 5-1. Summary of Areas Not Retained as AOPIs at HAAF

Area Description	Dates of Operation	Relevant Site History	Rationale
Radiological Disposal Site	Unknown	Two corrugated-metal cylinders were used for low-level radioactive waste disposal. The cylinders were removed from the property in 1988 (Weston 1990).	No evidence that PFAS-containing materials were disposed of. The materials disposed of at this site would not contain PFAS. The cylinders and material were removed and transported off-post to a licensed disposal site.
POL Area and JP-4 Fuel Line	Unknown to approximately 1986	The POL Area contained 20 25,000-gallon USTs and several ASTs that were used to store JP-4 jet fuel. An 840,000-gallon JP-4 AST supplied the lower tank farm by gravity feed via a pipeline. The aircraft fuel distribution system at HAAF consisted of fueling stations that were fed by a JP-4 fuel hydrant system. JP-4 was offloaded from barges at an unloading pier extending approximately 18,000 feet into the San Pedro Bay and transported by pipeline to the POL Area. All USTs and ASTs were removed in 1986, and fuel lines were removed in 1986, 1990, and 1993 (Earth Tech 1994).	No evidence that PFAS-containing materials were used, stored, or disposed of. No evidence that an AFFF-based fire suppression system was installed at this facility.
Aircraft Wash Racks (Parcel A5 and West Side of Building 90)	Unknown	A 1.8-acre parcel of airfield tarmac on the northern side of the Building 95 aircraft hangar was used as an aircraft wash rack (Earth Tech 1994). The wash rack facilities included drums, hose racks, and a detergent pumping system. Two additional wash racks were present along the western side of Building 90 (CH2M Hill 2001).	No evidence that PFAS-containing materials were used, stored, or disposed of. Exact dates of operation as aircraft wash racks are unknown. No evidence that emergency vehicles with AFFF were washed or otherwise maintained at the facilities. SDSs were unavailable for review at the time of the PA.
Hazardous Waste Storage Areas (Buildings 86, 87, 88, 90, and Conex 94B)	Unknown to approximately 1994	Hazardous substances and wastes were stored in various locations within the aircraft maintenance area in the southwestern portion of HAAF, including a storage area on the northeastern side of Building 86, an area to the northwest of Building 88, an area to the southeast of Building 94 (Conex 94B), and inside and around Building 87. Hazardous substances, including 55-gallon drums of POL, were also stored in Building 90 (Earth Tech 1994). Hazardous material used and substances generated as part of the aircraft maintenance activities at HAAF included stripping and degreasing solvents, oils, and other aircraft fluids, batteries and battery liquids, POL, antifreeze, and paints.	No evidence that PFAS-containing materials were used, stored, or disposed of. SDSs were unavailable for review at the time of the PA.

Table 5-1. Summary of Areas Not Retained as AOPIs at HAAF (Continued)

Area Description	Dates of Operation	Relevant Site History	Rationale
Former Aircraft Maintenance (Buildings 84, 86, 90, and 93)	1972 to approximately 1994	Aircraft maintenance activities were conducted inside Buildings 84, 86, 90, and 93, and on the tarmac to the northwest and southwest of Building 86. Aircraft maintenance activities included aircraft equipment repair, oil changing, jet and prop engine repair and service, aircraft bodywork painting and washing, and fuel testing (CH2M Hill 2001, Earth Tech 1994).	No evidence that PFAS-containing materials were used, stored, or disposed of. No evidence that emergency vehicles with AFFF were maintained at these facilities. SDSs were unavailable for review at the time of the PA.
East Levee Construction Debris Landfill and Burn Pit	1961 to 1974	The landfill is located on the eastern side of the site bordered by the east levee and San Pablo Bay. It was used primarily for disposal of construction debris and later was capped with clay and concrete (Weston 1990). A burn pit was located at the eastern end of the coastal salt marsh. The nature and quantity of wastes burned at the site are unknown (Army, DTSC, and RWQCB 2003). The landfill and burn pit were revegetated by 1982.	No evidence that PFAS-containing materials were used, stored, or disposed of. The absence of visible waste materials at the surface and in soil samples suggests that waste was allowed to burn until destroyed; therefore, the use of AFFF for fire suppression at the burn pit is unlikely.
Antenna Debris Disposal Area	Unknown	Located on the eastern bayfront levee at the northern end of the outfall drainage ditch, north of the pumping station area outfall basin. The Antenna Debris Disposal Area consists of two areas of apparent disposal, one located east of the outfall drainage ditch and one to the west of the outfall drainage ditch. The disposal area contained discarded material from the former antenna facilities and building materials (Army, DTSC, and RWQCB 2003). No additional information regarding the length of use or disposal practices implemented at the disposal area has been located.	No evidence that PFAS-containing materials were used, stored, or disposed of. Exact dates of waste disposal are unknown.

Table 5-1. Summary of Areas Not Retained as AOPIs at HAAF (Continued)

Area Description	Dates of Operation	Relevant Site History	Rationale
Crash Rescue Station (Building 92)	1972 to unknown	Building 92 operated as a crash rescue station beginning in 1972 for an undetermined length of time and was used to store a fire/rescue truck (Earth Tech 1994). According to a personal interview, AFFF was stored on the ARFF truck inside Building 92, and containers of excess AFFF were also stored within the building. Visual inspection also found compressed gas cylinders and drums of potassium bicarbonate used in firefighting activities stored within the building (Weston 1990).	Crash rescue station with AFFF storage on the fire truck and within the building. However, a soil removal action occurred when the building was demolished (125 yd^3 of soil were removed) and may have addressed any potential AFFF released to the soil. In addition, dredged material was placed over the location of the former crash rescue station as part of the HWRP, eliminating a soil exposure pathway. Following restoration, the site consists of seasonal wetlands. Groundwater at the site is not suitable for drinking water, irrigation, or commercial uses, and groundwater migration is minimal due to the low permeability of the Bay Mud present in the area. The potential also exists for cross contamination by the water and sediments from San Pablo Bay due to tidal exchange and from the placement of dredged fill material that was not tested for PFAS.
Firefighter Practice Burn Pit (Revetment Number 10)	Approximately 1975 to 1987	Revetment Number 10 operated as a firefighter practice burn pit from approximately 1975 to 1987 (Earth Tech 1994). Fuels, solvents, and vehicles were burned in the pit. According to a personnel interview, fire training activities were conducted by igniting JP-4 inside half drums placed at the site. The method used to extinguish fires at the firefighter practice burn pit was unknown at the time of the PA.	Potential AFFF use during firefighter training activities. However, Revetment Number 10 was excavated to approximately 5 feet bgs (2,475 yd^3 of soil were removed) and may have addressed any potential AFFF released to the soil. In addition, dredged material was placed over the location of the former firefighter practice burn pit as part of the HWRP, eliminating a soil exposure pathway. Following restoration, the site consists of tidal wetlands and is submerged throughout all but the lowest tidal levels. Groundwater at the site is not suitable for drinking water, irrigation, or commercial uses, and groundwater migration is minimal due to the low permeability of the Bay Mud present in the area. The potential also exists for cross contamination by the water and sediments from San Pablo Bay due to tidal exchange and from the placement of dredged fill material that was not tested for PFAS.

Table 5-1. Summary of Areas Not Retained as AOPIs at HAAF (Continued)

Area Description	Dates of Operation	Relevant Site History	Rationale
Airfield Runway and Revetment Area (excluding Revetment Number 10)	1935 to 1994 (Airfield Runway) Before 1948 to approximately 1974 (Revetment Area)	The airfield runway was constructed between 1932 and 1935 (NPS 2017). The runway, which was approximately 8,000 feet long and oriented in a northwest/southeast direction, was constructed of concrete, with tarmac overrun areas and concrete and tarmac taxiways (Earth Tech 1994). The Army used the runway and ancillary airfield facilities for Army and Army Reserve aircraft operations and training between 1974 and 1994 (Army, DTSC, and RWQCB 2003). The former revetment area was located north of the runway and consisted of 28 circular turnouts that were used for aircraft parking, fueling, maintenance, and jet engine testing until approximately 1974 (Earth Tech 1994).	No evidence that PFAS-containing materials were used, stored, or disposed of. Fire training at HAAF was conducted at Revetment Number 10 (discussed above); no evidence that AFFF was used for fire training or fire suppression at other areas of the airfield runway or revetment area. SDSs were unavailable for review at the time of the PA.
Perimeter Drainage Ditch	Unknown to approximately 2010	The perimeter drainage ditch encircled all but the western margin of HAAF. It was 17,500 feet in length and mostly concrete-lined, except for approximately 4,000 feet of unlined ditches along the northwestern perimeter of HAAF (IT 2000). Stormwater across most of the airfield drained by sheet flow to a system of storm drains, drop inlets, and storm sewers that connected with the perimeter drainage ditch (Earth Tech 1994). The perimeter drainage ditch conveyed water to three stormwater pumping stations located along the eastern bayfront levee.	If AFFF was used for training at the firefighter practice burn pit (Revetment Number 10), the potential exists that the perimeter drainage ditch received PFAS-impacted runoff related to fire training activities. However, the perimeter drainage ditch was periodically cleared of sediment and vegetation as part of regular maintenance and an estimated 2,800 yd^3 of material were removed from the perimeter drainage ditch and 13 historical spoil pile locations in 1998. Dredged and borrow material, in addition to concrete, was used to construct new levees on top of the former perimeter ditch as part of the HWRP (PWA 2008), reducing a soil exposure pathway. Groundwater at the site is not suitable for drinking water, irrigation, or commercial uses, and groundwater migration is minimal due to the low permeability of the Bay Mud present in the area. The potential also exists for cross contamination from the placement of dredged fill material that was not tested for PFAS.

Table 5-1. Summary of Areas Not Retained as AOPIs at HAAF (Continued)

Area Description	Dates of Operation	Relevant Site History	Rationale
Stormwater Pumping Station Area and Outfall Drainage Ditch	Before 1947 to approximately 2010	The stormwater pumping station area was located on the eastern side of HAAF along the eastern bayfront levee. Three stormwater pumping stations removed stormwater runoff from the airfield. The water was pumped into an outfall drainage ditch located outside the eastern bayfront levee, which drained into San Pablo Bay. The pumping station area included former Buildings 35, 39, 40, and 41. Drainage system pumps were located in Buildings 35, 39, and 41, and Building 40 contained a generator that supplied emergency power to Building 41 (Earth Tech 1994).	Portions of the stormwater pumping station area were excavated to depths of up to 9 feet bgs during soil removal actions in 1998 and 1999 (1,122 yd^3 of soil were removed), and the entire area was removed when the eastern bayfront levee was breached in 2014. The soil excavated during the levee breach was incorporated into the dredged material brought into the site to raise elevations and create a tidal wetland system at HAAF as part of the HWRP. Following restoration, the site consists of open water and tidal wetlands. In addition, groundwater at the site is not suitable for drinking water, irrigation, or commercial uses, and groundwater migration is minimal due to the low permeability of the Bay Mud present in the area. The potential also exists for cross contamination by the water and sediments from San Pablo Bay due to tidal exchange and from the placement of dredged fill material that was not tested for PFAS.
Historical Outfall Drainage Ditch	Unknown to before 1958	The historical outfall drainage ditch ran parallel to the eastern bayfront levee from the southern edge of the East Levee Construction Debris Landfill to the northern edge of the former boat dock area. This portion of the outfall drainage ditch was abandoned when the HAAF runway was extended sometime before 1958. After abandonment, the ditch gradually filled with sediment (CH2M Hill 2003).	No evidence that PFAS-containing materials were used, stored, or disposed of. The period of use precedes the wide use of PFAS-containing materials; therefore, it is unlikely that the historical outfall drainage ditch received PFAS-containing stormwater runoff.
Sewage Treatment Plant	Before 1947 to 1986	The STP was located on the eastern bayfront levee, immediately southwest of the stormwater pumping station area. It consisted of several buildings, a digester, and four unlined sludge drying beds that were contained within earthen berms (CH2M Hill 2001). The STP provided primary and secondary treatment of installation generated sanitary sewage (Earth Tech 1994).	No evidence that PFAS-containing materials were used, stored, or disposed of. The STP was used for sanitary waste only; no evidence that the STP received potentially PFAS-impacted wastewater.

6. CONCLUSIONS

This PA was conducted in accordance with DoD, Army and USEPA guidance documents. Programmatically, the Army has focused its PFAS PA efforts to identify locations where a potential for a release of PFAS exists (i.e., those locations where there was use, storage, or disposal of PFAS-containing materials). Locations on Army installations with the greatest likelihood of releases of PFAS were evaluated as part of this PA, including FTAs, AFFF storage locations, aircraft crash sites, fuel farms, and sites associated with aviation assets. However, other potential sources of PFAS at the installation were considered and have been documented in this PA. A combination of document review, Internet searches, interviews with installation personnel, and an installation site visit were used to identify specific areas of suspected PFAS use and releases at HAAF.

The entire HAAF installation along with an area of adjacent coastal salt marsh to the east was assessed; 14 preliminary areas were identified and evaluated for potential use, storage and/or disposal of PFAS-containing materials; and these areas were further refined during the PA process and then either identified either as an area not retained for further investigation or as an AOPI. In accordance with the established process for the PA, none of the preliminary areas have been identified as AOPIs.

Although research conducted for this PA indicates that PFAS-containing material use, storage, or disposal is potentially suspected at four of the preliminary areas, they have not been retained as AOPIs due to the lines of evidence listed below:

- Historical soil removal actions have occurred at each of the areas.
- Approximately 6.1 million yd^3 of dredged material were brought into the site to raise elevations and create a tidal wetland system at HAAF as part of the HWRP, eliminating a soil exposure pathway.
- Following the breach of the eastern bayfront levee, tidal wetlands are present at the former firefighter practice burn pit (Revetment Number 10), open water and tidal wetlands are present at the former stormwater pumping station area, and seasonal wetlands are present at the former Crash Rescue Station (Building 92)
- Groundwater at the site is not suitable for drinking water, irrigation, or commercial uses, and groundwater migration is minimal due to the low permeability of the Bay Mud present in the area.
- HAAF has no PFAS-containing material use, storage, or disposal areas, since being restored to wetlands. The potential exists for cross contamination from potential off-post PFAS sources due to ongoing tidal exchange with San Pablo Bay and the historical placement of dredged fill material.

Given the findings of this PA, further evaluation in an SI is not warranted.

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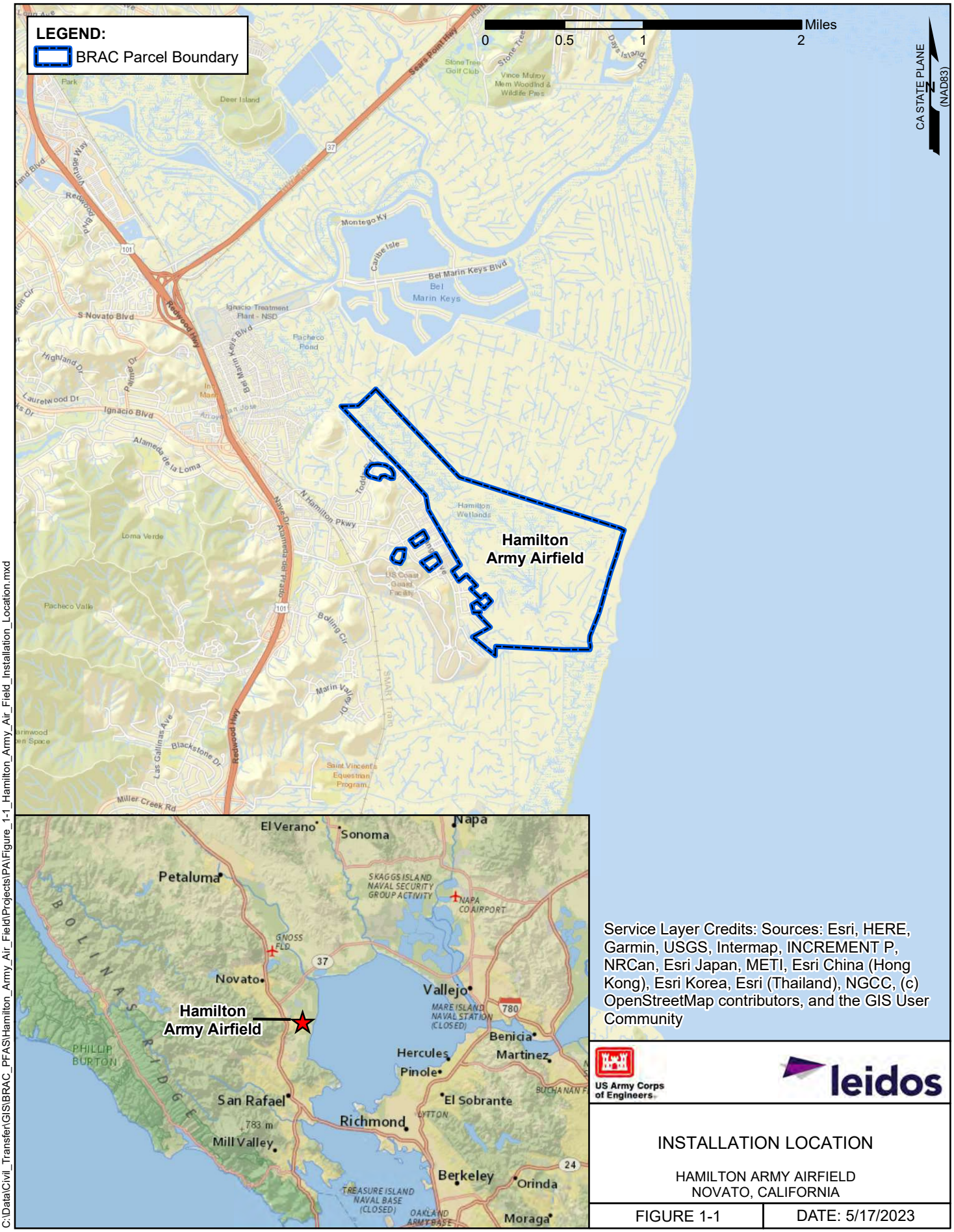
FIGURES


LEGEND:
BRAC Parcel Boundary
0
0.5
1
2
Miles
CA STATE PLANE ZONE 2 (NAD83)
Hamilton Army Airfield
Hamilton Army Airfield
Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
US Army Corps of Engineers
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INSTALLATION LOCATION
HAMILTON ARMY AIRFIELD
NOVATO, CALIFORNIA
FIGURE 1-1
DATE: 5/17/2023
C:\Data\Civil_Transfer\GIS\BRAC_PFAS\Hamilton_Army_Air_Field\Projects\PA\Figure_1-1_Hamilton_Army_Air_Field_Installation_Location.mxd

C:\Data\Civil_Transfer\GIS\BRAC_PFAS\Hamilton_Army_Air_Field\Projects\PA\Figure_2-1_Hamilton_Army_Air_Field_Site_Features.mxd

LEGEND:

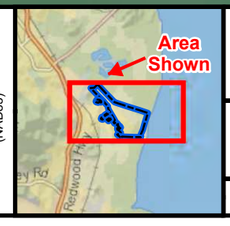
- BRAC Parcel Boundary
- Waterbody
- Building
- Road
- Stream/Canal
- Elevation Contour (40 ft)
- Inferred Groundwater Flow Direction

NOTES:

1. Background Source: ESRI World Imagery (Vivid/Maxar,11/2021).
2. USGS National Hydrography Dataset (NHD) (Streams, water bodies, elevation contours).
3. Marin County GeoHub (Roads, Buildings).
4. Note that the BRAC boundaries are estimated.
5. Generalized grondwater flow direction as shown in Shaw (2006).

0 500 1,000 2,000 Feet

CA STATE PLANE ZONE 2 (NAD83)



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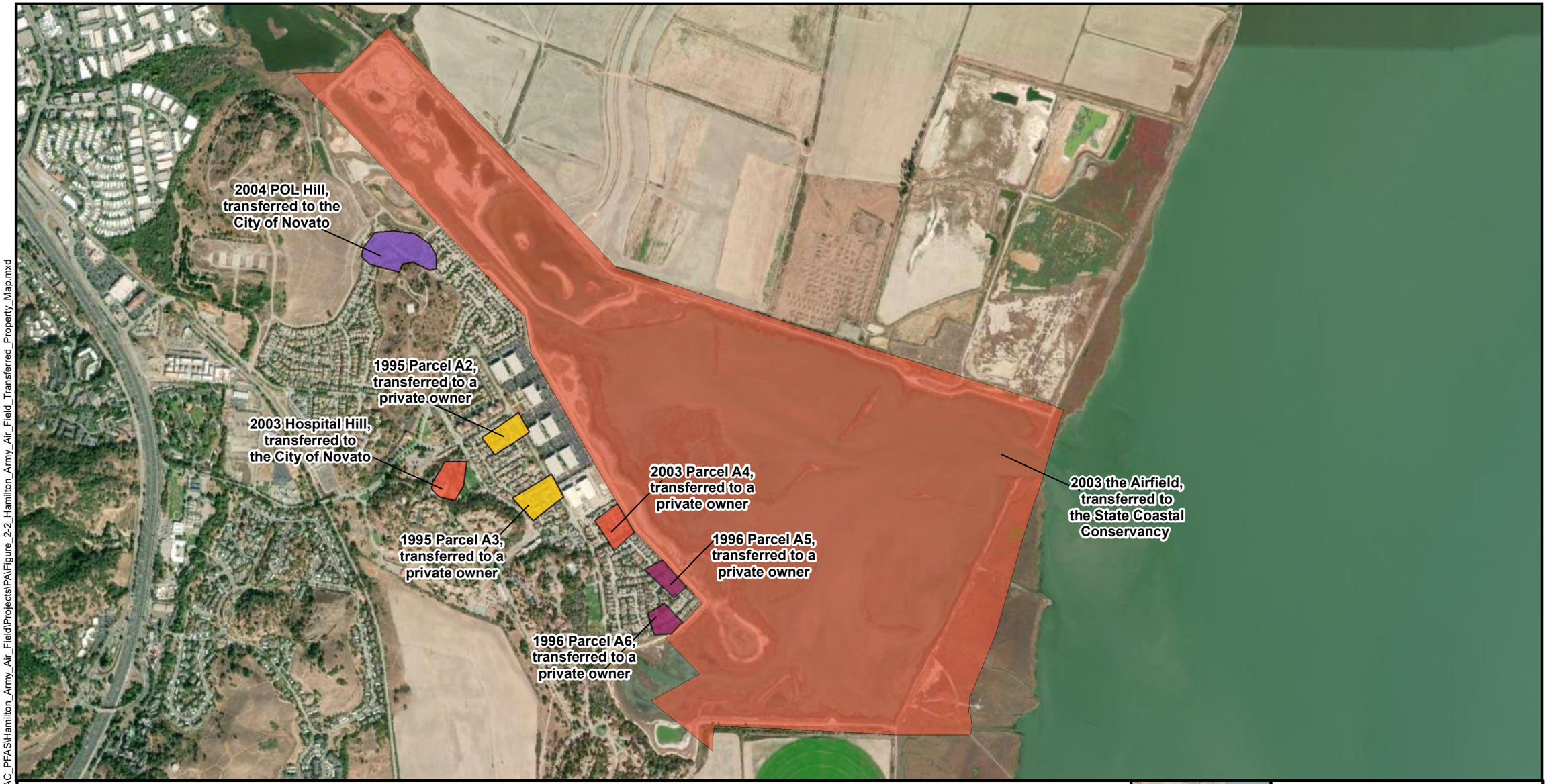
SITE FEATURES
HAMILTON ARMY AIRFIELD
NOVATO, CALIFORNIA

FIGURE 2-1 | DATE: 5/26/2023



LEGEND:

Parcel Transfer Year

- 1995
- 1996
- 2003
- 2004

NOTES:
1. Background Source: ESRI World Imagery (Vivid/Maxar,11/2021).
2. Note that the BRAC boundaries are estimated.

0 500 1,000 2,000 Feet

CA STATE PLANE ZONE 2 (NAD83)

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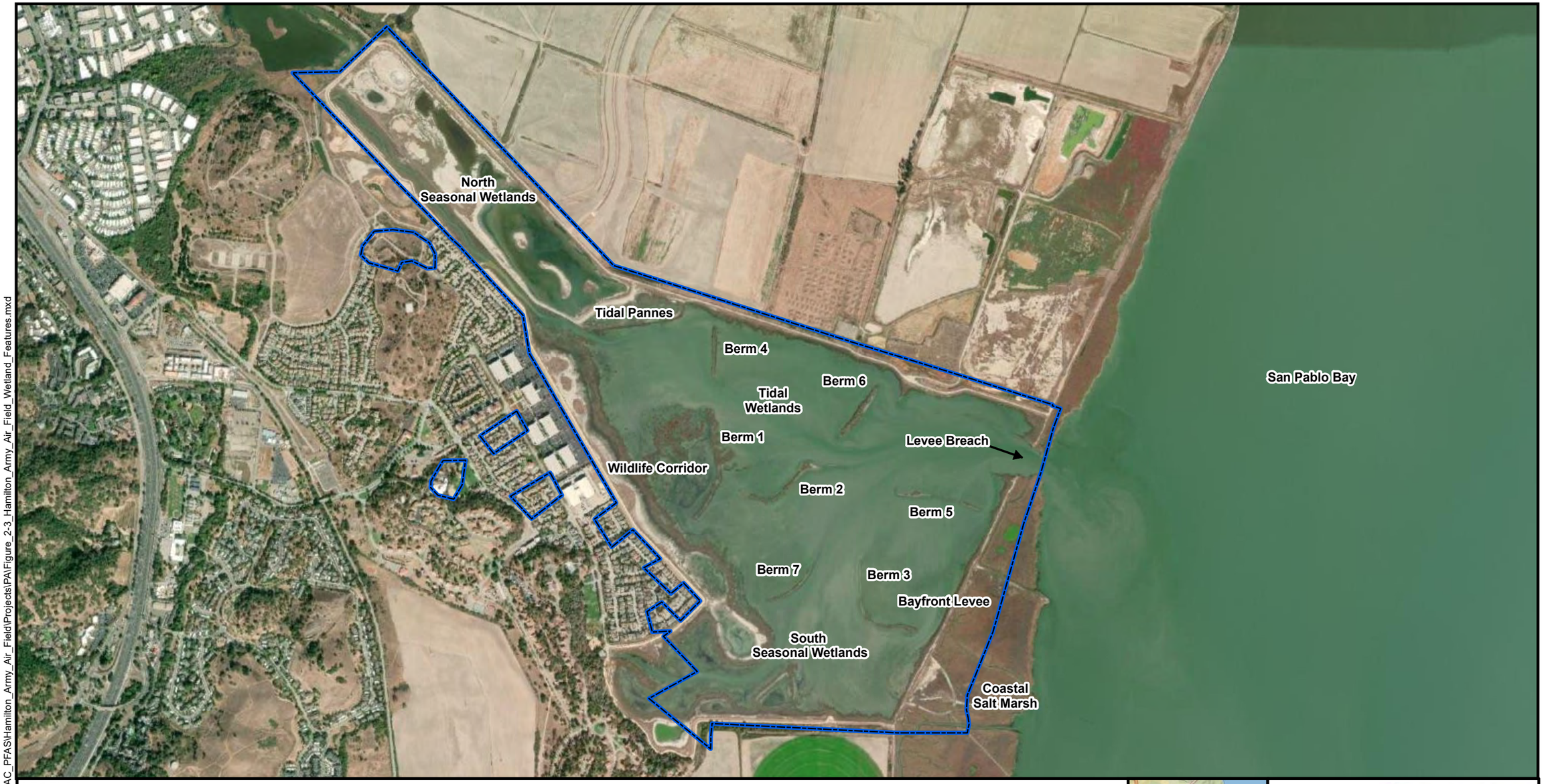
PARCEL TRANSFER MAP
HAMILTON ARMY AIRFIELD
NOVATO, CALIFORNIA

FIGURE 2-2 | DATE: 5/17/2023

C:\Data\Civil_Transfer\GIS\BRAC_PFAS\Hamilton_Army_Air_Field\Projects\PA\Figure_2-2_Hamilton_Army_Air_Field_Transferred_Property_Map.mxd



C:\Data\Civil_Transfer\GIS\BRAC_PFAS\Hamilton_Army_Air_Field\Projects\PA\Figure_2-3_Hamilton_Army_Air_Field_Wetland_Features.mxd

LEGEND:

BRAC Parcel Boundary

NOTES:
1. Background Source: ESRI World Imagery (Vivid/Maxar,11/2021).
2. Wetland Feeatures from Tetra Tech and ESA (2021).
3. Note that the BRAC boundaries are estimated.

0 500 1,000 2,000 Feet

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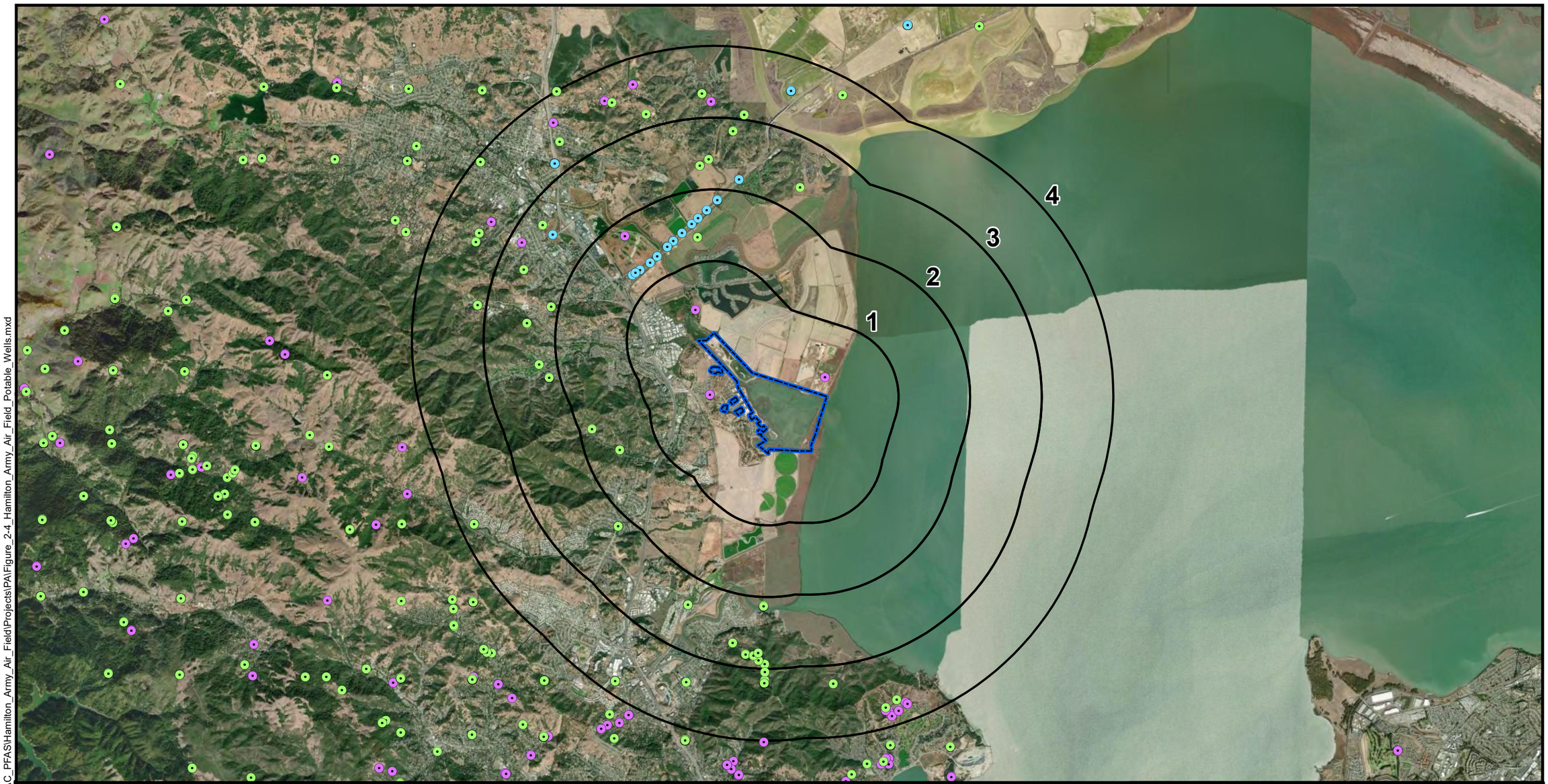
WETLAND FEATURES
HAMILTON ARMY AIRFIELD
NOVATO, CALIFORNIA

FIGURE 2-3 | DATE: 5/17/2023



C:\Data\Civil_Transfer\GIS\BRAC_PFAS\Hamilton_Army_Air_Field\Projects\PA\Figure_2-4_Hamilton_Army_Air_Field_Potable_Wells.mxd

LEGEND:

- BRAC Parcel Boundary
- Distance Ring
- Public Water Well
- Domestic Water Well
- Irrigation Well

NOTES:

1. Background Source: ESRI World Imagery (Vivid/Maxar,11/2021).
2. Well Data Source: California Natural Resources Agency; Unclassified wells not shown.
3. Note that the BRAC boundaries are estimated.

0 1 2 4 Miles

CA STATE PLANE ZONE 2 (NAD83)

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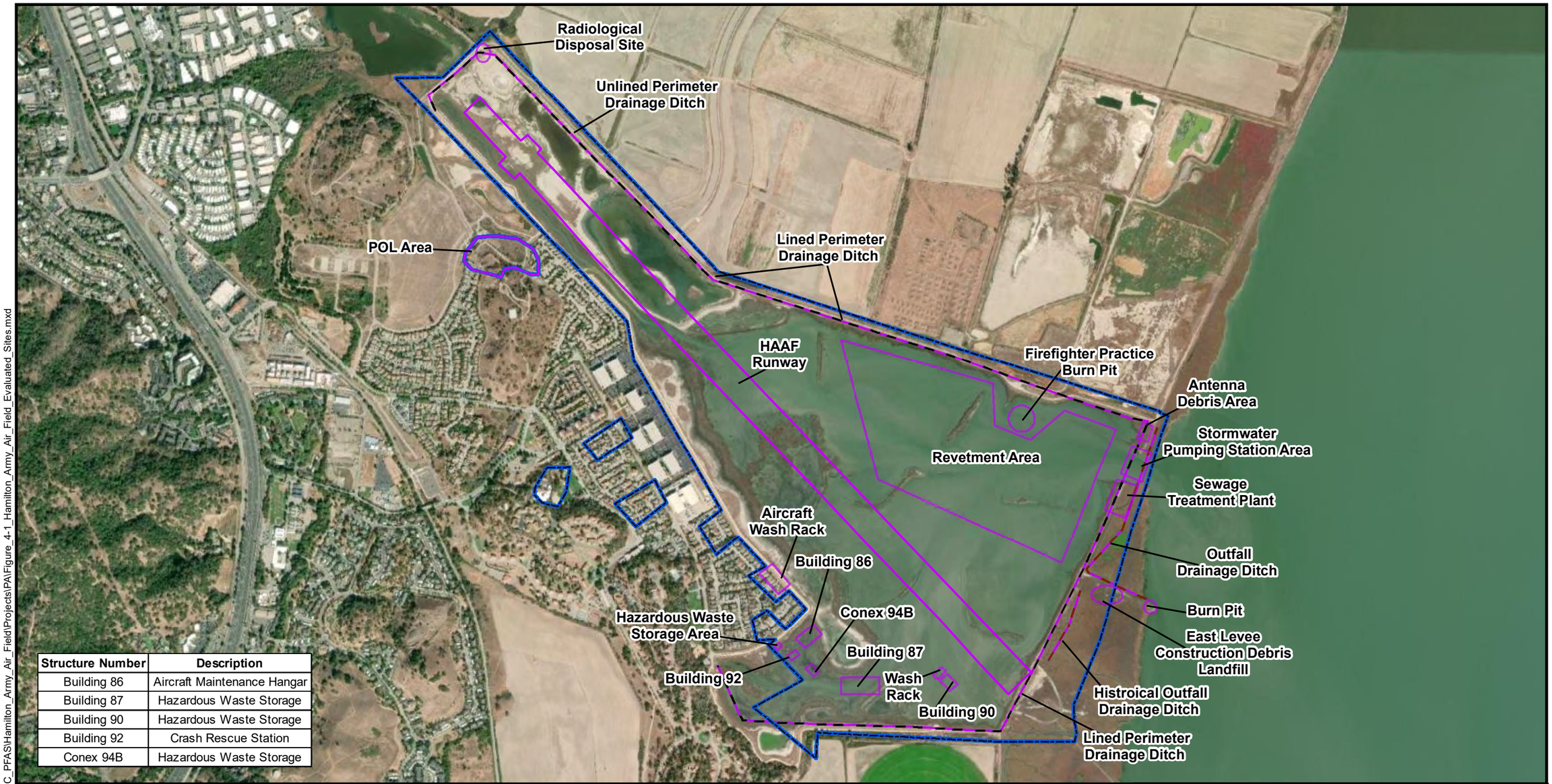
POTABLE WELLS WITHIN A 4-MILE RADIUS
HAMILTON ARMY AIRFIELD
NOVATO, CALIFORNIA

FIGURE 2-4 | DATE: 5/17/2023



Structure Number	Description
Building 86	Aircraft Maintenance Hangar
Building 87	Hazardous Waste Storage
Building 90	Hazardous Waste Storage
Building 92	Crash Rescue Station
Conex 94B	Hazardous Waste Storage

LEGEND:

- BRAC Parcel Boundary
- Evaluated Sites
- Outfall Drainage Ditch
- Perimeter Drainage Ditch

NOTES:

1. Background Source: ESRI World Imagery (Vivid/Maxar,11/2021).
2. BRAC Property Boundary has been estimated.
3. Estimated locations for evaluated sites are based on U.S. Army (1988), Weston (1990), Earth Tech (1994), IT (2000), and CH2MHill (2003).

0 500 1,000 2,000 Feet

CA STATE PLANE ZONE 2 (NAD83)

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EVALUATED SITES
HAMILTON army AIRFIELD
NOVATO, CALIFORNIA

FIGURE 4-1 | DATE: 5/26/2023

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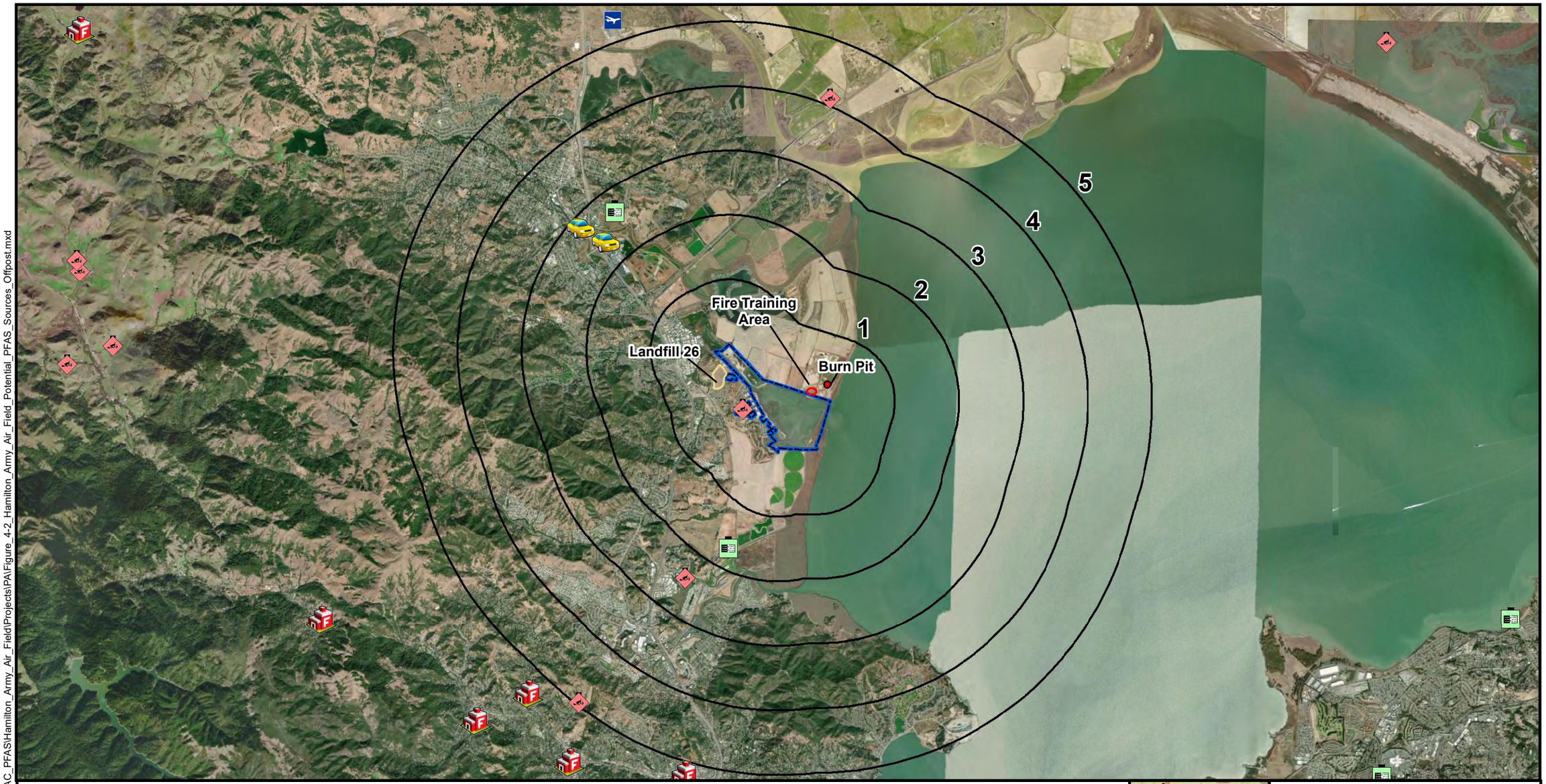

C:\Data\Civil_Transfer\GIS\BRAC_PFAS\Hamilton_Army_Air_Field\Projects\PA\Figure_4-2_Hamilton_Army_Air_Field_Potential_PFAS_Sources_Offpost.mxd

LEGEND:

- BRAC Parcel Boundary
- Distance_Ring
- Landfill 26
- Fire Training Area
- Burn Pit
- Solid Waste Landfill
- Airport
- Waste Water Treatment Plant
- Car Wash
- Fire Station

NOTES:

1. Background Source: ESRI World Imagery (Vivid/Maxar,11/2021).
2. Data Source: California State GeoPortal/ESRI; MyGEOData (WWTP, Solid Waste Landfills, Airports, Firestations).
3. BRAC Property Boundary has been estimated.
4. Fire Training Area (IT 2001), Landfill 26 (Earth Tech 1994), Burn Pits (CSCC 2003).
5. Car wash facilities (Google 2023).

0 1 2 4 Miles

CA STATE PLANE ZONE 2 (NAD83)

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POTENTIAL PFAS SOURCES
WITHIN A 5-MILE RADIUS
HAMILTON army AIRFIELD
NOVATO, CALIFORNIA

FIGURE 4-2 | DATE: 5/19/2023