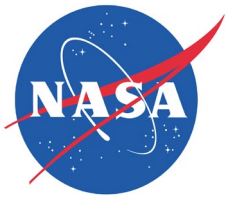
National Aeronautics and Space Administration




Final

# Third Five-Year Review Report

Goddard Space Flight Center
Wallops Flight Facility
Wallops Island, Virginia

**February 2024**

# FINAL

# THIRD FIVE-YEAR REVIEW REPORT

# NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
# GODDARD SPACE FLIGHT CENTER
# WALLOPS FLIGHT FACILITY
# WALLOPS ISLAND, VIRGINIA

**SUBMITTED BY:**
National Aeronautics and Space Administration
Goddard Space Flight Center
Wallops Flight Facility
Building F-160, Room C167
Wallops Island, Virginia 23337

**FEBRUARY 2024**

# EXECUTIVE SUMMARY

The National Aeronautics and Space Administration (NASA) conducted this Five-Year Review (FYR) for Goddard Space Flight Center, Wallops Flight Facility (WFF) located in Wallops Island, Virginia, as specified in Section VI(G)(5)(c) of the *Administrative Agreement on Consent (AAOC)* RCRA-03-2004-0201TH (EPA and NASA, 2004) for the WFF Environmental Compliance and Restoration (ECR) Program; Paragraph 70 of AAOC RCRA-03-2021-0022TH (EPA and NASA, 2021) for the WFF Formerly Used Defense Sites (FUDS); and, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121. WFF is not on the National Priorities List (NPL); however, the more recent AAOC (EPA and NASA, 2021) incorporates the EPA Superfund Alternative approach into the agreement which allows for integration of NASA's CERCLA response obligations and RCRA corrective action obligations under the AAOCs without being formally listed on the NPL. This is the third FYR conducted at WFF by NASA under the AAOC. The first FYR was completed in 2013 the second FYR was completed in 2018 (NASA, 2014 and 2019b).

This report is consistent with the EPA (2001a) *Comprehensive Five-Year Review Guidance* and generally follows the EPA (2016) *Five-Year Review Recommended Template*. It summarizes the evaluation of remedies and remedial actions that resulted in hazardous substances, pollutants, or contaminants remaining at sites above levels that allow for unlimited use and unrestricted exposure (UU/UE), and for which there is a final Record of Decision (ROD). The following two AAOC sites require a CERCLA FYR:

- Operable Unit 2–Former Fire Training Area (FFTA)
- Operable Unit 3–Waste Oil Dump (WOD)

The objective of the FYR is to evaluate the effectiveness of the remedies to determine if these continue to be protective of human health and the environment in accordance with the requirements set forth in the RODs. In addition, FYR reports identify issues found during the review and document recommendations to address them. This evaluation was accomplished through a review of various reports and documents pertaining to post-remedy implementation activities, analytical data, and findings, and through site visits, interviews, and inspections. The community was notified of the review process through public notices. This report identifies circumstances that may prevent a particular remedy from functioning as designed or providing sufficient protection of human health and the environment. The overall evaluations of the effectiveness of each remedy are presented as protectiveness statements in the *Five-Year Review Summary Form* provided at the beginning of the report.

**FFTA**: The first FYR identified per- and polyfluoroalkyl substances (PFAS) as contaminants of emerging concern likely present at the FFTA based on historical site use and proximity to the airfield runway. Although no issues were identified for the Selected Remedy or COCs identified in the Record of Decision (ROD), this necessitated a protectiveness-deferred determination for the FFTA. The report recommended determining the presence of PFAS before the second FYR. Land Use Controls (LUCs) are in place preventing the use of site groundwater for drinking or other purposes. Groundwater samples were collected at FFTA in 2016; PFAS were detected at concentrations exceeding the available comparison values at that time. The protectiveness determination was deferred again in the second FYR due to the lack of regulatory criteria for PFAS. No other issues were identified for the remedy or COCs during the second FYR. A Preliminary Assessment (PA), Site Inspection (SI), and Expanded SI for PFAS at the Main Base (MB) have since been completed. The results indicate the presence of PFAS in site media (soil, groundwater, and

surface water) at the FFTA and in an adjacent drainage channel at concentrations above available comparison values, including EPA Regional Screening Levels (RSLs) and ecological screening values (ESVs). The Expanded SI Report recommended a multi-phase Remedial Investigation (RI) for PFAS, which will include human health and ecological risk assessments. PFAS were evaluated again in this FYR. The first phase of the RI was scoped in 2023 so additional data collection and the risk assessments have not been completed. Because there is no direct human health exposure and LUCs are maintained, a "short-term protective" determination has been made for the FFTA during this FYR. PFAS will be evaluated again in the next FYR, at which time the RI risk assessments are expected to be completed. Several long-term monitoring well integrity issues were identified at the FFTA during the current FYR, which will be addressed before the next LTM event. Arsenic and manganese remain at concentrations above cleanup levels in some wells, which will continue to be monitored over the next FYR period.

WOD: The first and second FYRs did not identify any issues for the WOD: The remedy at WOD was deemed protective. LUCs are in place preventing the use of site groundwater for drinking or other purposes and monitoring will continue. PFAS were detected in groundwater at the WOD during the PFAS SI since the second FYR. Therefore, PFAS were evaluated for the WOD in this FYR. The first phase of a multi-phase RI was scoped in 2023 so additional data collection and the risk assessments have not been completed. Because there is no direct human health exposure and LUCs are maintained, a "short-term protective" determination has been made for the WOD during this FYR. PFAS will be evaluated again in the next FYR, at which time the RI risk assessments are expected to be completed. Arsenic remains at concentrations above cleanup levels in some wells, which will continue to be monitored over the next FYR period.

# FIVE-YEAR REVIEW SUMMARY FORM

| SITE IDENTIFICATION | | |
|---|---|---|
| **Site Name:** NASA Wallops Flight Facility | | |
| **EPA ID:** VA8800010763 | | |
| **Region:** 3 | **State:** VA | **City/County:** Wallops Island / Accomack County |

| SITE STATUS | |
|---|---|
| **NPL Status:** To date this facility has not been proposed for NPL listing; however, the more recent 2021 AAOC RCRA-03-2021-0022TH incorporates the EPA Superfund Alternative approach into the agreement which allows for integration of NASA's CERCLA obligations and RCRA corrective action obligations under the AAOCs without being formally listed on the NPL. | |
| **Multiple Operable Units (OUs)?** Yes | **Has the site achieved construction completion?** No |

| REVIEW STATUS |
|---|
| **Lead agency:** Other Federal Agency<br>**If "Other Federal Agency" was selected above, enter Agency name:** National Aeronautics and Space Administration (NASA) |
| **Author name (Federal or State Project Manager):** David Liu, Project Coordinator |
| **Author affiliation:** NASA, Environmental Compliance and Restoration Program |
| **Review period:** January 2019 – December 2023 |
| **Date of site inspection:** May 17, 2023 |
| **Type of review:** Statutory |
| **Review number:** 3 |
| **Triggering action date:** March 7, 2019 |
| **Due date *(five years after triggering action date)*:** March 7, 2024 |

# FIVE-YEAR REVIEW SUMMARY FORM (continued)

| Issues/Recommendations |
|---|
| **OU(s) without Issues/Recommendations Identified in the Five-Year Review:** |
| Both sites have issues and recommendations as noted below. |

**Issues and Recommendations Identified in the Five-Year Review:**

| **OU(s): 2–Former Fire Training Area (FFTA)** | **Issue Category: Changed Site Conditions** | | | |
|---|---|---|---|---|
| | **Issue:** PFAS were detected in soil, groundwater, surface water, and sediment at concentrations exceeding the available comparison values (Environmental Protection Agency [EPA] Regional Screening Levels [RSLs], values derived from EPA RSL calculator, and most current and applicable ecological screening values [ESVs]). | | | |
| | **Recommendation:** NASA will conduct a multi-phase RI and work with EPA and VDEQ to determine the most appropriate path forward for the presence of PFAS at the FFTA. | | | |
| **Affect Current Protectiveness** | **Affect Future Protectiveness** | **Party Responsible** | **Oversight Party** | **Milestone Date** |
| No | Yes | NASA | EPA/State | Final Phase 1 RI Work Plan by December 2025 (before next FYR) |

| **OU(s): 3–Waste Oil Dump (WOD)** | **Issue Category: Changed Site Conditions** | | | |
|---|---|---|---|---|
| | **Issue:** PFAS were detected in groundwater at concentrations exceeding the available comparison values (EPA RSLs). | | | |
| | **Recommendation:** NASA will conduct a multi-phase RI and work with EPA and VDEQ to determine the most appropriate path forward for the presence of PFAS at the WOD. | | | |
| **Affect Current Protectiveness** | **Affect Future Protectiveness** | **Party Responsible** | **Oversight Party** | **Milestone Date** |
| No | Yes | NASA | EPA/State | Final Phase 1 RI Work Plan by December 2025 (before next FYR) |

# FIVE-YEAR REVIEW SUMMARY FORM (continued)

| Protectiveness Statement(s) |
|---|
| **The Protectiveness Statements for the Sites are summarized below.** |

| *Operable Unit:* | Protectiveness Determination: | *Planned Addendum Completion Date:* |
|---|---|---|
| 2–FFTA | Short-term Protective | N/A |

*Protectiveness Statement:*
The remedy at FFTA currently protects human health and the environment because there is no direct exposure, LUCs are maintained, and post-closure groundwater monitoring is performed. RIs to evaluate risks are ongoing at the time of this review. In order for the remedy to be protective in the long-term, the following actions need to be taken (complete multi-phase PFAS RI including human health and ecological risk assessments for PFAS in soil, groundwater, surface water, and sediment) to ensure protectiveness.

| *Operable Unit:* | *Protectiveness Determination:* | *Planned Addendum Completion Date:* |
|---|---|---|
| 3–WOD | Short-term Protective | N/A |

*Protectiveness Statement:*
The remedy at WOD currently protects human health and the environment because there is no direct exposure, LUCs are maintained, and post-closure groundwater monitoring is performed. RIs to evaluate risks are ongoing at the time of this review. In order for the remedy to be protective in the long-term, the following actions need to be taken (complete multi-phase PFAS RI including a human health risk assessment and potentially ecological risk assessment for PFAS in groundwater and potentially other media) to ensure protectiveness.

**The signature below acknowledges NASA's review and acceptance of the enclosed Five-Year Review document findings for the Wallops Flight Facility Sites summarized herein. The findings of these Five-Year Reviews, acknowledged by this signature, are summarized in this Five-Year Review Summary Form, and are detailed in the pages that follow.**

David Reth Digitally signed by David Reth
Date: 2024.03.05 12:33:27 -05'00'

**David A. Reth, Director**
**Management Operations**
**Goddard Space Flight Center**

**Date**

This page intentionally left blank

# TABLE OF CONTENTS

**List of Appendices (Included electronically only)**



**List of Tables (Provided at end of document).**



**List of Figures (Provided at end of document)**

# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| µg | Microgram(s) |
| µg/kg | Microgram(s) per kilogram |
| µg/L | Microgram(s) per liter |
| AFFF | Aqueous film forming foams |
| AOC | Area of Concern |
| AAOC | Administrative Agreement on Consent |
| ARAR | Applicable or Relevant and Appropriate Requirements |
| bgs | Below ground surface |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act of 1980 |
| CFR | Code of Federal Regulations |
| COC | Chemical of Concern |
| DCE | Dichloroethene |
| ECR | Environmental Compliance and Restoration |
| EPA | U.S. Environmental Protection Agency |
| ESV | Ecological screening value |
| FAA | Federal Aviation Administration |
| FEMA | Federal Emergency Management Administration |
| FFTA | Former Fire Training Area |
| FMB | Facilities Management Branch |
| FS | Feasibility Study |
| FUDS | Formerly Used Defense Site |
| FYR | Five-Year Review |
| GIS | Geographic Information System |
| HHRA | Human health risk assessment |
| HI | Hazard index |
| HQ | Hazard quotient |
| IC | Institutional control |
| kg | Kilogram(s) |
| L | Liter |
| LTM | Long-term monitoring |
| LUC | Land use control |
| MB | Main Base [parcel of WFF facility] |
| MCL | Maximum Contaminant Level |
| mg | Milligram(s) |
| mg/kg | Milligram(s) per kilogram |
| mg/L | Milligram(s) per liter |
| ML | Main Land [parcel of WFF facility] |
| msl | Mean sea level (above or with respect to) |
| NAAS | [Chincoteague] Naval Auxiliary Air Station |
| NACA | National Advisory Committee for Aeronautics |
| NASA | National Aeronautics and Space Administration |
| NCP | National Oil and Hazardous Substances and Contingency Plan (i.e., National Contingency Plan) |
| ng | Nanogram(s) |
| ng/L | Nanogram(s) per liter |
| NOAA | National Oceanic and Atmospheric Administration |

| | |
|---|---|
| NPL | National Priorities List |
| NSZD | Natural source zone depletion |
| O&M | Operation and maintenance |
| ORP | Oxidation-reduction potential |
| OU | Operable Unit |
| PA | Preliminary Assessment |
| PFAS | Per- and polyfluoroalkyl substances |
| PFBA | Perfluorobutanoic acid |
| PFBS | Perfluorobutanesulfonic acid |
| PFDA | Perfluorodecanoic acid |
| PFDoA or PFDoDA | Perfluorododecanoic acid |
| PFHpA | Perfluoroheptanoic acid |
| PFHxA | Perfluorohexanoic acid |
| PFHxS | Perfluorohexanesulfonic acid |
| PFNA | Perfluorononanoic acid |
| PFOA | Perfluorooctanoic acid |
| PFOS | Perfluorooctanesulfonic acid |
| PFPeA | Perfluoropentanoic acid |
| PFPeS | Perfluoropentanesulfonic acid |
| PFHpS | Perfluoroheptanesulfonoic acid |
| PFTA or PFTetA | Perfluorotetradecanoic acid |
| PFTrDA | Perfluorotridecanoic acid |
| PFUnA or PFUDA | Perfluoroundecanoic acid |
| ppt | Parts per trillion |
| PRP | Potentially Responsible Party |
| RACR | Remedial Action Completion Report |
| RAGS | Risk Assessment Guidance for Superfund |
| RAO | Remedial Action Objective |
| RCRA | Resource Conservation and Recovery Act of 1976 |
| RD | Remedial Design |
| RI | Remedial Investigation |
| ROD | Record of Decision |
| RPM | Remedial Project Manager |
| RSL | Regional Screening Level |
| SERDP | Strategic Environmental Research and Development Program |
| SI | Site Investigation or Site Inspection |
| TBC | To-be-considered |
| TSCA | Toxic Substances Control Act |
| U.S. | United States |
| USACE | U.S. Army Corps of Engineers |
| UFP-QAPP | Uniform Federal Policy for Quality Assurance Project Plan |
| UST | Underground storage tank |
| UU/UE | Unlimited use and unrestricted exposure |
| VC | Vinyl chloride |
| VDEQ | Virginia Department of Environmental Quality |
| WOD | Waste Oil Dump |
| WFF | Wallops Flight Facility |
| WI | Wallops Island [parcel of WFF] |

# 1.0 INTRODUCTION

The purpose of a five-year review (FYR) is to evaluate the implementation and performance of remedies to determine if the remedies are and will continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in FYR reports. In addition, FYR reports identify issues found during the review and document recommendations to address them. The National Aeronautics and Space Administration (NASA) performed this FYR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, as amended, consistent with the National Contingency Plan (NCP) (Title 40 of the Code of Federal Regulations [CFR] Section 300.430[f][4][ii]), and considering United States (U.S.) Environmental Protection Agency (EPA) policy. The report was prepared in accordance with EPA's (2001a) *Comprehensive Five-Year Review Guidance*. NASA is the potentially responsible party (PRP) for the subject sites in the FYR.

This is the third FYR for NASA Goddard Space Flight Center's Wallops Flight Facility (WFF) located in Wallops Island, Virginia (Figure 1-1). WFF has not been officially proposed for addition to the National Priorities List (NPL). The most recent Administrative Agreement on Consent (AAOC) RCRA-03-2021-0022TH (EPA and NASA, 2021) incorporates the EPA Superfund Alternative approach into the agreement which allows for integration of NASA's CERCLA response obligations and RCRA corrective action obligations under the AAOCs without being formally listed on the NPL. The triggering action for this statutory review is the completion of the previous FYR (NASA, 2019b). The FYR has been prepared because hazardous substances, pollutants, or contaminants remain at the facility above levels that allow for unlimited use and unrestricted exposure (UU/UE).

Two sites under the AAOC require a CERCLA FYR: The Former Fire Training Area (FFTA) and the Waste Oil Dump (WOD) (Figure 1–2). Other environmental restoration sites or Areas of Concern (AOCs) at the facility (see Table 1–1) are not included in the FYR, because they are still under investigation or have been closed out under the AAOCs, or they are under other regulatory programs (e.g., Virginia's underground storage tank [UST] program) (NASA, 2023i).

The FYR was led by David Liu, the NASA Project Coordinator for the WFF Environmental Compliance and Restoration (ECR) Program. Participants included Lorie Baker, the Remedial Project Manager (RPM) for EPA, Kyle Newman, the RPM for Virginia Department of Environmental Quality (VDEQ), and NASA contractor participants from Tetra Tech. They are referred to collectively in this report as the RPM Team. The regulatory agencies were notified of the initiation of the FYR in January 2023 during an RPM meeting associated with the AAOC sites. The review began on January 30, 2023, and evaluates the data collected between December 2017 and December 2022.

This page intentionally left blank

# 2.0 FIVE-YEAR REVIEW PROCESS

## 2.1 ADMINISTRATIVE COMPONENTS

The EPA and VDEQ were notified in January 2023 about the initiation of the FYR process, which includes data and document reviews as well as site inspections and interviews. The NASA Project Coordinator assisted with the review as the base representative. The EPA and the VDEQ assisted with the review as the support agencies' representatives.

Site-specific FYR evaluations are presented in Section 4.0 for the FFTA and Section 5.0 for the WOD. FYR process components include the following:

- Community involvement
- Document review
- Data review
- Site inspection
- Interviews

## 2.2 COMMUNITY INVOLVEMENT

A public notice was posted in the Eastern Shore Post on February 24, 2023, to notify the public that this FYR had been initiated (see Figure 1-3). There were no public responses or inquiries for interviews. A notice will be posted to announce the completion of the FYR Report and that the review and report results will be available to the public on the WFF restoration program website and at the following locations. The Administrative Record for WFF is also available at these locations. A copy of the FYR Report will be provided to the Federally Recognized Tribes in Virginia and the Catawba Indian Nation.

| **Eastern Shore Public Library** | **Island Library** |
|---|---|
| 23610 Front St | 4077 Main St |
| Accomac, Virginia 23301 | Chincoteague, Virginia 23336 |
| 757-787-3400 | 757-336-3460 |

This page intentionally left blank

# 3.0 BACKGROUND INFORMATION

## 3.1 FACILITY PHYSICAL CHARACTERISTICS

WFF is in Accomack County, Virginia, and consists of three land parcels: Main Base (MB), Mainland (ML), and Wallops Island (WI) (Figure 1–1). The MB is comprised of 1,927 acres located near the intersection of Virginia Routes 798 and 175. The ML is located about 6 miles to the south of the MB on Virginia Route 679 and consists of 1,207 acres containing about 100 acres of usable land; the remaining acreage is marshland. The ML parcel is connected to the WI parcel by a causeway constructed in 1960. The WI parcel is a 7-mile-long 3,395-acre barrier island.

NASA, and its predecessor organization, the National Advisory Committee for Aeronautics (NACA), have had a presence at WFF since 1945. NACA commenced operations on the southern portion of WI in 1945 launching its first rocket during that year. In 1946, NACA constructed launch and radar support and experimental facilities. NASA was officially created by the federal government in 1958. In 1959, NASA expanded its presence at WFF with the lease of the MB from the Navy on June 30, 1959, and the acquisition of the ML. NASA formally acquired the MB from the Navy on December 1, 1961. The Navy operated the Chincoteague Naval Auxiliary Air Station (NAAS) at the MB from 1942 until 1959, when NASA acquired the facility. The Navy took control of the MB in 1942 and in 1943 constructed runways, buildings, and other support facilities for naval aviation and aviation ordnance testing and training. The Navy conducted pilot training and aviation and ordnance testing at the facility until the base was closed in 1959 (Occu-Health, 1999; USACE, 2000).

NASA continues to maintain the runways constructed at the facility by the Navy and occupies many of the structures and buildings that were present at the time of the property transfer. In addition, NASA has expanded and constructed additional buildings within the WFF area to support their mission and to provide support to other tenant organizations. NASA constructed the causeway that connects the ML to WI in 1960.

## 3.2 LAND AND RESOURCE USE

The mission of WFF has undergone several changes since it was established by NASA in 1959, but the main focus has been and continues to be rocket research, the management of suborbital projects, suborbital and orbital tracking, aeronautical research, and space technology research. NASA does not manufacture rockets or rocket fuels/propellants at WFF. Rocket motors are transported to the WFF from other facilities.

The facility maintains operational launch range and airfield capabilities to meet ongoing and emerging needs in the science, aerospace, defense, and commercial industries. In addition, Wallops is a multi-user/multi-tenant facility that supports satellite tracking and commanding, military operations and training, scientific investigations, technology development and testing, as well as commercial aerospace. The facility's diverse mission sets and on-site partners include the U.S. Navy, National Oceanic and Atmospheric Administration (NOAA), the Federal Aviation Administration (FAA), Virginia Space, and the Mid-Atlantic Regional Spaceport.

WFF is one of the major employers in Accomack County and employs a number of highly educated and trained engineers, research scientists, and technicians. Tourism, mainly on Chincoteague and Assateague Islands, and agriculture are the other major economic sectors within Accomack County. The immediate community around WFF includes residential areas, large farms, and a large campground surrounding the various WFF land parcels. Drinking water at NASA WFF and nearby Town of Chincoteague is obtained

from a series of production wells which are screened in the middle Yorktown-Eastover Aquifer. These production wells and the finished drinking water are routinely sampled and analyzed for potential contaminants, including per- and polyfluoroalkyl substances (PFAS).

## 3.3 BASE-WIDE INVESTIGATIONS

Base-wide Preliminary Assessments (PAs) and Site Inspections/Investigations (SIs) have been performed since the 2018 FYR on MB and WI for PFAS. PFAS investigations (including Remedial Investigations [RIs]), monitoring activities, and mitigation efforts at the facility are ongoing at the time of this third FYR. The following media have been characterized or monitored for PFAS: Drinking water, soil, groundwater, surface water, sediment, wastewater, and biosolids. The specifics of PFAS investigations at the facility thus far can be found in the following documents:

**PFAS Source Area Investigations**

- **MB**
  - Groundwater Investigation for PFAS at FFTA (NASA, 2016 and 2017c)
  - 2017 PFAS Sampling (2017a, 2017b, 2017d, and 2017e)
  - PA/SI for PFAS at MB (2019c and 2020)
  - ESI for PFAS at MB (2021d and 2023f)
  - Runway 4-22 Aqueous Film Forming Foam (AFFF) Response Area Investigation (2023a)

- **WI**
  - PA/SI for PFAS at WI (2021f and 2023g)
  - Launch Pad 0-B Expansion Area Investigation (2023e)

- **MB and WI**
  - SI Addendum for PFAS (2021c)

**PFAS Monitoring Programs on Main Base**

- 2017 PFAS Sampling (2017b and 2017d)
- 2018 to 2021 PFAS Sampling Annual Reports (2019e, 2021a, 2022b, and 2023d)
- Perimeter Monitoring Well Installation and PFAS Sampling (2017d and 2019a)
- Production Well Aquifer Testing (2017f and 2019a)
- PFAS Sampling Work Plans (2022a and 2023h)

In addition, PFAS treatability studies and pilot studies are ongoing internal to NASA.

The documents detailing these PFAS investigation were generated in general accordance with the Uniform Federal Policy for Quality Assurance Project Plan (UFP-QAPP) (NASA, 2021e) and UFP-QAPP Revision-1 (NASA, 2023h).

## 3.4 CLIMATE CHANGE

Facilities in coastal areas prone to flooding are dealing with or will be dealing with changes in climate that may impact their readiness capabilities and infrastructure resilience. EPA Region 3 climate change impacts of higher temperatures, increases in precipitation events, and sea level rise need to be considered when assessing the current and future success of remedies. Region 3 has Geographic Information System (GIS) web application tools and files that combine data on Superfund Site locations with sea level rise and storm

surge data from NOAA, as well as flooding data from Federal Emergency Management Agency (FEMA) and the Nature Conservancy (Active Waters).

The current FYR sites do not have actively powered remediation systems in need of climate resilience. That is, there are no active recirculation systems or other powered remedies (e.g., soil vapor extraction) in operation at the FFTA or WOD. Monitoring wells are inspected regularly as part of typical operation and maintenance (O&M) and land use control (LUC) inspections. Higher temperatures and droughts can negatively impact vegetation. However, this does not affect remedy protectiveness at the current FYR sites, both of which have in situ groundwater remedies in the long-term monitoring (LTM) stage.

Climate change impacts are discussed under Question C in the technical assessment for each of the FFTA and WOD sites (see Sections 4.5.3 and 5.5.3, respectively). The FFTA and WOD sites' elevations are above that which will be affected by sea level rise or storm surges in the coming decades. The in situ groundwater remedies in place at the FFTA and WOD would not be impacted by periodic flooding. Vegetative covers are not a component of the groundwater remedies at the FFTA and WOD, so higher temperatures and droughts would not affect remedy protectiveness at the sites.

This page intentionally left blank

# 4.0 FORMER FIRE TRAINING AREA

## 4.1 SITE BACKGROUND

FFTA is located along Runway 10–28 in the northern portion of the MB (Figure 4-1). The site was used by NASA for firefighter training exercises circa 1965 to 1987. It is reported that flammable liquids were dispersed onto the ground, into a pit, onto an abandoned plane fuselage, and/or into a tank and ignited for these exercises. Petroleum-contaminated soils were excavated and removed from the site by NASA in 1986 because of a removal order from VDEQ (NASA, 2022d). The area was identified as an AOC because of the site use history as well as visible staining.

FFTA is an open grass field and is no longer used for firefighter training. The FFTA is not used for any specific purpose, and there are no plans for residential development of the site. No change in the use of the site is likely because it is adjacent to an active runway, which is an important part of NASA's and other WFF tenants' mission. Shallow groundwater flows northeast and east through the site. Shallow groundwater is not used by NASA for any purpose other than environmental monitoring and there are no plans for the development of this resource for potable use in the future. Residential development of FFTA and exposure to groundwater are restricted as required by the Record of Decision (ROD) (Tetra Tech, 2007c). Effective implementation of the institutional controls (ICs) by the LUC Remedial Design (RD) prevents site development and exposure to site groundwater (Tetra Tech, 2008c).

The Town of Chincoteague shallow and deep groundwater supply wells are located more than 4,500 feet east (hydraulically side-gradient) of the FFTA-impacted shallow groundwater. The four active, deep production wells for WFF are located more than 2,500 feet south (hydraulically upgradient) of FFTA.

## 4.2 RESPONSE ACTION SUMMARY

### 4.2.1 Basis for Taking Action

Action was needed at FFTA to mitigate human health risks from exposure to Chemicals of Concern (COCs) in groundwater. The COCs were identified initially by the baseline human health risk assessment (HHRA) in the Supplemental RI Report (Tetra Tech, 2004b). The cleanup goals were developed in the Tetra Tech (2005a) Feasibility Study (FS) and finalized in the (2007c) ROD. There are no COCs associated with ecological risk at FFTA. The groundwater to surface water pathway was evaluated during the RI. COCs were identified in groundwater based on hypothetical future residential exposure to groundwater via ingestion, dermal contact, or inhalation. No action was required for other media. The COCs in groundwater are benzene, cis-1,2-dichloroethene (DCE), vinyl chloride (VC), 4-methylphenol, naphthalene, arsenic, and manganese (Table 4-1). A chronology of events for the FFTA is presented in Table 4-2.

### 4.2.2 Response Actions

Prior to the ROD (and any CERCLA response), approximately 120 cubic yards of petroleum-contaminated soils were excavated and removed from the site by NASA in 1986 because of a removal order from VDEQ under the UST Program (NASA, 2022d).

#### 4.2.2.1 Remedial Action Objectives

Based on the evaluation of site conditions, an understanding of the contaminants, the physical properties in media of concern, the results of risk assessments, and an analysis of applicable or relevant and

appropriate requirements (ARARs), the following remedial action objectives (RAOs) were finalized in the ROD for FFTA:

- Prevent the exposure to and use of the contaminated groundwater at the FFTA, which presents an unacceptable risk associated with the hypothetical future resident use of shallow groundwater.

- Restore impacted groundwater at the FFTA to drinking water standards and attain cleanup levels established in the ROD.

No RAO was developed specific to soil vapor or potential vapor intrusion issues at the time of the FS and ROD. See Section 4.5.2 for a discussion of potential vapor intrusion at FFTA.

#### 4.2.2.2 Remedy Components

The selected remedy for FFTA consists of the following components:

- In-Situ Biological Treatment (Biostimulation) via injection
- Institutional Controls / LUCs
- Long-term groundwater monitoring

The COCs and associated cleanup levels from the ROD are provided in Table 4-1.

### 4.2.3 Status of Implementation

The remedial action has been fully implemented. The Pilot Study Work Plan was finalized and approved in 2008 (Tetra Tech, 2008a). The pilot study conducted in December 2008 involved injections of biostimulation substrate within the contaminant plume area and performance monitoring. The monitoring results were presented in the Pilot Study Report for FFTA (Tetra Tech, 2009b). Concentrations were reduced within the plume area sufficiently such that EPA and VDEQ concurred that full-scale implementation of biostimulation was not necessary. Groundwater performance monitoring was initiated in August 2009 and the LTM program was approved and implemented in 2010 (Tetra Tech, 2010c). Groundwater LTM is ongoing. LUCs were implemented in 2008 (Tetra Tech, 2008c). The Remedial Action Completion Report (RACR) documenting that all components of the remedy were implemented and functioning was finalized in 2011 (Tetra Tech, 2011a).

#### 4.2.3.1 Institutional Controls (ICs)

The LUC boundary within which ICs are enforced at FFTA is shown on Figure 4-1. The ICs for FFTA are linked to the restricted area and are included in the Facilities Master Plan and Tool used by the WFF Facilities Management Branch (FMB). The FMB reviews the Tool to issue dig permits and review/evaluate proposed land use activities. The IC objectives from the LUC RD are listed in Table 4-3. LUC inspections are performed annually by NASA. The restrictions will remain in place until concentrations of hazardous substances in shallow groundwater are reduced to allow for UU/UE.

#### 4.2.3.2 Systems Operation & Maintenance (O&M)

NASA currently performs groundwater LTM sampling activities for FFTA. LTM events occur every 15 months at the time of this FYR. Contractors evaluate the data, document LTM activities, and provide the reports to NASA, EPA, and VDEQ. The LTM Program (e.g., sampling analyses, frequency, and wells) is updated as needed by NASA with concurrence from EPA and VDEQ. See Section 4.4.3–Data Review for additional information regarding groundwater monitoring at FFTA.

## 4.3 PROGRESS SINCE THE LAST REVIEW

This is the third FYR report for FFTA. No substantive issues were identified during the site inspection during the previous FYR. The 2013 and 2018 FYRs identified the presence of PFAS at the site and deferred protectiveness for additional data collection and until promulgated criteria are available. EPA has published Regional Screening Levels (RSLs) for six PFAS since the 2018 FYR through May 2023 (i.e., preparation of current FYR), and Maximum Contaminant Levels (MCLs) for PFAS are expected to be finalized in fiscal year 2024.

Additional PFAS sampling has occurred since the 2018 FYR, including a PA/SI (NASA, 2019c, 2020, and 2021c) and Expanded SI (2021d and 2023f). The FFTA area is referred to as PFAS "Area 9" in the SI and Expanded SI. The SI and Expanded SI included soil, sediment, surface water (including seeps), and groundwater sampling for PFAS. See data review discussion in Section 4.4.3. The report recommended performing a multi-phase RI for PFAS to further evaluate the extent of PFAS in soil and groundwater at the FFTA, further evaluate the groundwater to surface water pathway in an adjacent drainage channel, and to perform human health and ecological risk assessments. Treatability studies are also being implemented at the FFTA to evaluate the effectiveness of various treatment media to remove PFAS from aqueous and solid matrices. A pre-design investigation was conducted to provide high-resolution data that was used to design a pump test and treatability study for PFAS-containing groundwater, the results of which will be included in the forthcoming PFAS RI work plan. Additionally, a seep treatment system was constructed and began operating in June 2022. A list of all PFAS investigations and efforts at WFF is provided in Section 3.3.

Starting with the June 2010 LTM Event, 24 groundwater LTM events have taken place since the implementation of the remedy. Five of these sampling events were completed since the previous FYR. (The March 2018 LTM Event report was not prepared until after the 2018 FYR).

- March 2018 LTM Event (NASA, 2018b)
- December 2018 LTM Event (NASA, 2019d)
- July 2020 LTM Event (NASA, 2021b)
- June 2021 LTM Event (NASA, 2022c)
- September 2022 LTM Event (NASA, 2023c)

Groundwater samples are analyzed for the COCs from the ROD; however, the analytes and sample frequency have been reduced significantly by the RPM Team based on concentration trends since LTM began. LUC inspections occur annually to evaluate site conditions and the monitoring wells. Groundwater LTM results are discussed further in Section 4.4.3.

## 4.4 FIVE-YEAR REVIEW PROCESS

### 4.4.1 Community Involvement

As indicated in Section 2.2, a public notice was posted in the Eastern Shore Post on February 24, 2023, to notify the public that this FYR had been initiated (Figure 1-3). A notice will be posted to announce the completion of the FYR Report and that the review and report results will be available to the public. A copy of the FYR Report will be provided to the Federally Recognized Tribes in Virginia and the Catawba Indian Nation.

### 4.4.2 Document Review

The FYR includes a review of relevant documents. Historical documents for the FFTA are referenced in Table 4-1 with full citations in Section 6.0. All LTM work plans and reports (data reports and LUC inspection reports) are available in the Administrative Record (post-ROD) file.

### 4.4.3 Data Review

LTM groundwater data have been collected since the implementation of the remedial action. The monitoring locations and constituents were identified in the ROD as part of the Performance Standards. The ROD also required the preparation of an LTM Plan. An LTM Plan was developed in 2010 to comply with the groundwater monitoring requirements specified in the ROD. Revised LTM Plans were issued in 2012 (Tetra Tech, 2012e), 2014 (2014a), 2015 (2015e), and 2022 (NASA 2022d) to optimize the LTM Program. Optimization included removing wells and monitoring parameters from the LTM Program and changing LTM event frequency considering performance monitoring results.

The current groundwater monitoring program at FFTA consists of the analysis of naphthalene, total and dissolved arsenic, and total and dissolved manganese in seven monitoring wells. The RPM Team removed cis-1,2-DCE and VC analysis in 2013, benzene in 2018, and 4-methylphenol in 2021. In addition, the LTM wells to be sampled have been reduced to seven, and LTM sampling frequency is now once every 15 months. The LTM groundwater data collected since the previous FYR (i.e., March 2018, December 2018, July 2020, June 2021, and September 2022) are presented in Table A-1 screened against cleanup levels. PFAS soil, sediment, surface water, and groundwater data from the PFAS SI and Expanded SI are presented in Table A-2.

Each LTM event includes groundwater level gauging and sampling monitoring wells specific to the LTM Program. An isoconcentration contour figure showing COC exceedances of cleanup levels for the most recent LTM event in September 2022 is provided as Figure 4-2. The analytical data are compared to cleanup levels for each LTM event in Table A-1. A groundwater elevation contour map for September 2022 is also provided in Appendix A. Temporal analytical data trend graphs for the COCs are provided in Appendix B.

Compared to the site conditions prior to the biostimulation injection in 2008, the maximum concentrations of benzene, 4-methyphenol, naphthalene, and manganese have decreased, and the contaminant plumes have decreased in size. Concentrations of arsenic, manganese, and naphthalene remain above the cleanup goals. The exceedances are limited to the central portion of the site where aquifer conditions appear to still be reducing based on oxidation-reduction potential (ORP) ranges (-55 to -166 millivolts since the last FYR). Several wells were noted to have obstructions and sediment accumulation in the September 2022 LTM Event Report. The report recommended that certain wells be rehabilitated (i.e., developed) or abandoned and reinstalled before the next LTM event in December 2023.

Free product was detected in MW055S (0.13 feet thick) and MW101S (0.76 feet thick) during the October 2022 follow-up LTM event reported in the September 2022 LTM Event Report. December 2015 was the last LTM event that free product was detected (in well MW101S). Free product at the FFTA does not appear to be mobile and is thought to have only accumulated in MW055S and MW101S during periods when the groundwater table is unusually low or experiencing a significant and sustained drop. The report recommended free product monitoring and recovery in these wells and evaluating natural source zone depletion (NSZD) to determine whether the criteria provided in VDEQ's (2012) Case Closure Evaluation of Sites with Free Product memorandum has been achieved.

Several PFAS concentrations from samples collected in PFAS Area 9 (FFTA) during the PFAS SI and Expanded SI exceed human health screening levels and/or ESVs in soil, groundwater, surface water, and sediment samples (NASA, 2020 and 2023f). The data are tabulated in Table A-2. The sample locations and perfluorooctanesulfonic acid (PFOS) relative exceedances are shown on Figures 4-3 through 4-5, which are adapted from the Expanded SI Report.

In soil, two compounds (PFOS and perfluorohexanesulfonic acid [PFHxS]) are at concentrations above human health screening levels and/or ESVs. In groundwater, five compounds (perfluorooctanoic acid [PFOA], PFOS, PFHxS, perfluorohexanoic acid [PFHxA], and perfluorononanoic acid [PFNA]) are at concentrations above groundwater human health screening levels. These screening level exceedances surpass EPA's acceptable cumulative risk criteria for total noncancer HI not to exceed 1. In surface water samples collected from Outfall 003, the Outfall 003 Drainage Channel, and associated seeps downgradient of Area 9, four compounds (PFOA, PFOS, PFHxS, and PFNA) are at concentrations above human health screening levels and/or ESVs. PFAS concentrations detected in the sample from Little Mosquito Creek do not exceed surface water human health screening levels or ESVs. In sediment samples collected downgradient of Area 9, PFOS concentrations exceed the sediment ESV but not the human health screening level. These PFOS exceedances are present in sediment within the Outfall 003 Drainage Channel and Little Mosquito Creek.

### 4.4.4 Site Inspection

The FYR inspection of FFTA was conducted on May 17, 2023. The purpose of the inspection was to assess the monitoring well network and the protectiveness of the ICs portion of the remedy. Appendix C contains the photo log and Appendix D contains the completed site inspection form. No substantive issues were identified at FFTA during the FYR site inspection. The site is located within the controlled federal property of NASA WFF. Both facility and site access are restricted and controlled. Groundwater at the site is not used or accessed other than for environmental monitoring. The inspector noted the wells were in good condition, except for a few that had protective casings and covers that were rusty and deteriorated. These deficiencies were addressed in September 2023. Regular evaluation and periodic reconditioning are conducted as part of typical O&M.

## 4.5 TECHNICAL ASSESSMENT

### 4.5.1 Question A: Is The Remedy Functioning As Intended By The Decision Documents?

Yes, the review of historical documents, ARARs, risk assumptions, site inspection, and LTM data indicate the final remedy is functioning as intended by the ROD. No signs of intrusion, invasive development of the site, or activities that would have violated the ICs were observed. In summary, the remedy is in place and prevents exposure to the site-related contaminants defined in the ROD.

***Remedial Action Performance:*** LTM groundwater data indicate the concentrations of most site contaminants in groundwater are decreasing over time (refer to Section 4.4.3, Appendix A, and Appendix B). However, concentrations of naphthalene (MW058S and MW107), arsenic (MW058S and MW107), and manganese (MW057S, MW058S, and MW061I) continue to exceed cleanup goals at locations where reducing conditions persist. These conditions, enhanced by the biostimulation injection, addressed the benzene, cis-1,2-DCE, and VC COCs, but a return to aerobic and oxidative aquifer conditions is still needed to address remaining naphthalene, arsenic, and manganese. Apparent oxidative conditions are present at well MW057S (ORP values range from 232 to 320 millivolts since the last FYR), but manganese consistently exceeds the cleanup level due to other dissolved manganese flowing through this location. Data quality issues associated with excessive aquifer sediments in LTM wells were identified

in the most recent September 2022 LTM Event Report. The report recommended that certain wells be rehabilitated or abandoned and reinstalled, to address this issue, which may impact arsenic and manganese concentrations in these wells.

***System Operations/O&M:*** Site inspections and periodic sampling events indicate the LTM well network is intact. The September 2022 LTM Event Report recommended rehabilitation or replacement of certain wells to address obstructions and sedimentation. These wells were redeveloped or abandoned and reinstalled in September 2023.

***Implementation of ICs and Other Measures:*** The LUCs are functioning as intended. The FFTA is identified on the base-wide GIS. The site inspection did not identify any exposure problems.

### 4.5.2 Question B: Are The Exposure Assumptions, Toxicity Data, Clean-Up Levels, And RAOs Used At The Time Of The Remedy Selection Still Valid?

Yes, they are still valid. As summarized below, no changes have occurred in exposure assumptions, land use, toxicity, contaminant characteristics, or risk assessment methodology that would require modification of the remedial action or monitoring activities at FFTA. PFAS (chemicals of emerging concern) were identified at FFTA and are being addressed in a multi-phase RI at the time of this FYR. The SI and Expanded SI were completed since the previous FYR. Since the previous FYR through May 2023 (i.e., preparation of current FYR), comparison values are available for PFAS including RSLs for six compounds and ESVs for several compounds. However, MCLs still are not available.

***Changes in Standards and TBCs:*** ARARs and to-be-considered information (TBCs) taken into account during preparation of the ROD were reviewed to determine changes since the LTM Plan for FFTA was issued. There have been no changes to currently relevant ARARs and TBCs.

***Changes in Toxicity and Other Contaminant Characteristics:*** There have been no changes in human health toxicity criteria that would impact the monitoring criteria, except for the criteria for 4-methylphenol and naphthalene. An oral reference dose of 0.005 milligram per kilogram (mg/kg) per day was used to derive the cleanup goal of 27 micrograms per liter (µg/L) for 4-methylphenol. The current oral reference dose of 0.02 mg/kg per day and current exposure assumptions would result in a remedial goal of 185 µg/L. The cleanup goal of 16 µg/L for naphthalene was based on noncarcinogenic effects to an adult resident. At the time the risk assessment was performed during the RI, there were no carcinogenic toxicity criteria available for naphthalene. A cancer slope factor of 0.12 $(mg/kg\text{-}day)^{-1}$ is available from the California EPA. Additionally, an inhalation unit risk of $3.4\times10^{-5}$ $(\mu g \text{ per cubic meter})^{-1}$ is available from the California EPA. The remedial goal for naphthalene for an adult resident based on carcinogenic effects and current EPA exposure assumptions would be 0.46 µg/L for a target cancer risk of $1\times10^{-6}$. The cancer risk associated with the current remedial goal of 16 µg/L would be $3\times10^{-5}$ based on the adult resident remedial goal. This value is within EPA's target risk range of $1\times10^{-4}$ to $1\times10^{-6}$, so the current remedial goal is still protective of human health. A remedial goal for naphthalene calculated for a lifelong resident based on carcinogenic effects and current EPA exposure assumptions would be 0.33 µg/L for a target cancer risk of $1\times10^{-6}$. The cancer risk associated with the current remedial goal of 16 µg/L would be $5\times10^{-5}$ based on the lifelong resident remedial goal, which is also within EPA's target risk range, so the current remedial goal is still protective of human health based on this evaluation.

***Changes in Risk Assessment Methods:*** There have been several changes in EPA risk assessment methodology since the risk assessment in the Tetra Tech (2004b) Supplemental RI Report; although, none of the changes would impact the protectiveness of the remedy. Among these changes are the following:

- The implementation of EPA's Dermal Guidance (Risk Assessment Guidance for Superfund [RAGS] Part E), which was finalized in July 2004. Use of the RAGS Part E guidance would result in slight changes in some dermal exposure parameters. However, the effect of these changes on the calculated risks would be minimal and would not affect the results and conclusions of the risk assessment or the protectiveness of the selected remedy.

- Carcinogens that Act by a Mutagenic Mode of Action. In March 2005, EPA provided general direction on implementing EPA's (2005) Guidelines for Carcinogen Risk Assessment and Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens, because of special considerations for carcinogens that act via a mutagenic mode of action. This guidance does not impact the conclusions of the risk assessment or the protectiveness of the selected remedy, because VC was the only mutagenic chemical detected in groundwater at FFTA, VC was retained as a COC, and the MCL was selected as the cleanup goal.

- RAGS Part F, Supplemental Guidance for Inhalation Risk Assessment, was published in January 2009. Use of the RAGS Part F guidance would result in minor changes in the inhalation risks. However, the effect of these changes on the calculated total risks would be minimal and would not affect the results and conclusions of the risk assessment or the protectiveness of the selected remedy.

- In 2014, EPA updated standard exposure factors for human health (EPA, 2014). For most chemicals the changes in exposure assumptions result in lower risks. However, the reduction in risks would not change the conclusions of the HHRA and the remedy for FFTA would not change.

The 2007 ROD indicated that there were no unacceptable ecological risks, which was based on an evaluation of the 2004 ERA, so the remedy was based on unacceptable human health risks. There have been no changes in ecological risk assessment methodology since the last FYR. There have been no changes in exposure pathways, toxicity data, and other contaminant characteristics that would impact the ecological risk evaluation or affect the protectiveness of the remedy since the last FYR. Ecological risks from exposure to PFAS will be evaluated as part of the multi-phase PFAS RI that is ongoing at the time of this FYR.

***Changes in Exposure Pathways:*** There have been no changes in land use at the FFTA that would have resulted in new exposure pathways to human or ecological receptors or impact the protectiveness of the remedy. Other than PFAS, no new contaminants or new contaminant sources have been identified. PFAS results from the Expanded SI are reported for the FFTA herein and a multi-phase PFAS RI is ongoing at the time of this FYR.

Potential exposures from vapor intrusion into buildings were not evaluated during the RI/FS and was not included in the ROD for FFTA. It is presumed that vapor intrusion would be a potential issue for a future structure until concentrations of the volatile COCs (naphthalene is the only remaining volatile COC above its cleanup level) meet cleanup levels. There is no RAO to minimize human health risk due to potential vapor issue; however, there are no buildings on the site, and the LUCs portion of the remedy prohibits the development of commercial or residential buildings at the site to avoid vapor intrusion issues (Tetra Tech, 2008c). The LUCs have been implemented and are enforced by NASA.

***Expected Progress Towards Meeting RAOs:*** The LUCs prevent exposure to and use of shallow groundwater. LTM groundwater data indicate the concentrations of the majority of the COCs in

groundwater have decreased over time. Remaining wells with arsenic, manganese, and/or naphthalene concentrations above cleanup levels will continue to be monitored.

The remedy is functioning as intended. FFTA will continue to be subject to the FYR requirement until groundwater cleanup levels are achieved (or waived). PFAS are being further evaluated under a multi-phase RI at the time of this FYR.

### 4.5.3 Question C: Has Any Other Information Come To Light That Calls Into Question The Protectiveness Of The Remedy?

No other information has been made available that calls into question the protectiveness of the remedial action.

The risks posed by climate change at WFF are not expected to alter the protectiveness of the remedy at the FFTA site because the site's elevation is above that which will be affected by sea level rise or storm surges in the coming decades. The surface elevation of the FFTA ranges from approximately 27 to 32 feet above mean sea level (msl). WFF could experience 1 to 2 feet of sea level rise in the coming decades: 1.18 feet by 2040 and 2.46 feet by 2060 (NOAA, 2023; high scenario). The in situ groundwater remedy in place at the FFTA would not be impacted by periodic flooding. It does not have any actively powered remediation systems in need of climate resilience. Vegetative cover is not a component of the groundwater remedy at the FFTA, so higher temperatures and droughts would not affect remedy protectiveness.

Ongoing O&M and LUCs/remedy inspections and the FYR process are in place to sufficiently evaluate and recommend actions that may be required to account for impacts to any remedy related to climate change.

### 4.5.4 Interview

During the FYR process, interviews were conducted to document any perceived problems or successes with the remedy that has been implemented to date. Interviews were conducted via questionnaire with the RPM Team (Appendix B). Other than the ongoing PFAS investigations, no issues were identified by the RPMs.

## 4.6 ISSUES/RECOMMENDATIONS

The September 2022 LTM Event Report (NASA, 2023c) identified the presence of petroleum free product in wells MW055S and MW101S. It recommended performing free product recovery and evaluating NSZD to determine whether the criteria provided in VDEQ (2012) has been achieved. The report also recommended rehabilitating or abandoning and reinstalling certain LTM wells to improve metals data quality due to excessive aquifer sediments in the wells. The RPM Team agreed that these recommendations should be pursued as part of LTM and O&M.

Below is the protectiveness issue related to PFAS documented in this third FYR.

| Issues and Recommendations Identified in the Five-Year Review: | | | | |
|---|---|---|---|---|
| **OU(s): 2–FFTA** | **Issue Category: Changed Site Conditions** | | | |
| | **Issue:** PFAS were detected in soil, groundwater, surface water, and sediment at concentrations exceeding the available comparison values (EPA RSLs, values derived from EPA RSL calculator, and most current and applicable ESVs). | | | |
| | **Recommendation:** NASA will conduct a multi-phase RI and work with EPA and VDEQ to determine the most appropriate path forward address PFAS at the FFTA. | | | |
| **Affect Current Protectiveness** | **Affect Future Protectiveness** | **Party Responsible** | **Oversight Party** | **Milestone Date** |
| No | Yes | NASA | EPA/State | Final Phase 1 RI Work Plan by December 2025 (before next FYR) |

### *4.7* OTHER FINDINGS

During the FYR site inspection in May 2023, protective casings and covers for certain monitoring wells included in LTM program were noted as needing maintenance. This was also documented in the September 2022 LTM Event Report that recommended certain wells be rehabilitated or abandoned and reinstalled. These deficiencies were addressed in September 2023 and the details will be documented in the December 2023 LTM Event Report.

### 4.8 PROTECTIVENESS STATEMENT

| Protectiveness Statement(s) | | |
|---|---|---|
| *Operable Unit:*<br>2–FFTA | *Protectiveness Determination:*<br>Short-term Protective | *Planned Addendum Completion Date:*<br>N/A |
| *Protectiveness Statement:*<br>The remedy at FFTA currently protects human health and the environment because there is no direct exposure, LUCs are maintained, and post-closure groundwater monitoring is performed. RIs to evaluate risks are ongoing at the time of this review. In order for the remedy to be protective in the long-term, the following actions need to be taken (complete multi-phase PFAS RI including human health and ecological risk assessments for PFAS in soil, groundwater, surface water, and sediment) to ensure protectiveness. | | |

### 4.9 NEXT REVIEW

The next FYR report for FFTA is required 5 years from the completion date of this review.

This page intentionally left blank

# 5.0 WASTE OIL DUMP

## 5.1 SITE BACKGROUND

The WOD was reportedly used for disposal of waste oils and possibly solvents from the 1940s through the 1950s. At least some of the waste oils were excess and could not be used for firefighting training activities. No records are available to determine the types and quantities of materials disposed or the duration of this activity at the site. A review of aerial photographs from 1943 through 1994 indicate the presence of ground scarring and possible excavation at the WOD from 1943 to 1961.

The WOD is at the north end of the Runway 17–35 and is currently maintained as an open space (Figure 5-1). The WOD is not used for any specific purpose, and there are no plans for residential development of the site. No change in the use of the site is likely as it is adjacent to an active runway that is an important part of the future facility plan. Shallow groundwater is not used by NASA for any purpose other than environmental monitoring and there are no plans for the development of this resource for potable use in the future. Residential development of WOD and exposure to groundwater are restricted as required by the ROD (Tetra Tech, 2008b). Effective implementation of the ICs by the LUC RD prevents site development and exposure to site groundwater (Tetra Tech, 2008d).

The Town of Chincoteague shallow and deep groundwater supply wells are located more than 3,500 feet east (hydraulically side-gradient) of the WOD-impacted shallow groundwater (Tetra Tech, 2017; NASA, 2018a) (some are shown on Figure 5-3). The four active, deep production wells for WFF are located more than 4,500 feet south (hydraulically upgradient) of the WOD.

## 5.2 RESPONSE ACTION SUMMARY

### 5.2.1 Basis for Taking Action

Action was needed at WOD to mitigate human health risks from exposure to COCs in groundwater. The COCs were identified initially by the baseline HHRA in the Supplemental RI Report (Tetra Tech, 2004c). The cleanup goals were developed in the Tetra Tech (2005b) FS, and finalized in the Tetra Tech (2008b) ROD. There are no COCs associated with ecological risk at WOD. The groundwater to surface water pathway was evaluated during the RI. COCs were identified in groundwater based on future residential exposure to groundwater via ingestion, dermal contact, or inhalation. No action was required for other media. The COCs in groundwater are benzene and arsenic (Table 5-1). A chronology of events for the WOD is presented in Table 5-2.

### 5.2.2 Response Actions

Prior to the ROD (and any CERCLA response), approximately 180 cubic yards of petroleum-contaminated soils were excavated and removed from the site by NASA in 1986, because of a removal order from VDEQ under the UST Program (NASA, 2022d).

#### 5.2.2.1 Remedial Action Objectives

Based on the evaluation of site conditions, an understanding of the contaminants, the physical properties in media of concern, the results of risk assessments, and an analysis of ARARs, the following are the RAOs finalized in the ROD for WOD (Tetra Tech, 2008b):

- Prevent exposure to and use of contaminated groundwater at WOD which presents an unacceptable risk associated with hypothetical future residential use of shallow groundwater.

- Restore impacted groundwater at WOD to drinking water standards (MCLs).

No RAO was developed specific to soil vapor or potential vapor intrusion issues at the time of the FS and ROD. See Section 5.5.2 for a discussion of potential vapor intrusion at WOD.

#### 5.2.2.2 Remedy Components

The selected remedy for WOD consists of the following components:

- In-Situ Biological Treatment (Biostimulation)
- Institutional Controls / LUCs
- Long-term groundwater monitoring

The COCs and associated cleanup levels from the ROD are provided in Table 5-1.

### 5.2.3 Status of Implementation

The remedial action has been fully implemented. The Pilot Study Work Plan to support the design and implementation of the biostimulation injections was issued in November 2008 (Tetra Tech, 2008e). The pilot study injections were conducted in December 2008 followed by full-scale injection planning. The pilot study report and monitoring results were included as an appendix to the Remedial Action Work Plan (Tetra Tech, 2009d). The LTM Plan for WOD was finalized and approved in 2009 (Tetra Tech, 2009e). The full-scale biostimulation injection was conducted in December 2009 and the first round of post-injection monitoring was conducted in March 2010. Groundwater LTM has continued since the initial performance monitoring. LUCs were implemented in 2008 (see Section 5.2.3.1). The RACR documenting that all components of the remedy were implemented and functioning was finalized in 2011 (Tetra Tech, 2011a).

#### 5.2.3.1 Institutional Controls

The LUC boundary within which ICs are enforced at WOD is shown on Figure 5-1. The ICs for WOD are linked to the restricted area and are included in the Facilities Master Plan and Tool used by the WFF FMB. The FMB reviews the Tool to issue dig permits and review/evaluate proposed land use activities. The IC objectives from the LUC RD are listed in Table 5-3 (Tetra Tech, 2008d). LUC inspections are performed annually by NASA. These restrictions will remain in place until concentrations of hazardous substances in shallow groundwater are reduced to allow for UU/UE.

#### 5.2.3.2 Systems Operation & Maintenance (O&M)

NASA currently performs groundwater LTM sampling activities for WOD. LTM events occur twice every 5 years (intended to be once in the spring and once in the fall) since the RPM Team changed the frequency in 2017 (NASA, 2023b). Contractors evaluate the data, document LTM activities, and provide the reports to NASA, EPA, and VDEQ. The LTM Program is updated (e.g., sampling analyses, frequency, and wells) as needed by NASA with concurrence from EPA and VDEQ. See Section 5.4.3 for additional information regarding groundwater monitoring at WOD.

## 5.3 PROGRESS SINCE THE LAST REVIEW

This is the third FYR report for WOD. No issues were identified for WOD during the first or second FYRs. PFAS has been detected in groundwater at WOD wells since the last FYR (see Section 5.4.3). LTM and LUC inspections have continued without issue since the last FYR.

Starting with the June 2010 LTM Event, 18 groundwater LTM events have taken place since the implementation of the remedy. Two of these sampling events were completed since the previous FYR:

- July 2020 LTM Event (NASA, 2021b)
- September 2022 LTM Event (NASA, 2023b)

Groundwater samples are analyzed for the COCs identified in the ROD. The analytes and sample frequency have been reduced significantly by RPM Team decisions based on concentration trends since LTM began. LUC inspections occur annually to evaluate site conditions and the monitoring wells. Groundwater LTM results are discussed further in Section 5.4.3.

## 5.4 FIVE-YEAR REVIEW PROCESS

### 5.4.1 Community Involvement

As indicated in Section 2.2, a public notice was posted in the Eastern Shore Post on February 24, 2023, to notify the public that this FYR had been initiated (Figure 1-3). A notice will be posted to announce the completion of the FYR Report and that the review and report results will be available to the public. A copy of the FYR Report will be provided to the Federally Recognized Tribes in Virginia and the Catawba Indian Nation.

### 5.4.2 Document Review

The FYR includes a review of relevant documents. Historical documents for the WOD are referenced in Table 5-2 with full citations in Section 6.0. The LTM work plans and reports (data reports and LUC inspection reports) are available in the Administrative Record (post-ROD) file.

### 5.4.3 Data Review

LTM groundwater data have been collected since the implementation of the remedial action, which was a pilot test followed by a full-scale biostimulation injection. The monitoring locations and constituents were identified in the WOD ROD as part of the Performance Standards. The ROD also required the preparation of an LTM Plan. An LTM Plan was developed in 2009 to comply with the groundwater monitoring requirements of the ROD for WOD (Tetra Tech, 2009e). Revised LTM Plans were issued in 2012 (Tetra Tech, 2012f), 2014 (2014b), 2015 (2015f), and 2022 (NASA, 2022e) to optimize the LTM Program. Optimization included removing wells and monitoring parameters from the LTM Program and changing LTM event frequency considering performance monitoring results.

The current groundwater monitoring program at WOD consists of the analysis of total and dissolved arsenic in seven monitoring wells. The RPM Team removed benzene analysis in 2014. In addition, the LTM wells to be sampled have been reduced to seven, and LTM sampling frequency is now twice every 5 years with one sampling event in the spring and one in the fall. The LTM groundwater data collected since the previous FYR (i.e., July 2020 and September 2022) are provided in Table A-3. PFAS groundwater data from the PFAS SI are provided in Table A-4.

Each LTM event includes groundwater level gauging and sampling monitoring wells specific to the LTM Program at WOD. An isoconcentration contour figure showing COC exceedances of cleanup levels for the most recent LTM event in September 2022 is provided as Figure 5-2. The analytical data are compared to cleanup levels for each LTM event in Table A-3. The groundwater potentiometric contour map for September 2022 is also provided in Appendix A. Temporal analytical data trend graphs for the COCs are provided in Appendix B.

Compared to the site conditions prior to the biostimulation injection in 2009, the maximum concentrations of benzene and arsenic have decreased, and the contaminant plume(s) has(have) decreased in size. The concentrations of arsenic remain above the cleanup goals in the central portion of the site in two wells (15-MW001 and 15-MW007) where aquifer reducing conditions appear to persist based on ORP ranges (-14 to -169 millivolts since the last FYR).

Groundwater samples collected from some WOD wells during the PFAS SI detected three compounds (PFOA, PFOS, and PFNA) at concentrations exceeding current human health screening levels (NASA, 2020). At the time of SI, the concentrations did not exceed comparison criteria and therefore further investigation was not conducted. These screening level exceedances surpass EPA's acceptable cumulative risk criteria for total noncancer HI not to exceed 1. The data are tabulated in Table A-4. The sample locations and relative exceedances are shown on Figure 5-3, adapted from the SI Report. Further investigation of PFAS at the WOD will be conducted as part of the multi-phase PFAS RI ongoing at the time of this FYR.

### 5.4.4 Site Inspection

The FYR inspection of WOD was conducted on May 17, 2023. The purpose of the inspection was to assess the monitoring well network and the protectiveness ICs portion of the remedy. Appendix C contains the photo log and Appendix D contains the completed site inspection form. No substantive issues were identified at WOD during the FYR site inspection. The site is located within the controlled federal property of NASA WFF. Both facility and site access are restricted and controlled. Groundwater at the site is not used or accessed other than for environmental monitoring. The inspector noted the wells were in good condition, except for a few that had protective casings and covers that were rusty and deteriorated and well labels that were fading. These deficiencies were addressed in September 2023. Regular evaluation and periodic reconditioning are conducted as part of typical O&M.

## 5.5 TECHNICAL ASSESSMENT

### 5.5.1 Question A: Is The Remedy Functioning As Intended By The Decision Documents?

Yes, the review of historical documents, ARARs, risk assumptions, site inspection, and LTM data indicate the final remedy is functioning as intended by the ROD. No signs of intrusion, invasive development of the site, or activities that would have violated the ICs were observed. In summary, the remedy is in place and prevents exposure to the site-related contaminants defined in the ROD.

***Remedial Action Performance:*** Benzene cleanup was demonstrated in 2014 when the analyte was removed from LTM after its concentrations were below the cleanup level during four consecutive monitoring events. LTM groundwater data indicate the concentrations of arsenic are below the cleanup level in most of the monitoring wells. Arsenic levels fluctuate closely above and below the cleanup level in two wells (15-MW001 and 15-MW007) on the western portion of the site where reducing conditions persist based on ORP measurements. These conditions, enhanced by the biostimulation injection, addressed the benzene COC, but a return to aerobic and oxidative aquifer conditions is still needed to address remaining arsenic.

***System Operations/O&M:*** Site inspections and periodic sampling events indicate the LTM well network is intact.

***Implementation of ICs and Other Measures:*** The LUCs are functioning as intended. The WOD is identified on the base-wide GIS. The site inspection did not identify any exposure problems.

### 5.5.2 Question B: Are The Exposure Assumptions, Toxicity Data, Clean-Up Levels, And RAOs Used At The Time Of The Remedy Selection Still Valid?

Yes, they are still valid. As summarized below, no changes have occurred in exposure assumptions, land use, toxicity, contaminant characteristics, or risk assessment methodology that would require modification of the remedial action or monitoring activities at WOD. PFAS (chemicals of emerging concern) were identified at WOD during the SI and are being addressed in a multi-phase RI at the time of this FYR. Since the previous FYR through May 2023 (i.e., preparation of current FYR), comparison values are available for PFAS including RSLs for six compounds and ESVs for several compounds. However, MCLs still are not available.

***Changes in Standards and TBCs:*** ARARs and TBCs taken into account during preparation of the ROD were reviewed to determine changes since the LTM Plan for WOD was issued. There have been no changes to currently relevant ARARs and TBCs.

***Changes in Toxicity and Other Contaminant Characteristics:*** There have been no changes in human health toxicity criteria that would impact the monitoring criteria or effect the protectiveness of the remedy at WOD.

***Changes in Risk Assessment Methods:*** There have been several changes in EPA risk assessment methodology since the risk assessment in the Tetra Tech (2004c) Supplemental RI Report; although, none of the changes would impact the protectiveness of the remedy. Among these changes are the following:

- The implementation of the EPA's Dermal Guidance (RAGS Part E), which was finalized in July 2004. Use of the RAGS Part E guidance would result in slight changes in some dermal exposure parameters. However, the effect of these changes on the calculated risks would be minimal and would not affect the results and conclusions of the risk assessment or the protectiveness of the selected remedy.

- Carcinogens that Act by a Mutagenic Mode of Action. In March 2005, the EPA provided general direction on implementing the EPA's 2005 Guidelines for Carcinogen Risk Assessment and Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens because of special considerations for carcinogens that act via a mutagenic mode of action. This guidance affects risks calculated for children and adolescents. However, there were no chemicals considered to act via a mutagenic mode of action detected in groundwater at WOD. Therefore, using the new guidance would not affect the results of the risk assessment for groundwater or the remedy for the site.

- RAGS Part F, Supplemental Guidance for Inhalation Risk Assessment was published in January 2009. Use of the RAGS Part F guidance would result in minor changes in the inhalation risks. However, the effect of these changes on the calculated total risks would be minimal and would not affect the results and conclusions of the risk assessment or the protectiveness of the remedy for the site.

- In 2014, EPA updated standard exposure factors for human health (EPA, 2014). For most chemicals the changes in exposure assumptions result in lower risks. However, the reduction in risks would not change the conclusions of the HHRA and the remedy for WOD would not change.

The 2008 ROD indicated that there were no unacceptable ecological risks, which was based on an evaluation of the 2004 ERA, so the remedy was based on unacceptable human health risks. There have been no changes in ecological risk assessment methodology since the last FYR. There have been no changes in exposure pathways, toxicity data, and other contaminant characteristics that would impact the ecological risk evaluation or affect the protectiveness of the remedy since the last FYR.

***Changes in Exposure Pathways:*** There have been no changes in land use at the WOD that would have resulted in new exposure pathways to human or ecological receptors or impact the protectiveness of the remedy. Other than PFAS, no new contaminants or new contaminant sources have been identified. PFAS results are reported for the WOD herein and a multi-phase PFAS RI is ongoing at the time of this FYR.

Vapor intrusion was evaluated in the uncertainty section of the HHRA for the WOD and it was concluded there were no vapor intrusion issues. The LUC RD for WOD prohibits the development of commercial or residential buildings at the site to avoid vapor intrusion issues (Tetra Tech, 2008c). There have been no changes in land use at the WOD that would have resulted in new exposure pathways to human or ecological receptors or impact the protectiveness of the remedy. Further, the volatile COC, benzene, has reached its cleanup goal in groundwater.

***Expected Progress Towards Meeting RAOs:*** The LUCs prevent exposure to and use of shallow groundwater. LTM groundwater data indicate the concentrations of the majority of the COCs in groundwater have decreased over time. Remaining wells with arsenic concentrations above cleanup levels will continue to be monitored.

The remedy is functioning as intended. WOD will continue to be subject to the FYR requirement until groundwater cleanup levels are achieved (or waived).

### 5.5.3 Question C: Has Any Other Information Come To Light That Calls Into Question The Protectiveness Of The Remedy?

No other information has been made available that calls into question the protectiveness of the remedial action. The risks posed by climate change at WFF are not expected to alter the protectiveness of the remedy at the WOD site because the site's elevation is above that which will be affected by sea level rise or storm surges in the coming decades. The surface elevation of the WOD ranges from approximately 12 to 28 feet msl. WFF could experience 1 to 2 feet of sea level rise in the coming decades: 1.18 feet by 2040 and 2.46 feet by 2060 (NOAA, 2023; high scenario). The in situ groundwater remedy in place at the WOD would not be impacted by periodic flooding. It does not have any actively powered remediation systems in need of climate resilience. Vegetative cover is not a component of the groundwater remedy at the WOD, so higher temperatures and droughts would not affect remedy protectiveness.

Ongoing O&M and LUCs/remedy inspections and the FYR process are in place to sufficiently evaluate and recommend actions that may be required to account for impacts to any remedy related to climate change.

## 5.6 ISSUES AND RECOMMENDATIONS

| **Issues and Recommendations Identified in the Five-Year Review:** | | | | |
|---|---|---|---|---|
| **OU(s): 3–WOD** | **Issue Category: Changed Site Conditions** | | | |
| | **Issue:** PFAS were detected in groundwater at the WOD at concentrations exceeding the available comparison values (EPA RSLs). | | | |
| | **Recommendation:** NASA will conduct a multi-phase RI and work with EPA and VDEQ to determine the most appropriate path forward address PFAS at the WOD. | | | |
| **Affect Current Protectiveness** | **Affect Future Protectiveness** | **Party Responsible** | **Oversight Party** | **Milestone Date** |
| No | Yes | NASA | EPA/State | Final Phase 1 RI Work Plan by December 2025 (before next FYR) |

## 5.7 OTHER FINDINGS

During the FYR site inspection in May 2023, protective casings and covers for certain monitoring wells included in the LTM program were noted as needing maintenance (e.g., redevelopment or abandonment and reinstallation). These deficiencies were addressed in September 2023 and the details will be documented in the report for the next monitoring event.

## 5.8 PROTECTIVENESS STATEMENT

| **Protectiveness Statement(s)** | | |
|---|---|---|
| *Operable Unit:*<br>3–WOD | *Protectiveness Determination:*<br>Short-term Protective | *Planned Addendum Completion Date:* N/A |
| *Protectiveness Statement:*<br>The remedy at WOD currently protects human health and the environment because there is no direct exposure, LUCs are maintained, and post-closure groundwater monitoring is performed. RIs to evaluate risks are ongoing at the time of this review. In order for the remedy to be protective in the long-term, the following actions need to be taken (complete multi-phase PFAS RI including a human health risk assessment and potentially ecological risk assessment for PFAS in groundwater and potentially other media) to ensure protectiveness. | | |

## 5.9 NEXT REVIEW

The next FYR report for the WFF is required 5 years from the completion date of this review.

This page intentionally left blank

# 6.0 REFERENCES


Conder, J., Arblaster, J., Larson, E., Brown, J., and Higgins, C., 2020. Technical Report: Guidance for Assessing the Ecological Risks of PFAS to Threatened and Endangered Species at Aqueous Film Forming Foam Impacted Sites. Revision 2. Geosyntec Consultants and Colorado School of Mines. SERDP Project: ER18-1614. September.

Divine, C., Zodrow, J., Frenchmeyer, M., Dally, K., Osborn, E., Anderson, P. 2020. Approach for Assessing PFAS Risk to Threatened and Endangered Species. Arcadis US Inc. SERDP Project ER18-1653. March.

Ebasco (Ebasco Services, Inc.), 1990. Final Report of Site Investigation, Wallops Flight Facility, Wallops Island, Virginia. January.

EPA (United States Environmental Protection Agency), 1988. Guidance on Remedial Actions for Contaminated Groundwater at Superfund Sites. EPA/540/G-88-003, OSWER Directive 9283.1-2, Office of Emergency and Remedial Response, Washington, D.C. December.

EPA, 1991a. OSWER (Office of Solid Waste and Emergency Response) Directive 9355.0-30: Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions. April 22.

EPA, 1991b. Risk Assessment Guidance for Superfund: Volume I (Human Health Evaluation Manual) Part B (Development of Risk-Based Preliminary Remediation Goals). EPA/540/R-92/003. December.

EPA, 1995a. Guidelines for Carcinogen Risk Assessment. EPA/630/P-03/001F. March.

EPA, 1995b. Land Use in the CERCLA Remedy Selection Process. OSWER Directive No. 9355.7-04. May.

EPA, 2001a. Comprehensive Five-Year Review Guidance. EPA 540-R-01-007, OSWER No. 9355.7-03B-P, Office of Emergency and Remedial Response. June.

EPA, 2001b. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual, Part E, Supplemental Guidance for Dermal Risk Assessment. EPA/540/R/99/005. OSWER 9285.7-02EP. September.

EPA, 2004. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, (Part E, Supplemental Guidance for Dermal Risk Assessment), Final. EPA/540/R/99/005, Office of Emergency and Remedial Response, Washington, D.C. July.

EPA, 2005. Guidelines for Carcinogen Risk Assessment and Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens. EPA/630/R-03/003F. March.

EPA, 2009a. Risk Assessment Guidance for Superfund: Volume 1, Human Health Evaluation Manual (Part F). OSWER 9285.7-82. January.

EPA, 2009b. Five-Year Reviews, Frequently Asked Questions (FAQs) and Answers. September.

EPA, 2011. Recommended Evaluation of Institutional Controls: Supplement to "Comprehensive Five-Year Review Guidance". OSWER 9355.7-18. September.

EPA, 2012a. Clarifying the Use of Protectiveness Determinations for CERCLA Five-Year Reviews. OSWER 9200.2-111. September.

EPA, 2012b. Assessing Protectiveness at Sites for Vapor Intrusion. Supplement to the "Comprehensive Five-Year Review Guidance". OSWER 9200.2-84. November.

EPA, 2012. Compilation and Review of Data on Relative Bioavailability of Arsenic in Soil and Recommendations for Default Value for Relative Bioavailability of Arsenic in Soil. OSWER Directive 9200.1-113. December.

EPA, 2014. Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors. OSWER 9200.1-120. February 6.

EPA, 2016. Five-Year Review Recommended Template. OLEM 9200.0-89. Amends Appendix E of EPA (2001a) Comprehensive Five-Year Review Guidance. Transmitted via memorandum from Office of Superfund Remediation and Technology Innovation. January 20.

EPA, 2018. Cleanups at Federal Facilities: Emerging Contaminants and Federal Facility Contaminants of Concern. https://www.epa.gov/fedfac/emerging-contaminants-and-federal-facility-contaminants-concern. Accessed on July 3, 2018.

EPA, 2023a. Regional Screening Levels for Chemical Contaminants at Superfund Sites. https://www.epa.gov/risk/regional-screening-levels-rsls. May.

EPA, 2023b. Regional Screening Levels for Chemical Contaminants at Superfund Sites, Regional Screening Levels (RSLs)–User's Guide, https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search, Washington, DC.

EPA and NASA (National Aeronautics and Space Administration), 2004. Administrative Agreement on Consent, United States Environmental Protection Agency Region 3 in the Matter of National Aeronautics and Space Administration Wallops Island, Virginia. Docket Number: RCRA-03-2004-0201TH. September.

EPA and NASA, 2021. Administrative Agreement on Consent, United States Environmental Protection Agency Region 3 in the Matter of National Aeronautics and Space Administration, Wallops FUDS Program, NASA Wallops Flight Facility, Wallops Island, Virginia 23337. Docket Number: RCRA-03-2021-0022TH. January.

Grippo, M., Hayse, J., Hlohowskyj, I., and Picel, K., 2021. Derivation of PFAS Ecological Screening Values. Argonne National Laboratory. September.

Metcalf & Eddy, 1992. Site Investigation at Wallops Flight Facility, Wallops Island, Virginia. Final Report Revision. August.

Metcalf & Eddy, 1993. Fire Training Area Remedial Investigation/Feasibility Study Final Work Plan, Wallops Flight Facility Wallops Island, Virginia. March.

Metcalf & Eddy, 1996. Remedial Investigation for Former Fire Training Area, NASA Wallops Flight Facility, Wallops Island, Virginia. February.

NASA (National Aeronautics and Space Administration), 1988. Preliminary Assessment Report for Wallops Flight Facility, Wallops Island, Virginia. April.

NASA, 2004. Letter Report–Waste Oil Dump (WOD) Groundwater Sampling Results. From Sue Fields to Michelle Price-Fay and Paul Herman. November.

NASA, 2014. First Five-Year Review, NASA Wallops Flight Facility, Wallops Island, Virginia. Finalized December 2013. Signed January 30.

NASA, 2016. Work Plan Groundwater Investigation for Perfluorinated Compounds at Former Fire Training Area, NASA Wallops Flight Facility, Wallops Island, Virginia. October.

NASA, 2017a. Letter Work Plan, 2017 PFAS Sampling, NASA Wallops Flight Facility, Wallops Island, Virginia. April.

NASA, 2017b. Letter Work Plan Addendum, 2017 PFAS Sampling, Groundwater in Areas West of WFF Runway 10-28, NASA Wallops Flight Facility, Wallops Island, Virginia. April.

NASA, 2017c. Data Summary Report, Groundwater Investigation for Per- and Polyfluoroalkyl Substances at Former Fire Training Area, Goddard Space Flight Facility, Wallops Flight Center, Wallops Island, Virginia. May.

NASA, 2017d. Letter Work Plan, Perimeter Monitoring Well Installation and PFAS Sampling, NASA Wallops Flight Facility, Wallops Island, Virginia. August.

NASA, 2017e. Letter Report, April 2017 PFAS Sampling, NASA Wallops Flight Facility, Wallops Island, Virginia. October.

NASA, 2017f. Letter Work Plan, Production Well Aquifer Testing, NASA Wallops Flight Facility, Wallops Island, Virginia. October.

NASA, 2017g. Data Summary Report, June 2017 Groundwater Monitoring, Former Fire Training Area, Wallops Flight Facility, Wallops Island, Virginia. November.

NASA, 2018a. Data Summary Report for October 2017 Groundwater Monitoring Activities at Waste Oil Dump, NASA Wallops Flight Facility, Wallops Island, Virginia. March.

NASA, 2018b. Data Summary Report, March 2018 Groundwater Monitoring, Former Fire Training Area, Wallops Flight Facility, Wallops Island, Virginia. September.

NASA, 2019a. Data Summary Report, PFAS Perimeter Monitoring Well and Observation Well Installation and Sampling, NASA Wallops Flight Facility, Wallops Island, Virginia. February.

NASA, 2019b. Second Five-Year Review, NASA Wallops Flight Facility, Wallops Island, Virginia. Finalized December 2018. Signed 19 February 2019.

NASA, 2019c. Preliminary Assessment and Site Investigation Work Plan for Per- and Polyfluoroalkyl Substances, NASA Wallops Flight Facility, Wallops Island, Virginia. March.

NASA, 2019d. Data Summary Report for December 2018 Groundwater Monitoring, Operable Unit 2–Former Fire Training Area, NASA Wallops Flight Facility, Wallops Island, Virginia. September.

NASA, 2019e. Final 2018 PFAS Sampling Annual Summary Report, Goddard Space Flight Facility, Wallops Flight Center, Wallops Island, Virginia. October.

NASA, 2020. Site Investigation Report for Per- and Polyfluoroalkyl Substances, Goddard Space Flight Center, NASA Wallops Flight Facility, Wallops Island, Virginia. November.

NASA, 2021a. Final 2019 PFAS Sampling Annual Summary Report, Goddard Space Flight Facility, Wallops Flight Center, Wallops Island, Virginia. January.

NASA, 2021b. Data Summary Report for July 2020 Groundwater Monitoring, Operable Unit 3–Waste Oil Dump, NASA Wallops Flight Facility, Wallops Island, Virginia. February.

NASA, 2021c. Final Site Investigation Report Addendum for Per- and Polyfluoroalkyl Substances, Goddard Space Flight Facility, Wallops Flight Center, Wallops Island, Virginia. June.

NASA, 2021d. Expanded Site Investigation Work Plan for Per- and Polyfluoroalkyl Substances at Main Base, Goddard Space Flight Facility, Wallops Flight Center, Wallops Island, Virginia. August.

NASA, 2021e. Uniform Federal Policy for Quality Assurance Project Plan, Per- and Polyfluoroalkyl Substances for Wallops Flight Facility. August.

NASA, 2021f. Preliminary Assessment and Site Investigation Work Plan for Per- and Polyfluoroalkyl Substances at Wallops Island, Goddard Space Flight Facility, Wallops Flight Center, Wallops Island, Virginia. September.

NASA, 2022a. Routine Sampling Work Plan for Per- and Polyfluoroalkyl Substances, Goddard Space Flight Facility, Wallops Flight Center, Wallops Island, Virginia. January.

NASA, 2022b. 2020 PFAS Sampling Annual Summary Report, Goddard Space Flight Facility, Wallops Flight Center, Wallops Island, Virginia. April.

NASA, 2022c. Data Summary Report for June 2021 Groundwater Monitoring, Operable Unit 2–Former Fire Training Area, NASA Wallops Flight Facility, Wallops Island, Virginia. May.

NASA, 2022d. Uniform Federal Policy for Sampling and Analysis Plan, Operable Unit 2–Former Fire Training Area, Long-Term Monitoring Plan, Revision 4, Goddard Space Flight Facility, Wallops Flight Center, Wallops Island, Virginia. September.

NASA, 2022e. Long Term Monitoring Plan–Rev 4, Waste Oil Dump, NASA Wallops Flight Facility, Wallops Island, Virginia. September.

NASA, 2023a. Final Letter Work Plan Runway 4-22 AFFF Response Area, Wallops Flight Center, Wallops Island, Virginia. January.

NASA, 2023b. Data Summary Report for September 2022 Groundwater Monitoring, Operable Unit 3–Waste Oil Dump, NASA Wallops Flight Facility, Wallops Island, Virginia. March.

NASA, 2023c. Data Summary Report for September 2022 Groundwater Monitoring, Operable Unit 2–Former Fire Training Area, NASA Wallops Flight Facility, Wallops Island, Virginia. August.

NASA, 2023d. 2021 PFAS Sampling Annual Summary Report, Goddard Space Flight Facility, Wallops Flight Center, Wallops Island, Virginia. June.

NASA, 2023e. Launch Pad 0-B Expansion PFAS Investigation Data Summary Report, Wallops Flight Center, Wallops Island, Virginia. June.

NASA, 2023f. Expanded Site Investigation Report for PFAS at Main Base, Goddard Space Flight Facility, Wallops Flight Center, Wallops Island, Virginia. September.

NASA, 2023g. Site Investigation Report for Per- and Polyfluoroalkyl Substances at Wallops Island, Goddard Space Flight Facility, Wallops Flight Center, Wallops Island, Virginia. September.

NASA, 2023h. Uniform Federal Policy for Quality Assurance Project Plan, Per- and Polyfluoroalkyl Substances Investigations–Revision 1, Goddard Space Flight Facility, Wallops Flight Center, Wallops Island, Virginia. September.

NASA, 2023i. Site Management Plan for Fiscal Years 2023 and 2024, NASA Wallops Flight Facility, Wallops Island, Virginia. September.

NOAA (National Oceanic and Atmospheric Administration), 2023. Sea Level Rise Viewer. https://coast.noaa.gov/digitalcoast/tools/slr.html. Access September 4.

Occu-Health, 1999. Environmental Resources Document, NASA Goddard Space Flight Center, Wallops Flight Facility, Wallops Island, Virginia. October.

Tetra Tech, 2003a. Work Plan for Supplemental Remedial Investigation Activities at the Former Fire Training Area and Waste Oil Dump, NASA Wallops Flight Facility, Wallops Island, Virginia. January.

Tetra Tech, 2003b. Community Involvement Plan for NASA Wallops Flight Facility, Wallops Island, Virginia. March.

Tetra Tech, 2004a. Background Soil and Groundwater Investigation Report for the Main Base, NASA Wallops Flight Facility, Wallops Island, Virginia. Revised Final. July.

Tetra Tech, 2004b. Supplemental Remedial Investigation for Former Fire Training Area, NASA Wallops Flight Facility, Wallops Island, Virginia. Revised Final. May.

Tetra Tech, 2004c. Supplemental Remedial Investigation for Waste Oil Dump Site, NASA Wallops Flight Facility, Wallops Island, Virginia. Revised Final. December.

Tetra Tech, 2005a. Feasibility Study for Former Fire Training Area, NASA Wallops Flight Facility, Wallops Island, Virginia. September.

Tetra Tech, 2005b. Feasibility Study for Waste Oil Dump Site, NASA Wallops Flight Facility, Wallops Island, Virginia. October.

Tetra Tech, 2007a. Proposed Remedial Action Plan, Former Fire Training Area, NASA Wallops Flight Facility, Wallops Island, Virginia. January.

Tetra Tech, 2007b. Proposed Remedial Action Plan, Waste Oil Dump, NASA Wallops Flight Facility, Wallops Island, Virginia. January.

Tetra Tech, 2007c. Record of Decision, Former Fire Training Area, NASA Wallops Flight Facility, Wallops Island, Virginia. December.

Tetra Tech, 2008a. Pilot Study Work Plan, Former Fire Training Area, NASA Wallops Flight Facility, Virginia. February.

Tetra Tech, 2008b. Record of Decision, Waste Oil Dump Site, NASA Wallops Flight Facility, Wallops Island, Virginia. March.

Tetra Tech, 2008c. Remedial Design for Land Use Controls, Former Fire Training Area, NASA Wallops Flight Facility, Wallops Island, Virginia. October.

Tetra Tech, 2008d. Remedial Design for Land Use Controls, Waste Oil Dump Site, NASA Wallops Flight Facility, Wallops Island, Virginia. October.

Tetra Tech, 2008e. Pilot Study Work Plan, Waste Oil Dump, NASA Wallops Flight Facility, Virginia. November.

Tetra Tech, 2009a. Free Product Monitoring Plan, Former Fire Training Area Site, NASA Wallops Flight Facility, Wallops Island, Virginia. April.

Tetra Tech, 2009b. Pilot Study Report, Former Fire Training Area. NASA Wallops Flight Facility, Virginia. July.

Tetra Tech, 2009c. Supplemental Groundwater Sampling Letter Work Plan, Former Fire Training Area Site, NASA Wallops Flight Facility, Wallops Island, Virginia. July

Tetra Tech, 2009d. Remedial Action Work Plan, Waste Oil Dump Site, NASA Wallops Flight Facility, Virginia. (Includes Pilot Study Report for Waste Oil Dump). September.

Tetra Tech, 2009e. Long-Term Monitoring Plan, Waste Oil Dump, NASA Wallops Flight Facility, Wallops Island, Virginia. October.

Tetra Tech, 2010a. March 2010 Groundwater Investigation Activities, Former Fire Training Area, NASA Wallops Flight Facility, Wallops Island, Virginia. March.

Tetra Tech, 2010b. Data Summary Report for Additional Groundwater Investigation at Former Fire Training Area, NASA Wallops Flight Facility, Wallops Island, Virginia. June.

Tetra Tech, 2010c. Long-Term Monitoring Plan, Former Fire Training Area, NASA Wallops Flight Facility, Wallops Island, Virginia. July.

Tetra Tech, 2010d. Data Summary Report for June 2010 Groundwater Investigation at Former Fire Training Area, NASA Wallops Flight Facility, Wallops Island, Virginia. August.

Tetra Tech, 2010e. Data Summary Report for 6-Month Post-Injection Sampling at Waste Oil Dump, NASA Wallops Flight Facility, Wallops Island, Virginia. August.

Tetra Tech, 2010f. Data Summary Report for September 2010 Groundwater Investigations at Former Fire Training Area, NASA Wallops Flight Facility, Wallops Island, Virginia. December.

Tetra Tech, 2011a. Remedial Action Completion Report, Waste Oil Dump Site, NASA Wallops Flight Facility, Virginia. April.

Tetra Tech, 2011b. Annual Groundwater Monitoring Report for Year 2010, Former Fire Training Area, NASA Wallops Flight Facility, Wallops Island, Virginia. November.

Tetra Tech, 2011c. Annual Groundwater Monitoring Report for Year 2010, Waste Oil Dump, NASA Wallops Flight Facility, Wallops Island, Virginia. November.

Tetra Tech. 2011d, Remedial Action Completion Report, Former Fire Training Area, NASA Wallops Flight Facility, Wallops Island, Virginia. December.

Tetra Tech, 2012a. Annual Groundwater Monitoring Report for Year 2011, Former Fire Training Area, NASA Wallops Flight Facility, Wallops Island, Virginia. May.

Tetra Tech, 2012b. Annual Groundwater Monitoring Report for Year 2011, Waste Oil Dump, NASA Wallops Flight Facility, Wallops Island, Virginia. July.

Tetra Tech, 2012c. Data Summary Report for March 2012 Groundwater Monitoring at Former Fire Training Area, NASA Wallops Flight Facility, Wallops Island, Virginia. May.

Tetra Tech, 2012d. Data Summary Report for March 2012 Groundwater Monitoring at Waste Oil Dump, NASA Wallops Flight Facility, Wallops Island, Virginia. May.

Tetra Tech, 2012e. Long-Term Monitoring Plan–Rev 1, Former Fire Training Area, NASA Wallops Flight Facility, Wallops Island, Virginia. July

Tetra Tech, 2012f. Long-Term Monitoring Plan–Rev 1, Waste Oil Dump Site, NASA Wallops Flight Facility, Virginia. July.

Tetra Tech, 2013a. Annual Groundwater Monitoring Report for Year 2012 for Former Fire Training Area, NASA Wallops Flight Facility, Wallops Island, Virginia. May.

Tetra Tech, 2013b. Annual Groundwater Monitoring Report for Year 2012 for Waste Oil Dump, NASA Wallops Flight Facility, Wallops Island, Virginia. May.

Tetra Tech, 2013c. Data Summary Report for March 2013 Groundwater Monitoring at Waste Oil Dump, NASA Wallops Flight Facility, Wallops Island, Virginia. June.

Tetra Tech, 2014a. Long-Term Monitoring Plan–Rev 2, Former Fire Training Area, NASA Wallops Flight Facility, Wallops Island, Virginia. February.

Tetra Tech, 2014b. Long-Term Monitoring Plan–Rev 2, Waste Oil Dump Site, NASA Wallops Flight Facility, Virginia. February.

Tetra Tech, 2014c. Annual Groundwater Monitoring Report for Year 2013, Former Fire Training Area, NASA Wallops Flight Facility, Wallops Island, Virginia. February.

Tetra Tech, 2014d. Annual Groundwater Monitoring Report for Year 2013, Waste Oil Dump, NASA Wallops Flight Facility, Wallops Island, Virginia. February.

Tetra Tech, 2014e. Data Summary Report for March 2014 Groundwater Monitoring for Former Fire Training Area, NASA Wallops Flight Facility, Wallops Island, Virginia. June.

Tetra Tech, 2014f. Data Summary Report for March 2014 Groundwater Monitoring for Waste Oil Dump, NASA Wallops Flight Facility, Wallops Island, Virginia. June.

Tetra Tech, 2015a. Annual Groundwater Monitoring Report for Year 2014, Former Fire Training Area, NASA Wallops Flight Facility, Wallops Island, Virginia. April.

Tetra Tech, 2015b. Annual Groundwater Monitoring Report for Year 2014, Waste Oil Dump, NASA Wallops Flight Facility, Wallops Island, Virginia. April.

Tetra Tech, 2015c. Data Summary Report for March 2015 Groundwater Monitoring at Former Fire Training Area, NASA Wallops Flight Facility, Wallops Island, Virginia. May.

Tetra Tech, 2015d. Data Summary Report for March 2015 Groundwater Monitoring for Waste Oil Dump, NASA Wallops Flight Facility, Wallops Island, Virginia. May.

Tetra Tech, 2015e. Long-Term Monitoring Plan–Rev 3, Former Fire Training Area, NASA Wallops Flight Facility, Wallops Island, Virginia. September

Tetra Tech, 2015f. Long-Term Monitoring Plan–Rev 3, Waste Oil Dump Site, NASA Wallops Flight Facility, Virginia. September.

Tetra Tech, 2016a. Data Summary Report December 2015 Groundwater Monitoring Former Fire Training Area, NASA Wallops Flight Facility, Wallops Island, Virginia. February.

Tetra Tech, 2016b. Annual Groundwater Monitoring Report for Year 2015 for Waste Oil Dump, NASA Wallops Flight Facility, Wallops Island, Virginia. April.

Tetra Tech, 2016c. Data Summary Report for April 2016 Groundwater Monitoring Activities at Waste Oil Dump, NASA Wallops Flight Facility, Wallops Island, Virginia. June.

Tetra Tech, 2016d. Letter Work Plan–Monitoring Well Installation, Former Fire Training Area, NASA Wallops Flight Facility, Wallops Island, Virginia. August 17.

Tetra Tech, 2016e. Data Summary Report for September 2016 Groundwater Monitoring, Former Fire Training Area, NASA Wallops Flight Facility, Wallops Island, Virginia. December.

Tetra Tech, 2017. Annual Groundwater Monitoring Report for the Year 2016 for Waste Oil Dump, NASA Wallops Flight Facility, Wallops Island, Virginia. February.

USACE (United States Army Corps of Engineers), 2000. Wallops Flight Facility – Main Base – GIS-Based Historical Photographic Analysis. 1938–1940. November.

Versar, 2000. Risk Assessment Update Former Fire Training Area. Goddard Space Flight Center, Wallops Flight Facility, Wallops Island, Virginia. March.

Versar, 2001. Remedial Investigation/Feasibility Study Site 16 Waste Oil Dump Goddard Space Flight Center Wallops Flight Facility Wallops Island, Virginia. March.

VDEQ (Virginia Department of Environmental Quality), 2012. Memorandum: Case Closure Evaluation of Sites with Free Product. Document Number LPR-SRR-03-2012. December 2018.

This page intentionally left blank

This page intentionally left blank

**TABLE 1-1**
**AAOC AREAS OF CONCERN**
**FIVE-YEAR REVIEW**
**NASA WALLOPS FLIGHT FACILITY, WALLOPS ISLAND, VIRGINIA**
**PAGE 1 OF 3**

| AOC No. | OU No. | AOC Name | Location | Status / Alias |
|---|---|---|---|---|
| 1 | 6 | Old Wastewater Treatment Plant | MB | Deferred to FUDS Program / Site 1 (FUDS Project 13). |
| ***2*** | | ***Maintenance Facility*** | ***MB*** | ***Closed Out under AAOC RCRA-03-2004-0201TH / Building E-52, Site 2.*** |
| 3 | | Two 600,000-Gallon Fuel Tanks | MB | Deferred to FUDS Program / Buildings A46-A and A46-B. |
| ***4*** | | ***Debris Pile*** | ***WI*** | ***Closed Out under AAOC RCRA-03-2004-0201TH / Island Debris Pile - North End, Site 4.*** |
| ***5*** | | ***Paint Stain*** | ***WI*** | ***Closed Out under AAOC RCRA-03-2004-0201TH / Paint Spray Booth, Site 5.*** |
| 6 | | Former Island Fueling System | WI | Deferred to UST Programs / Site 6. |
| ***7*** | | ***Transformer Pads*** | ***MB, ML, WI*** | ***Closed Out under AAOC RCRA-03-2004-0201TH / Site 7.*** |
| 8 | | Former Main Base Fueling System | MB | Deferred to UST Program / Site 8. |
| 9 | 4 | Abandoned Drum Dump | MB | Deferred to FUDS Program / Site 9 (FUDS Project 15). |
| 10 | | Advanced Data Acquisition Support Facility | MB | Closed Out under CERCLA / Site 10, ADAS. |
| ***11*** | | ***Transformer Storage Areas*** | ***MB, WI*** | ***Closed Out under AAOC RCRA-03-2004-0201TH / Site 11.*** |
| ***12*** | | ***Former Wind Tunnel*** | ***WI*** | ***Closed Out under AAOC RCRA-03-2004-0201TH / Site 12.*** |
| 13 | 9 | Ordnance Disposal Area | MB | Deferred to FUDS Program / Boat Basin and Visitor's Center, Site 13 (FUDS MMRP Project 07). |
| 14 | 5 | Debris Pile | MB | Deferred to FUDS Program / Site 14 (FUDS Project 15). |

**TABLE 1-1**
**AAOC AREAS OF CONCERN**
**FIVE-YEAR REVIEW**
**NASA WALLOPS FLIGHT FACILITY, WALLOPS ISLAND, VIRGINIA**
**PAGE 2 OF 3**

| AOC No. | OU No. | AOC Name | Location | Status / Alias |
|---|---|---|---|---|
| 15 | 5 | Debris Pile | MB | Deferred to FUDS Program / Site 15 (FUDS Project 15). |
| (none) | **3** | **Waste Oil Dump (WOD)** | **MB** | **Remedial Action Complete; Long-Term Monitoring / Site 16, Pits at end of Runway 17-35.** |
| (none) | | Old Aviation Fuel Tank Farm | MB | Deferred to UST Program. |
| (none) | ***1*** | ***Scrapyard*** | ***MB*** | ***Closed Out under AAOC RCRA-03-2004-0201TH / Building N-222.*** |
| (none) | | PCB Transformer Pad | MB | Closed Out under TSCA and CERCLA / N-161C. |
| (none) | | ***Photographic Tank*** | ***MB*** | ***Closed Out under AAOC RCRA-03-2004-0201TH / M-15 Photo Tank, Building M-15.*** |
| (none) | **2** | **Former Fire Training Area (FFTA)** | **MB** | **Remedial Action Complete; Long-Term Monitoring.** |
| (none) | | Industrial/Sanitary Landfill | MB | Closed under FUDS Program, 2006 |
| (none) | 7 | Construction Debris Landfill | MB | Deferred to FUDS Program (FUDS Project 15). |
| (none) | | ***Pistol/Rifle Range*** | ***MB*** | ***Closed out under AAOC RCRA-03-2004-0201TH.*** |
| (none) | | ***South End Disposal Area (SEDA)*** | ***WI*** | ***Closed Out under AAOC RCRA-03-2004-0201TH.*** |
| (none) | | ***Area of Interest – 20 Transformer (AI-20)*** | ***WI*** | ***Closed Out under AAOC RCRA-03-2004-0201TH.*** |
| (none) | | ***North Island Transformer*** | **WI** | ***Closed Out under AAOC RCRA-03-2004-0201TH.*** |
| (none) | | **F-10A/F-10B – Paint Locker and Battery Shop** | **MB** | **Under investigation.** |
| (none) | | **N-166 – Alcohol Storage Building** | **MB** | **Under investigation.** |
| (none) | | **Former Circular Area** | **MB** | **Under investigation.** |

**TABLE 1-1**
**AAOC AREAS OF CONCERN**
**FIVE-YEAR REVIEW**
**NASA WALLOPS FLIGHT FACILITY, WALLOPS ISLAND, VIRGINIA**


| AOC No. | OU No. | AOC Name | Location | Status / Alias |
|---|---|---|---|---|
| (none) | | **PFAS Sampling** | **MB** | **Under investigation.** |
| (none) | | **Open Burn Area** | **WI** | **Under investigation.** |

**Notes:**
This table was adapted from Table 4-1 in the *Site Management Plan for Fiscal Years 2023 and 2024* (NASA, 2023h).
Location: Land parcel where the AOC is located—Main Base (MB), Mainland (ML), or Wallops Island (WI).
AAOC – Administrative Agreement On Consent
AOC – Area of Concern
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act
FUDS – Formerly Utilized Defense Sites
OU – Operable Unit
USACE – U.S. Army Corps of Engineers
UST – Underground Storage Tank
TSCA – Toxic Substance Control Act
**Bold, shaded entry indicates the AOC is considered a NASA Site with response actions under the AAOC *RCRA-03-2004-0201TH* (versus a FUDS lead by the USACE). *Bold, Italicized, shaded entry indicates the AOC has been closed under the AAOC.***
No shading and an OU Number indicates that the AOC is being pursued for further response actions under FUDS AAOC RCRA-03-2021-0022TH.

**TABLE 4-1**
**CHEMICALS OF CONCERN–FORMER FIRE TRAINING AREA**
**FIVE-YEAR REVIEW**
**NASA WALLOPS FLIGHT FACILITY, WALLOPS ISLAND, VIRGINIA**

| Exposure Scenario | Chemical of Concern (COC) | Range of Detected Concentrations During Remedial Investigation (µg/L) | Cleanup Level (µg/L) | *Basis of Cleanup Level* |
|---|---|---|---|---|
| Future Resident exposed to groundwater via ingestion, dermal contact, inhalation | Benzene | 0.26 – 7.49 | 5 | *MCL* |
| | cis-1,2-DCE | 0.3 – 16 | 70 | *MCL* |
| | Vinyl Chloride | 0.3 – 2 | 2 | MCL |
| | 4-Methylphenol | 0.37 – 140 | 27 | *HI = 0.5* |
| | Naphthalene | 0.04 – 89 | 16 | *HI = 0.5* |
| | Arsenic | 0.36 – 51.2 | 10 | *MCL* |
| | Manganese | 0.812 – 4,100 | 124 | *HI = 0.5* |

**Notes**
Table/information adapted from *Record of Decision (ROD) for FFTA* (Tetra Tech, 2007c).
µg/L - microgram(s) per liter
DCE - dichloroethene
MCL - Maximum Contaminant Level
HI = [non-cancer] Hazard Index

**TABLE 4-2**
**CHRONOLOGY OF EVENTS–FORMER FIRE TRAINING AREA**
**FIVE-YEAR REVIEW**
**NASA WALLOPS FLIGHT FACILITY, WALLOPS ISLAND, VIRGINIA**

| Event/Document | Date |
|---|---|
| FFTA Site Operations | circa 1965-1987 |
| Excavation of petroleum impacted soils (subsequent to 1986 VDEQ inspection findings) | 1986 |
| Preliminary Assessment (PA) (NASA, 1988) | 1988 |
| Site Inspection (SI) (Ebasco, 1990) | 1989-1990 |
| Supplemental SI (Metcalf & Eddy, 1992) | 1991-1992 |
| Remedial Investigation (RI) / Feasibility Study (FS) Work Plan (Metcalf & Eddy, 1993) | March 1993 |
| Remedial Investigation (RI) (Metcalf & Eddy, 1996) | 1993-1994; 1996 |
| Risk Assessment Update (Versar, 2000) | March 2000 |
| Supplemental RI Work Plan (Tetra Tech, 2003a) | January 2003 |
| Supplemental RI (Revised Final Supplemental RI Report dated 2004) (Tetra Tech, 2004b) | 2000-2003; 2004 |
| Feasibility Study (FS) (Tetra Tech, 2005a) | September 2005 |
| Proposed Remedial Action Plan (PRAP) (Tetra Tech, 2007a) | January 2007 |
| Record of Decision (ROD) (Tetra Tech, 2007c) | December 2007 |
| Pilot Study Work Plan (Tetra Tech, 2008a) | November 2008 |
| Land Use Control (LUC) Remedial Design (RD) (Tetra Tech, 2008c) | October 2008 |
| Free Product Monitoring Plan (Tetra Tech, 2009a) | April 2009 |
| Remedial Action Implementation (including Pilot Test) | 2008-2010 |
| Pilot Study Report (Tetra Tech, 2009b) | July 2009 |
| Supplemental Sampling Report (Tetra Tech, 2010a and 2010b) | April-June 2010 |
| Long-Term Monitoring (LTM) Plan (Tetra Tech, 2010c) | July 2010 |
| Data Summary Report - June 2010 Groundwater Investigation (Tetra Tech, 2010d) | August 2010 |
| Data Summary Report - September 2010 Groundwater Investigation (Tetra Tech, 2010f) | December 2010 |
| 2010 Annual LTM Report (Tetra Tech, 2011b) | November 2011 |
| Remedial Action Completion Report (RACR) (Tetra Tech, 2011d) | December 2011 |
| 2011 Annual Groundwater Summary Report (Tetra Tech, 2012a) | May 2012 |
| Data Summary Report - March 2012 Groundwater Monitoring (Tetra Tech, 2012c) | May 2012 |
| LTM Plan – Revision 1 (Tetra Tech, 2012e) | July 2012 |
| 2012 Annual LTM Report (Tetra Tech, 2013a) | May 2013 |
| First Five-Year Review (NASA, 2014) | January 2014 |
| LTM Plan – Revision 2 (Tetra Tech, 2014a) | February 2014 |
| 2013 Annual LTM Report (Tetra Tech, 2014c) | February 2014 |
| Data Summary Report - March 2014 Groundwater Monitoring (Tetra Tech, 2014e) | June 2014 |
| 2014 Annual LTM Report (Tetra Tech, 2015a) | April 2015 |
| Data Summary Report - March 2015 Groundwater Monitoring (Tetra Tech, 2015c) | May 2015 |
| LTM Plan – Revision 3 (Tetra Tech, 2015e) | September 2015 |
| Data Summary Report - December 2015 Groundwater Monitoring (Tetra Tech, 2016a) | February 2016 |
| Work Plan – Groundwater Investigation for PFCs at FFTA (NASA, 2016) | October 2016 |
| Letter Work Plan for Monitoring Well Installation at FFTA (Tetra Tech, 2016d) | August 2016 |
| Data Summary Report - September 2016 Groundwater Monitoring (Tetra Tech, 2016e) | December 2016 |
| Data Summary Report – Groundwater Investigation for PFAS at FFTA (NASA, 2017c) | May 2017 |
| Data Summary Report – June 2017 Groundwater Sampling Event (NASA, 2017g) | November 2017 |
| Data Summary Report – March 2018 Groundwater Sampling Event (NASA, 2018b) | September 2018 |
| Second Five-Year Review (NASA, 2019b) | February 2019 |
| Data Summary Report – December 2018 Groundwater Monitoring (NASA, 2019d) | September 2019 |
| Data Summary Report – July 2020 Groundwater Monitoring (NASA, 2021b) | February 2021 |
| Data Summary Report – June 2021 Groundwater Monitoring (NASA, 2022c) | May 2022 |
| LTM Plan – Revision 4 (NASA, 2022d) | September 2022 |
| Data Summary Report – September 2022 Groundwater Monitoring (NASA, 2023c) | August 2023 |

**Notes**
LTM and enforcement of LUCs ongoing

**TABLE 4-3**
**SUMMARY OF IMPLEMENTED INSTITUTIONAL CONTROLS–FORMER FIRE TRAINING AREA**
**FIVE-YEAR REVIEW**
**NASA WALLOPS FLIGHT FACILITY, WALLOPS ISLAND, VIRGINIA**

| Media, engineered controls, and areas that do not support UU/UE based on current conditions | ICs Needed? | ICs Called for in the Decision Documents? | Impacted Parcel(s) | IC Objective | Title of IC Instrument Implemented and Date (or planned) |
|---|---|---|---|---|---|
| Groundwater | Yes | Yes | FFTA | No use of groundwater as a source of drinking water is permitted until concentrations of hazardous substances in groundwater are at such levels to allow for unrestricted use and exposure. | *Remedial Design for LUCs at FFTA, NASA WFF, Wallops Island, Virginia.* (Tetra Tech, 2008c). |
| | | | | No use of groundwater other than for environmental testing is permitted without an approved plan. | |
| | | | | Construction and/or development of commercial or residential buildings is prohibited. | |
| | | | | This is a controlled area undergoing Environmental Remediation. Any planned use or activity in this area must be approved by the Environmental Office, Code 250. | |

**Notes**
UU/UE - Unlimited Use and unrestricted exposure
IC - Institutional Control

**TABLE 5-1**
**CHEMICALS OF CONCERN - WASTE OIL DUMP**
**FIVE-YEAR REVIEW**
**NASA WALLOPS FLIGHT FACILITY, WALLOPS ISLAND, VIRGINIA**

| Exposure Scenario | Chemical of Concern (COC) | Range of Detected Concentrations During Remedial Investigation (µg/L) | Cleanup Level (µg/L) | *Basis of Cleanup Level* |
|---|---|---|---|---|
| Future Resident exposed to groundwater via ingestion, dermal contact, inhalation | Benzene | 0.17 – 33 | 5 | *MCL* |
| | Arsenic | 0.94 – 58 | 10 | *MCL* |

**Notes**
Table/information adapted from *Record of Decision (ROD) for WOD* (Tetra Tech, 2008b).
µg/L - microgram(s) per liter

**TABLE 5-2**
**CHRONOLOGY OF EVENTS - WASTE OIL DUMP**
**FIVE-YEAR REVIEW**
**NASA WALLOPS FLIGHT FACILITY, WALLOPS ISLAND, VIRGINIA**

| EVENT / DOCUMENT | DATE |
|---|---|
| WOD Site Operations | circa 1940s-1950s |
| Excavation of petroleum-impacted soil (subsequent to 1986 VDEQ inspection findings) | 1986 |
| Preliminary Assessment (PA) (NASA, 1988) | 1988 |
| Site Investigation (SI) (Ebasco, 1990) | 1990 |
| Additional Monitoring well installation for adjacent FUD Site 15 (Debris Pile) revealed solvent- and petroleum-related contamination. | 1998 |
| Remedial Investigation (RI) / Feasibility Study (FS) (Versar, 2001) | 1998-2000; 2001 |
| Supplemental RI (Tetra Tech, 2004c) | 2003-2004 |
| Chromium Speciation Study (NASA, 2004) | 2004 |
| Feasibility Study (FS) (Tetra Tech, 2005b) | October 2005 |
| Proposed Remedial Action Plan (PRAP) (Tetra Tech, 2007b) | January 2007 |
| Record of Decision (ROD) (Tetra Tech, 2008b) | March 2008 |
| Land Use Control (LUC) Remedial Design (RD) (Tetra Tech, 2008d) | October 2008 |
| Pilot Study Work Plan (Tetra Tech, 2008e) | November 2008 |
| Pilot Study Biostimulation Injection Implementation (Tetra Tech, 2008e and 2009b) | December 2008 |
| Remedial Action Work Plan (Tetra Tech, 2009d)<br>(Note - Pilot Study Report appended to Remedial Action Work Plan) | September 2009 |
| Full Biostimulation Injection Remedial Action Implementation | December 2009 |
| Long-Term Monitoring (LTM) Plan (Tetra Tech, 2009e) | October 2009 |
| Data Summary Report – 6-month Post-Injection Sampling Event (Tetra Tech, 2010e) | August 2010 |
| Remedial Action Completion Report (Tetra Tech, 2011a) | April 2011 |
| 2010 Annual LTM Report (Tetra Tech, 2011c) | November 2011 |
| 2011 Annual LTM Report (Tetra Tech, 2012b) | July 2012 |
| Data Summary Report - March 2012 Groundwater Monitoring Event (Tetra Tech, 2012d) | May 2012 |
| LTM Plan – Revision 1 (Tetra Tech, 2012f) | July 2012 |
| 2012 Annual LTM Report (Tetra Tech, 2013b) | May 2013 |
| First Five-Year Review (NASA, 2014) | January 2014 |
| Data Summary Report - March 2013 Groundwater Monitoring Event (Tetra Tech, 2013c) | June 2013 |
| LTM Plan – Revision 2 (Tetra Tech, 2014b) | February 2014 |
| 2013 Annual LTM Report (Tetra Tech, 2014d) | February 2014 |
| Data Summary Report - March 2014 Groundwater Monitoring Event (Tetra Tech, 2014f) | June 2014 |
| 2014 Annual LTM Report (Tetra Tech, 2015b) | April 2015 |
| Data Summary Report - March 2015 Groundwater Monitoring Event (Tetra Tech, 2015d) | May 2015 |
| LTM Plan – Revision 3 (Tetra Tech, 2015) | September 2015 |
| 2015 Annual LTM Report (Tetra Tech, 2016b) | April 2016 |
| Data Summary Report - April 2016 Groundwater Monitoring Event (Tetra Tech, 2016c) | June 2016 |
| 2016 Annual LTM Report (Tetra Tech, 2017) | February 2017 |
| Data Summary Report – October 2017 Groundwater Sampling Event (NASA, 2018a) | March 2018 |
| Second Five-Year Review (NASA, 2019b) | February 2019 |
| Data Summary Report – July 2020 Groundwater Monitoring (NASA, 2021b) | February 2021 |
| LTM Plan – Revision 4 (NASA, 2022e) | September 2022 |
| Data Summary Report – September 2022 Groundwater Monitoring (NASA, 2023b) | March 2023 |

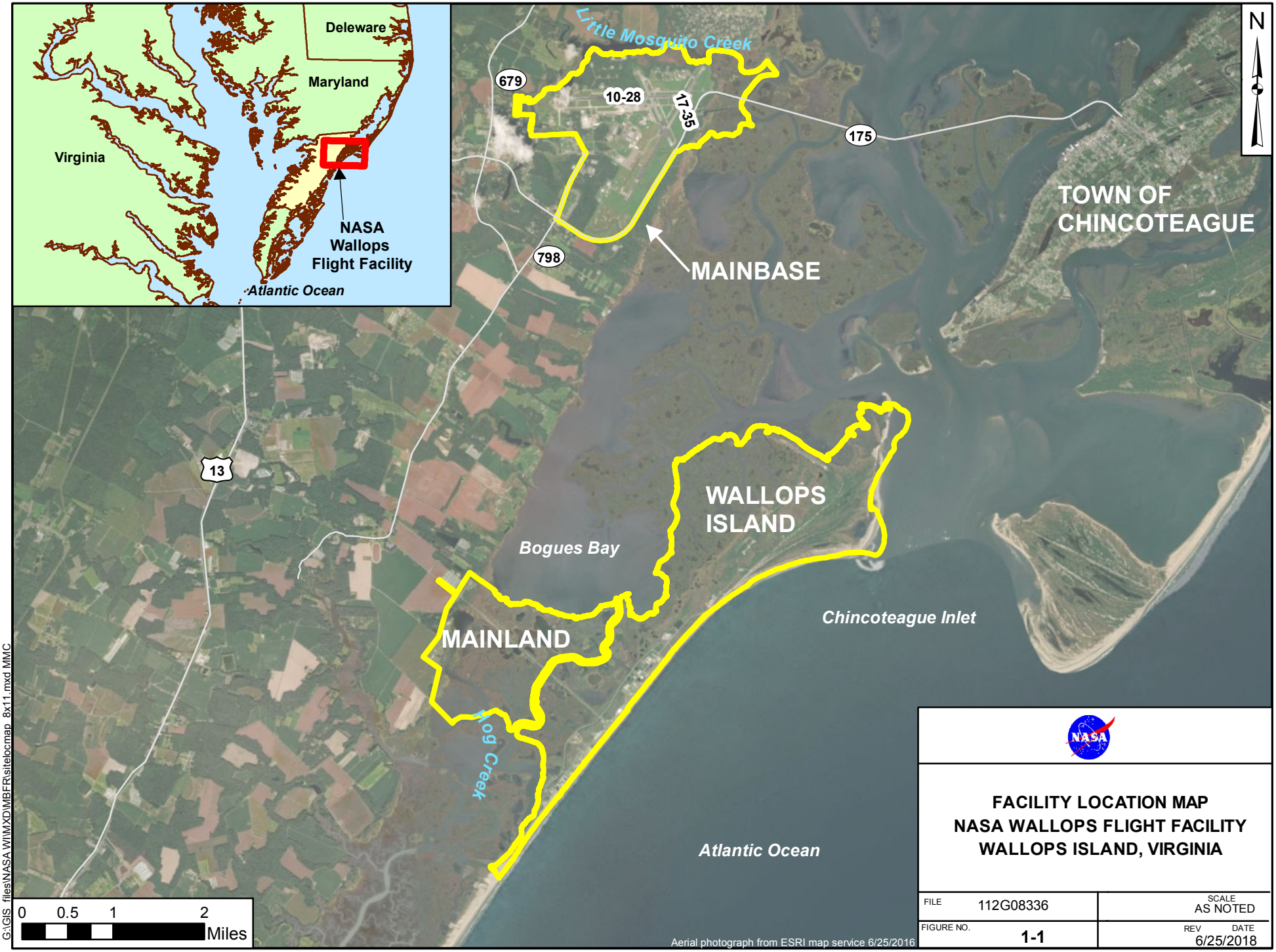
**Notes**
LTM and enforcement of LUCs ongoing

**TABLE 5-3**
**SUMMARY OF IMPLEMENTED INSTITUTIONAL CONTROLS–WASTE OIL DUMP**
**FIVE-YEAR REVIEW**
**NASA WALLOPS FLIGHT FACILITY, WALLOPS ISLAND, VIRGINIA**

| Media, engineered controls, and areas that do not support UU/UE based on current conditions | ICs Needed? | ICs Called for in the Decision Documents? | Impacted Parcel(s) | IC Objective | Title of IC Instrument Implemented and Date (or planned) |
|---|---|---|---|---|---|
| Groundwater | Yes | Yes | WOD | No use of groundwater as a source of drinking water is permitted until concentrations of hazardous substances in groundwater are at such levels to allow for unrestricted use and exposure. | *Remedial Design for LUCs at WOD, NASA WFF, Wallops Island, Virginia.* (Tetra Tech, 2008d). |
| | | | | No use of groundwater other than for environmental testing is permitted without an approved plan. | |
| | | | | Construction and/or development of commercial or residential buildings is prohibited. | |
| | | | | This is a controlled area undergoing Environmental Remediation. Any planned use or activity in this area must be approved by the Environmental Office, Code 250. | |

**Notes**
UU/UE - Unlimited Use and unrestricted exposure
IC - Institutional Control

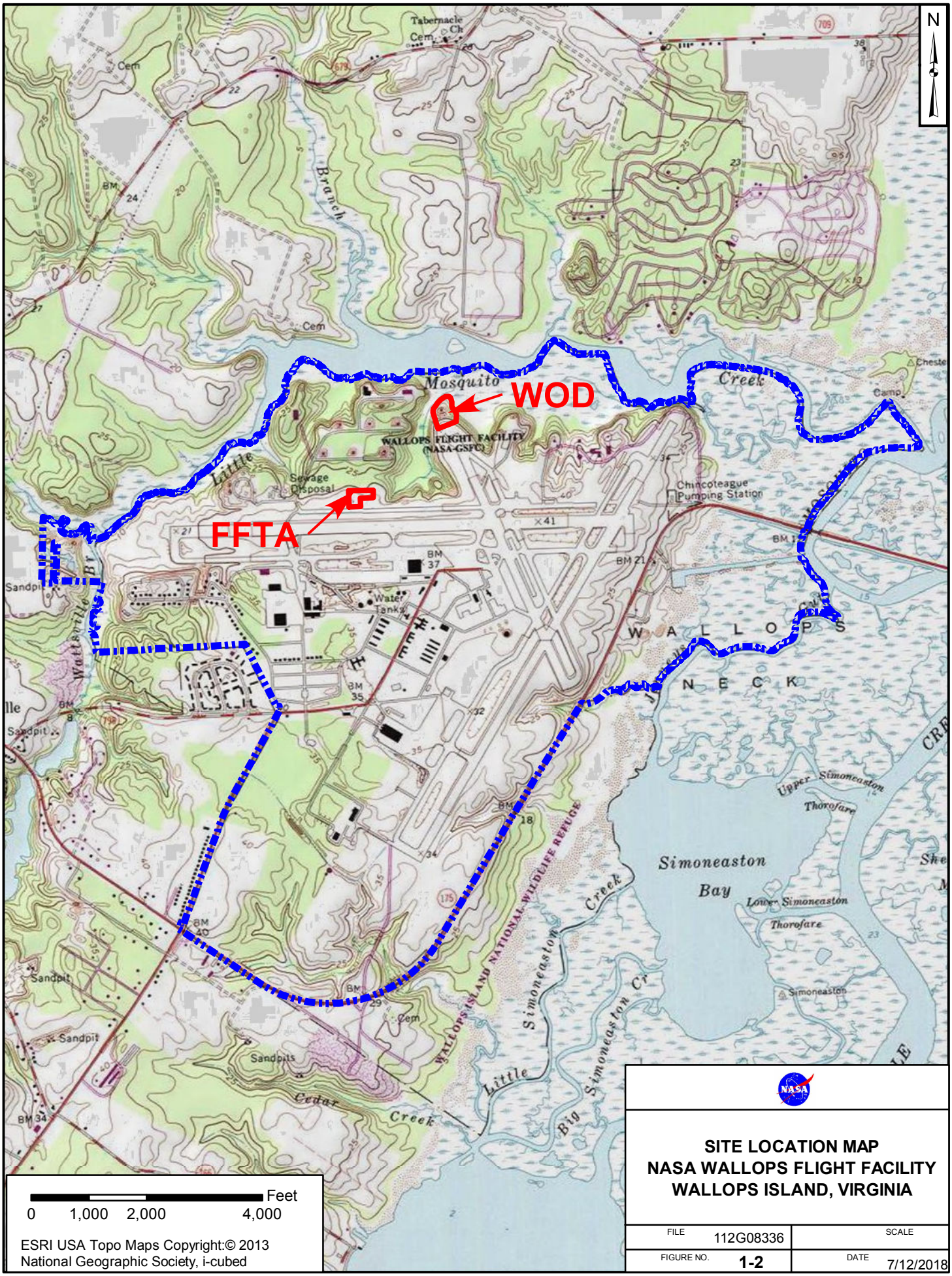
This page intentionally left blank




G:\GIS_files\NASA WI\MXD\MBFR\sitelocmap_8x11.mxd MMC

**FACILITY LOCATION MAP**
**NASA WALLOPS FLIGHT FACILITY**
**WALLOPS ISLAND, VIRGINIA**

| | | | |
|---|---|---|---|
| FILE | 112G08336 | SCALE | AS NOTED |
| FIGURE NO. | 1-1 | REV DATE | 6/25/2018 |


N
WOD
FFTA
WALLOPS FLIGHT FACILITY (NASA-GSFC)
Sewage Disposal
Chincoteague Pumping Station
Water Tanks
WALLOPS NECK
Mosquito Creek
Little Wattsville Br
Wattsville Br
Simoneaston Bay
Upper Simoneaston
Thorofare
Lower Simoneaston
Thorofare
Simoneaston Creek
Simoneaston Cr
Little Big Simoneaston Cr
Cedar Creek
WALLOPS ISLAND NATIONAL WILDLIFE REFUGE
Tabernacle Ch Cem
Cem
Sandpit
Sandpits
Camp
Simoneaston
Feet
0 1,000 2,000 4,000
ESRI USA Topo Maps Copyright:© 2013 National Geographic Society, i-cubed
SITE LOCATION MAP
NASA WALLOPS FLIGHT FACILITY
WALLOPS ISLAND, VIRGINIA
FILE 112G08336
SCALE
FIGURE NO. 1-2
DATE 7/12/2018
Document Path: G:\GIS_files\NASA WIM\MXD\5YR_2018\site_loc_topo.mxd

## Nandua swimmers fare well in states

The Nandua Swim team finished out its season at the Class 1 and 2 Swim and Dive Championships on Saturday, Feb. 18, at the Christiansburg Aquatic Center in Christiansburg, Va.

The team had 16 swimmers move on from the Region 2A Championship and compete at the State Championship, with all 16 swimmers advancing to the finals session.

The girls team raced hard to a third-place finish out of 31 teams. This season, the girls team had two goals: repeat as Region 2A Champions and improve on last season's 4th place finish.

Podium finishers for the girls team were the 200-yard medley relay and 200-yard freestyle relay, both setting new school records and earning second-place silver medals for the relay team of Grace Bentley, Sarah Bentley, Emma Cathey, and Meya Charnock.

These four swimmers also stood on the podium for individual top eight finishes. Junior Grace Bentley took fifth in the 200-yard individual medley and third in the 100-yard backstroke. She is the school record holder in both events.

Freshman Sarah Bentley earned fifth in the 100-yard freestyle and fourth in the 100-yard breaststroke. The 100 breaststroke time was a new school record. Junior Emma Cathey was sixth in the 100-yard butterfly. Sophomore Meya Charnock set a new school record in the 500-yard freestyle and earned a fourth-place medal.

Morgan Johnson placed ninth in the 100-yard breaststroke. Emma Cathey placed ninth in the 200-yard freestyle and Meya Charnock was ninth in the 100-yard Backstroke .

The girls 400-yard freestyle relay of Robyn Anderson, Emma Holt, Morgan Johnson, and Jordan Penland took 11th place.

The boys team finished 15 out of 29 teams. The boys team had one podium finisher, Camden Lewis with a new school record in the 500-yard freestyle.

Lewis earned a third-place medal in the event.

There were eight boys who scored points for the team in the finals session of the meet.

Austin Wert placed 14th in 50-yard freestyle and 11th in 100-yard freestyle.

Zac Smith placed 13th in the 100-yard backstroke with a new school record in the event. Lucas Elliott swam the 200-yard individual medley and finished 14th.

Camden Lewis took 10th in the 100-yard breaststroke, breaking his previous school record.







### PUBLIC NOTICE

**NASA's Goddard Space Flight Center's Wallops Flight Facility Announces Initiation of Third Five-Year Review of Remedial Actions**

The National Aeronautics and Space Administration (NASA) and the U.S. Environmental Protection Agency (EPA) Region 3 are beginning the third five-year review for the ongoing remedial (environmental cleanup) actions at the Former Fire Training Area and Waste Oil Dump located at NASA Wallops Flight Facility (WFF) in Wallops Island, VA. The purpose of the review is to ensure that these remedial actions are providing adequate protection of human health and the environment as required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The final report is expected to be available for inspection by community members in the public information repositories by January 2024.

For more information, please visit:
https://code200-external.gsfc.nasa.gov/250-WFF/program-areas-restoration-program

The Administrative Record is available to the public via computer access at the following locations:

**Eastern Shore Public Library**
**23610 Front St**
**Accomac, VA 23301**
**(757) 787-3400**

**Island Library**
**4077 Main St**
**Chincoteague, VA 23336**
**(757) 336-3460**

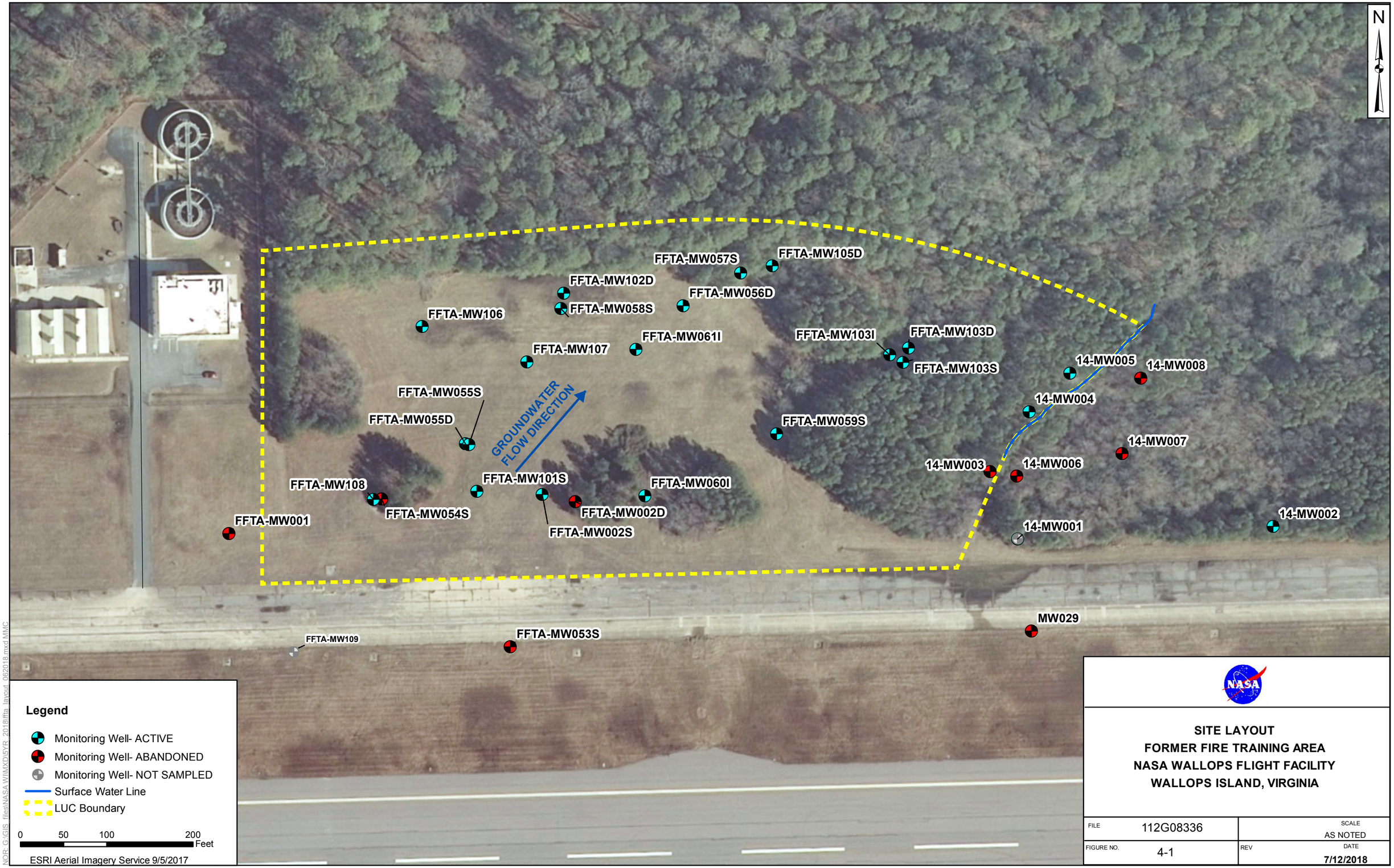
**Let us know what you think!**

Community members near WFF who have questions about the effectiveness of the remedies or need other information are encouraged to contact:

**Mr. David Liu**
**NASA Restoration Program Manager**
**NASA Wallops Flight Facility**
**Building F-160, Code 250**
**Wallops Island, VA 23337**
**david.liu-1@nasa.gov**
**(757) 824-2141**



**Figure 1-3. Public Notice of Start of Five-Year Review**




**Legend**

- Monitoring Well- ACTIVE
- Monitoring Well- ABANDONED
- Monitoring Well- NOT SAMPLED
- Surface Water Line
- LUC Boundary

0 50 100 200 Feet

ESRI Aerial Imagery Service 9/5/2017

**SITE LAYOUT**
**FORMER FIRE TRAINING AREA**
**NASA WALLOPS FLIGHT FACILITY**
**WALLOPS ISLAND, VIRGINIA**

| FILE | 112G08336 | SCALE | AS NOTED |
|---|---|---|---|
| FIGURE NO. | 4-1 | REV | DATE 7/12/2018 |

NOR: G:\GIS_files\NASA.WIMXD\SYR_2018\fta_layout_062018.mxd MMC

**FFTA-MW058S**

| | 9/22/2022 |
|---|---|
| SVOCs | (µg/L) |
| Napthalene | **21.4** |
| Total Metals | (µg/L) |
| Arsenic | **38.8** |
| Manganese | **422** |

**FFTA-MW057S**

| | 9/22/2022 |
|---|---|
| Total Metals | (µg/L) |
| Manganese | **149** |

**FFTA-MW061I**

| | 9/22/2022 |
|---|---|
| Total Metals | (µg/L) |
| Manganese | **1000** |

**FFTA-MW107**

| | 9/22/2022 | 9/22/2022 DUP |
|---|---|---|
| SVOCs | | |
| Napthalene | **38.3** | **33** |
| Total Metals | (µg/L) | (µg/L) |
| Arsenic | **40.4** | **40.6** |
| Manganese | **239** | **243** |

FFTA-MW-105D
FFTA-MW-102D
FFTA-MW-56D
FFTA-MW-106
FFTA-MW-103D
FFTA-MW-103I
FFTA-MW-103S
14-MW005
14-MW004
FFTA-MW-59S
FFTA-MW-55D
FFTA-MW-55S
FFTA-MW-108
FFTA-MW002S
FFTA-MW-60I
FFTA-MW-54S
FFTA-MW002D
FFTA-MW-101S
14-MW007
14-MW003
14-MW006
14-MW002
14-MW001
FFTA-MW-109
FFTA-MW-53S
Outfall 003 Drainage Channel

N

## Legend

- Monitoring Well - NOT SAMPLED
- Monitoring Well - ABANDONED
- Monitoring Well - SAMPLED
- Approximate Groundwater Flow Direction
- Drainage Channel
- 2010 Lidar Contours
- Total Arsenic Exceedance
- Total Napthalene Exceedance
- Total Manganese Exceedance

0 25 50 100 150 Feet

**Site Cleanup Goals**

| | | |
|---|---|---|
| Naphthalene | 16 | µg/L |
| Arsenic | 10 | µg/L |
| Manganese | 124 | µg/L |

**Notes:**

J - Estimated Value
U - Analyte was not detected in the sample at a level greater than the instrument detection
µg/L - micrograms per liter
(1) Bolded Values indicate exceedances of the Cleanup Goal.

**Aerial Imagery:08/13/2021**

Source: Esri, [illegible]

**SEPTEMBER 2022**
**CLEAN-UP GOAL EXCEEDANCES**
**FORMER FIRE TRAINING AREA**
**NASA WALLOPS FLIGHT FACILITY**
**WALLOPS ISLAND, VIRGINIA**

| | |
|---|---|
| FILE 112G09524 | SCALE AS NOTED |
| FIGURE NO. **4-2** | REV / DATE **12/21/2022** |

NOR: G:\GIS_files\NASA WI\MXD\PRO\2022\FFTA_LTM\FFTA_LTM_MAS.aprx SKS

Little Mosquito Creek

Wastewater Treatment Plant

Outfall 003 Drainage Channel

Wormhoudt St

Helicopter Crash Site

Wastewater Treatment Plant (Building D-12)

Former Fire Training Area

FFTA-SW05
WFF-PMW01S
WFF-PMW01D
FFTA-TW08
FFTA-SW03
FFTA-TW07
FFTA-SW02
FFTA-Seep02
FFTA-MW201I
FFTA-MW201D
FFTA-PZ03
FFTA-SEEP01
FFTA-MW202I
FFTA-MW056D
FFTA-TW06
FFTA-MW061I
FFTA-MW202D
FFTA-MW057S
FFTA-MW102D
FFTA-MW207I
LSBF-SEEP04
LSBF-SEEP02
Outfall 001 SEEP
Outfall 001 Alt
Outfall 001
FFTA-MW058S
FFTA-MW105D
FFTA-PZ02
FFTA-SW04
FFTA-TW102
FFTA-MW107
FFTA-MW103I
FFTA-TW05
FFTA-MW103S
FFTA-MW103D
14-MW005
WWTP-SW01
P11-MW101S
FFTA-TW04
FFTA-PZ01
FFTA-SW01
WFF1-MW7
WFF1-MW6
FFTA-MW106
Outfall003-SEEP
FWTP-TW05
FFTA-MW055D
FFTA-MW059S
Outfall 003
FWTP-TW03
FFTA-MW055S
Outfall 003A
WFF1-MW2
HCS-TW03
Outfall 003B
FFTA-MW206S
FFTA-MW060I
14-MW001
14-MW002
HCS-TW02
HCS-TW04
FFTA-MW109
FFTA-MW002S
FFTA-TW01
FFTA-MW205S
FFTA-TW03
FFTA-MW108
FFTA-TW02
FFTA-MW204I
HCS-TW01
FFTA-MW204S
FFTA-MW204D
FFTA-MW101S
FFTA-TW101

N

## Legend

**Perfluorooctanesulfonic acid (PFOS)**

Groundwater
- <4 ng/L
- 4-40 ng/L
- 40-400 ng/L
- 400-4,000 ng/L
- 4,000-40,000 ng/L
- >40,000 ng/L

Surface Water
- <58 ng/L
- 58-580 ng/L
- 580-5,800 ng/L
- >5,800 ng/L

- Stormwater Sewer Line
- Stormwater Channel
- Drainage Channel
- Roads
- Building Apron or Area
- Current PFAS Investigation Area
- Installation Boundary

**Aerial Imagery: 8/29/2018**

**Note: Highest concentration represented at sample locations with multiple intervals. (e.g. Temporary Wells)**

0 150 300 600 Feet

NASA

**GROUNDWATER AND SURFACE WATER PFOS SUMMARY FROM EXPANDED SI**
**FFTA (PFAS AREA 9)**
**NASA WALLOPS FLIGHT FACILITY**
**WALLOPS ISLAND, VIRGINIA**

| | | | |
|---|---|---|---|
| FILE | 112G09158 | SCALE | AS NOTED |
| FIGURE NO. | 4-3 | REV | DATE 6/22/2023 |

NOR: Z:\GIS_CADD\GIS_Files\NASA WI\APRX\NASA_WFF_PFAS_ESI_MS.aprx Layout: Figure 4-11 MB_PFOS_Sample_GW_SW_Sed_Area_9

**Legend**

**Perfluorooctanesulfonic acid (PFOS)**

Soil

- < 13 µg/kg
- 13-130 µg/kg
- > 130 µg/kg

Roads

Building Apron, or Area

Current PFAS Investigation Area

**Aerial Imagery: 8/29/2018**

**Note: Highest concentration represented at sample locations with multiple intervals.**

0 50 100 200 Feet

N

Wastewater Treatment Plant

Former Fire Training Pit Area

FFTA-SB03

FFTA-SB05

FFTA-SB04

FFTA-SB02

FFTA-SB102

FFTA-SB103

Former Fire Training Area

FFTA-SB01

FFTA-SB06

FFTA-SB101

FFTA-SB105

FFTA-SB104

FFTA-SB107

FFTA-SB106

FFTA-SB07

FFTA-SB108

Former Fire Training Tank & Airplane Area

HCS-SB02

HCS-SB03

HCS-SB01

Helicopter Crash Site

NOR: G:\GIS_files\NASA WIMXD\PRO\NASA_WFF_PFAS_ESI_TB.aprx Layout: Figure 4-10 MB_PFOS_Sample_Soil_Area9

**SOIL PFOS SUMMARY FROM EXPANDED SI FFTA (PFAS AREA 9) NASA WALLOPS FLIGHT FACILITY WALLOPS ISLAND, VIRGINIA**

| | | | |
|---|---|---|---|
| FILE | 112G09158 | SCALE | AS NOTED |
| FIGURE NO. | **4-4** | REV / DATE | **1/9/2023** |

**Legend**

**Perfluorooctanesulfonic acid (PFOS)**

| Soil | Sediment |
|---|---|
| <13 µg/kg | <1.4 µg/kg |
| 13-130 µg/kg | 1.4-14 µg/kg |
| >130 µg/kg | 14-85 µg/kg |

Town of Chincoteague GAC Treatment System

Installation Boundary

Current PFAS Investigation Area

0 500 1,000 2,000 Feet

**Aerial Imagery: 8/29/2018**

Area 6 - Lear Jet Soil Bioremediation Landfarm

Little Mosquito Creek

Area 9 - Former Fire Training Area

Town of Chincoteague GAC Treatment System

Area 3 - Fire Training Pit and Nearby Buildings

Boat Basin

Area 1 - Building B-129 Fire Station

Area 7 - Observation Well 06 Area

Simoneaston Bay

Area 10 - Lear Jet Crash Site

Jenneys Gut

Runway 10-28

Runway 17-35

Runway 4-22

BLOUGH ROAD

KNEELAND ROAD

BEEDER ROAD

CHINCOTEAGUE ROAD

ODUM COURT

BLISS STREET

KINE STREET

FULTON STREET

STUBBS BOULEVARD

N-162 ROAD

ATLANTIC ROAD

SKEETER LANE

N

**SOIL AND SEDIMENT PFOS**
**SUMMARY FROM EXPANDED SI**
**FFTA (PFAS AREA 9)**
**NASA WALLOPS FLIGHT FACILITY**
**WALLOPS ISLAND, VIRGINIA**

| FILE | 112G9158 | SCALE | AS NOTED |
|---|---|---|---|
| FIGURE NO. | **4-5** | REV | DATE **1/9/2023** |

NOR: G:\GIS_files\NASA.WIM\DPR\NASA_WFF_PFAS_FSI_TR.aprx!Layout: Figure 4-1_FacWide_PFOS_Soil_Sediment

N

FFTA-MW104S

WOD-MW004-1

WOD-MW004-2

WOD-MW005

WOD-MW008

WOD-MW003

WOD-MW006

15-MW001

WOD-MW002S

WOD-MW002D

WOD-MW007

Groundwater Flow Direction

WOD-MW001

15-MW002

15-MW007

Mosquito Creek

15-MW003

WOD-MW003A

WOD-MW003R

15-MW004

15-MW005

15-MW006

**Legend**

- Monitoring Well- ACTIVE
- Monitoring Well- ABANDONED
- Surface Water
- Waste Oil Dump Boundary
- LUC Boundary

0 50 100 200 Feet

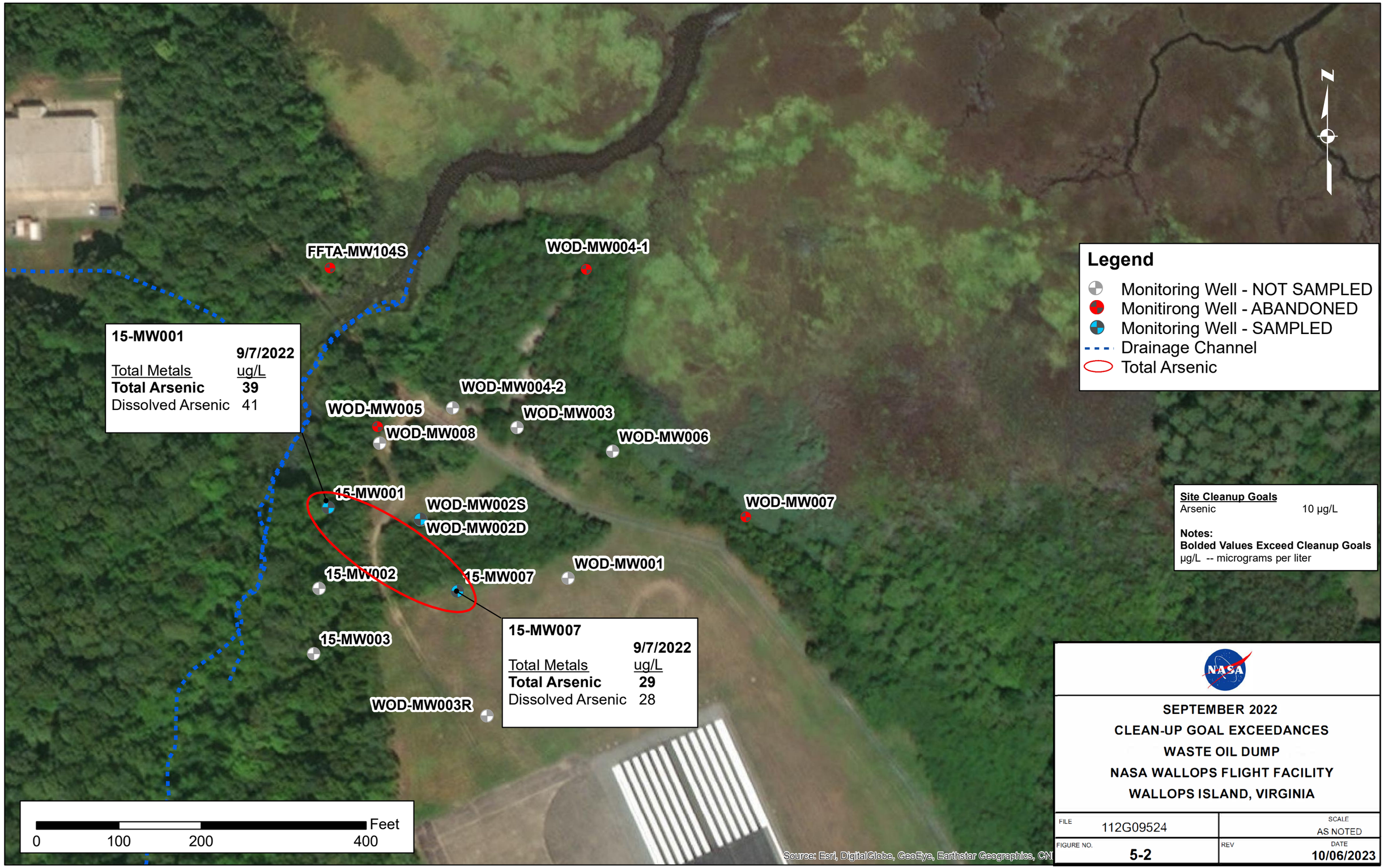
ESRI Aerial Imagery 9/5/2017

P:\GIS_Files\NASA WI\NASA WOD RI FILES\wod_LAYOUT_052313.MXD 101613

NASA

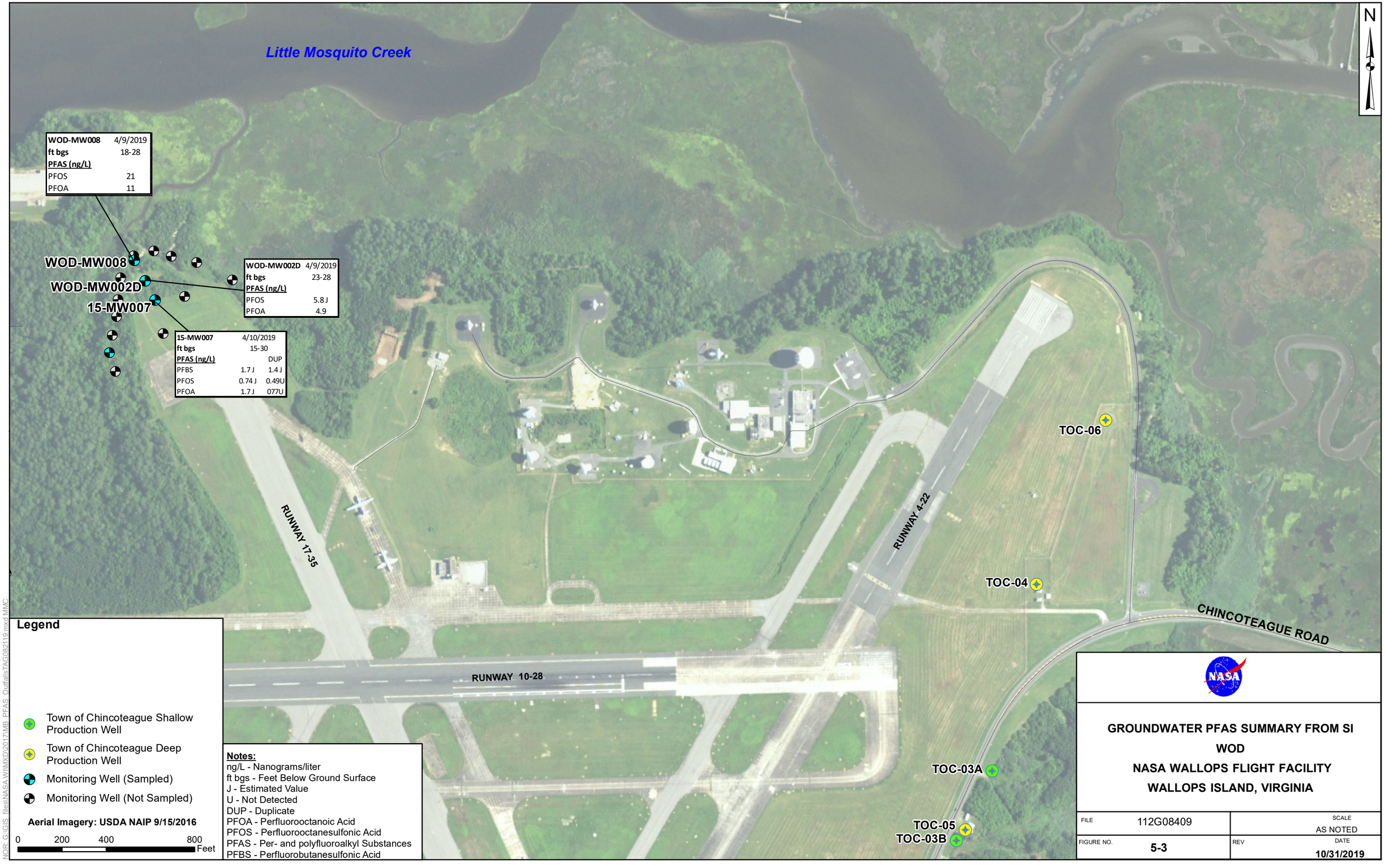
**SITE LAYOUT MAP**
**WASTE OIL DUMP**
**NASA WALLOPS FLIGHT FACILITY**
**WALLOPS ISLAND, VIRGINIA**

| FILE | 112G08336 | SCALE | AS NOTED |
|---|---|---|---|
| FIGURE NO. | 5-1 | REV | DATE 7/12/2018 |




SEPTEMBER 2022
CLEAN-UP GOAL EXCEEDANCES
WASTE OIL DUMP
NASA WALLOPS FLIGHT FACILITY
WALLOPS ISLAND, VIRGINIA

| FILE | SCALE |
|---|---|
| 112G09524 | AS NOTED |
| FIGURE NO. 5-2 | REV / DATE 10/06/2023 |




# GROUNDWATER PFAS SUMMARY FROM SI WOD
# NASA WALLOPS FLIGHT FACILITY
# WALLOPS ISLAND, VIRGINIA

| FILE | 112G08409 | SCALE | AS NOTED |
|---|---|---|---|
| FIGURE NO. | 5-3 | REV / DATE | 10/31/2019 |

This page intentionally left blank

## APPENDIX A

## ANALYTICAL DATA AND HISTORICAL INFORMATION

This page intentionally left blank

**Table A-1**
**LTM Data Summary Table**
**Former Fire Training Area**
**NASA Wallops Flight Facility, Wallops Island, Virginia**


| LOCATION | Cleanup Level (µg/L) | FFTA-MW055D | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE ID | | FFTA-MW055D-20130320 | FFTA-MW055D-20130905 | FFTA-MW055D-20140318 | FFTA-MW055D-20140924 | FFTA-MW055D-20150318 | FFTA-MW055D-20151202 | FFTA-MW055D-20160927 |
| SAMPLE DATE | | 20130320 | 20130905 | 20140318 | 20140924 | 20150318 | 20151202 | 20160927 |
| SAMPLE CODE | | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL |
| **VOLATILES (µg/L)** | | | | | | | | |
| BENZENE | 5 | 0.11 U | 0.25 U | 0.25 U | 0.11 U | 0.11 U | 0.26 U | 0.26 U |
| CIS-1,2-DICHLOROETHENE | 70 | 0.24 U | NA | NA | NA | 0.24 U | NA | NA |
| **SEMIVOLATILES (µg/L)** | | | | | | | | |
| 3&4-METHYLPHENOL | 27 | 1.5 | 16 | 10 U | NA | NA | 5.4 U | 0.46 U |
| 4-METHYLPHENOL | 27 | NA | NA | NA | 0.61 J | 0.21 U | NA | NA |
| NAPHTHALENE | 16 | 0.013 U | 13 | 5 U | 0.024 U | 0.06 J | 2.1 U | 0.067 U |
| **METALS (µg/L)** | | | | | | | | |
| ARSENIC | 10 | 3.8 | **12** | 3.2 J | 0.29 U | 0.47 J | 2.3 U | 2.3 U |
| MANGANESE | 124 | 50 | 65 | 31 | 30 | 29 | 9.32 | 15.8 |
| **DISSOLVED METALS (µg/L)** | | | | | | | | |
| ARSENIC | 10 | 3.1 | 11 | 1.4 J | 0.29 U | 0.37 J | 2.3 U | 2.3 U |
| MANGANESE | 124 | 57 | 66 | 23 | 29 | 31 | 7.88 | 15 |
| **FIELD (MG/L)** | | | | | | | | |
| ALKALINITY | NA | 10 < | 10 < | 10 | NA | NA | NA | NA |
| DISSOLVED OXYGEN | NA | 5 | 0.1 | 4 | NA | NA | NA | NA |
| DISSOLVED OXYGEN - HORIBA | NA | 2.19 | 0 | 6.54 | NA | NA | NA | NA |
| FERROUS IRON | NA | 1 | 5 | 1 | NA | NA | NA | NA |
| HYDROGEN SULFIDE | NA | 0 | 1.5 | 0 | NA | NA | NA | NA |
| NITRATE | NA | 0 | 0 | 0 | NA | NA | NA | NA |
| NITRITE | NA | 0 | 0 | 0 | NA | NA | NA | NA |
| SALINITY (%) | NA | NA | NA | 0 | NA | NA | NA | NA |
| TEMPERATURE (deg C) | NA | 14.1 | 20.89 | 10.82 | NA | NA | NA | NA |
| SPECIFIC CONDUCTANCE (ms/cm) | NA | 0.72 | 0.072 | 0.076 | NA | NA | NA | NA |
| OXIDATION REDUCTION POTENTIAL (mv) | NA | 224 | -79 | 133 | NA | NA | NA | NA |
| TURBIDITY (ntu) | NA | 1.4 | 0.41 | 5.35 | NA | NA | NA | NA |
| PH (s.u.) | NA | 4.42 | 5.81 | 5.53 | NA | NA | NA | NA |

µg/L- micrograms per liter
mg/L- micrograms per liter

Notes:
1. Cleanup levels were defined for the COCs at the Former Fire Training Area in the ROD.
2. Shaded and **bolded** values indicate a result exceeding the appropriate cleanup level.

**Table A-1**
**LTM Data Summary Table**
**Former Fire Training Area**
**NASA Wallops Flight Facility, Wallops Island, Virginia**


| LOCATION | FFTA-MW055D | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE ID | FFTA-MW55D-20170622 | FFTA-MW55D-20170622-AVG | FFTA-MW55D-20170622-D | FFTA-MW055D-20180327 | FFTA-MW055D-20181212 | FFTA-MW055D-20200721 | FFTA-MW055D-20210629 | FFTA-MW055D-20220927 |
| SAMPLE DATE | 20170622 | 20170622 | 20170622 | 20180327 | 20181212 | 20200721 | 20210629 | 20220927 |
| SAMPLE CODE | ORIG | AVG | DUP | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL |
| **VOLATILES (µg/L)** | | | | | | | | |
| BENZENE | 0.26 U | 0.26 U | 0.26 U | 0.26 U | NA | NA | NA | NA |
| CIS-1,2-DICHLOROETHENE | NA | NA | NA | NA | NA | NA | NA | NA |
| **SEMIVOLATILES (µg/L)** | | | | | | | | |
| 3&4-METHYLPHENOL | 24 | 24 | 24 | 8.6 | 7.8 J | 9.5 U | NA | NA |
| 4-METHYLPHENOL | NA | NA | NA | NA | NA | NA | NA | NA |
| NAPHTHALENE | 13 | 13.5 | 14 | 3.2 | 3.2 | 9.5 U | 8.8 | 0.23 U |
| **METALS (µg/L)** | | | | | | | | |
| ARSENIC | **11** | **12** | **13** | 4.6 J | 4.7 J | 3.3 | **17.4** | 2.8 U |
| MANGANESE | **175** | **174** | **173** | 91.9 | 86.2 | 110 | 93 | 1.4 U |
| **DISSOLVED METALS (µg/L)** | | | | | | | | |
| ARSENIC | 10 | 11 | 12 | 4.3 K | 5.0 J | 3.1 | 15.1 | 2.8 U |
| MANGANESE | 162 | 165 | 168 | 97 | 92.7 | 110 | 80 | 1.4 U |
| **FIELD (MG/L)** | | | | | | | | |
| ALKALINITY | NA | NA | NA | NA | NA | NA | NA | NA |
| DISSOLVED OXYGEN | NA | NA | NA | NA | 3 | 0 | 2 | NA |
| DISSOLVED OXYGEN - HORIBA | NA | NA | NA | 4.0 | 2.4 | 8.5 | 1.25 | 4.44 |
| FERROUS IRON | NA | NA | NA | NA | NA | NA | NA | NA |
| HYDROGEN SULFIDE | NA | NA | NA | NA | NA | NA | NA | NA |
| NITRATE | NA | NA | NA | NA | NA | NA | NA | NA |
| NITRITE | NA | NA | NA | NA | NA | NA | NA | NA |
| SALINITY (%) | NA | NA | NA | NA | NA | NA | NA | NA |
| TEMPERATURE (deg C) | NA | NA | NA | 14.01 | 17.21 | 23.12 | 19.73 | 19.46 |
| SPECIFIC CONDUCTANCE (ms/cm) | NA | NA | NA | 0.072 | 0.076 | 0.07 | 0.079 | 0.054 |
| OXIDATION REDUCTION POTENTIAL (mv) | NA | NA | NA | 101 | 81 | 79 | -8 | 272 |
| TURBIDITY (ntu) | NA | NA | NA | 4.3 | 0.9 | 4.8 | 6.19 | 1.3 |
| PH (s.u.) | NA | NA | NA | 5.76 | 5.47 | 5.58 | 5.72 | 4.92 |

µg/L- micrograms per liter
mg/L- micrograms per liter

Notes:
1. Cleanup levels were defined for the COCs at the Former Fire Training Area in the ROD.
2. Shaded and **bolded** values indicate a result exceeding the appropriate cleanup level.

**Table A-1**
**LTM Data Summary Table**
**Former Fire Training Area**
**NASA Wallops Flight Facility, Wallops Island, Virginia**


| LOCATION | FFTA-MW055S | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE ID | FFTA-MW055S-20130320 | FFTA-MW055S-20130320-AVG | FFTA-MW055S-20130320-D | FFTA-MW055S-20130905 | FFTA-MW055S-20130905-AVG | FFTA-MW055S-20130905-D | FFTA-MW055S-20140318 | FFTA-MW055S-20140318-AVG |
| SAMPLE DATE | 20130320 | 20130320 | 20130320 | 20130905 | 20130905 | 20130905 | 20140318 | 20140318 |
| SAMPLE CODE | ORIG | AVG | DUP | ORIG | AVG | DUP | ORIG | AVG |
| **VOLATILES (µg/L)** | | | | | | | | |
| BENZENE | 0.19 J | 0.21 | 0.23 J | 0.42 J | 0.47 | 0.52 J | 0.5 J | 0.485 |
| CIS-1,2-DICHLOROETHENE | 0.26 J | 0.19 | 0.24 U | NA | NA | NA | NA | NA |
| **SEMIVOLATILES (µg/L)** | | | | | | | | |
| 3&4-METHYLPHENOL | **50** | **55.5** | **61** | **44** | **44** | **44** | **49 J** | **49** |
| 4-METHYLPHENOL | NA | NA | NA | NA | NA | NA | NA | NA |
| NAPHTHALENE | 12 | 13.5 | 15 | **46** | **46.5** | **47** | **44 J** | **44** |
| **METALS (µg/L)** | | | | | | | | |
| ARSENIC | **23** | **22** | **21** | **24** | **23.5** | **23** | **28** | **27** |
| MANGANESE | **350** | **340** | **330** | **430** | **430** | **430** | **440** | **430** |
| **DISSOLVED METALS (µg/L)** | | | | | | | | |
| ARSENIC | 24 | 24.5 | 25 | 24 | 23 | 22 | 23 | 23 |
| MANGANESE | 370 | 375 | 380 | 410 | 405 | 400 | 410 | 410 |
| **FIELD (MG/L)** | | | | | | | | |
| ALKALINITY | 35 | 35 | NA | 12 | 12 | NA | 20 | 20 |
| DISSOLVED OXYGEN | 0.2 | 0.2 | NA | 2 | 2 | NA | 0.2 | 0.2 |
| DISSOLVED OXYGEN - HORIBA | 0.1 | 0.1 | NA | 1.78 | 1.78 | NA | 0.31 | 0.31 |
| FERROUS IRON | 2.6 | 2.6 | NA | 4.6 | 4.6 | NA | 1.2 | 1.2 |
| HYDROGEN SULFIDE | 0 | 0 | NA | 0.3 | 0.3 | NA | 0 | 0 |
| NITRATE | 0 | 0 | NA | 0 | 0 | NA | 0 | 0 |
| NITRITE | 0 | 0 | NA | 0 | 0 | NA | 0 | 0 |
| SALINITY (%) | NA | NA | NA | NA | NA | NA | 0 | 0 |
| TEMPERATURE (deg C) | 14.26 | 14.26 | NA | 18.23 | 18.23 | NA | 11.49 | 11.49 |
| SPECIFIC CONDUCTANCE (ms/cm) | 0.107 | 0.107 | NA | 0.058 | 0.058 | NA | 0.179 | 0.179 |
| OXIDATION REDUCTION POTENTIAL (mv) | 49 | 49 | NA | -28 | -28 | NA | -39 | -39 |
| TURBIDITY (ntu) | 2.95 | 2.95 | NA | 9.26 | 9.26 | NA | 0.69 | 0.69 |
| PH (s.u.) | 5.09 | 5.09 | NA | 5.68 | 5.68 | NA | 5.41 | 5.41 |

µg/L- micrograms per liter
mg/L- micrograms per liter

Notes:
1. Cleanup levels were defined for the COCs at the Former Fire Training Area in the ROD.
2. Shaded and **bolded** values indicate a result exceeding the appropriate cleanup level.

**Table A-1**
**LTM Data Summary Table**
**Former Fire Training Area**
**NASA Wallops Flight Facility, Wallops Island, Virginia**


| LOCATION | FFTA-MW055S | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE ID | FFTA-MW055S-20140318-D | FFTA-MW055S-20140924 | FFTA-MW055S-20140924-AVG | FFTA-MW055S-20140924-D | FFTA-MW055S-20150318 | FFTA-MW055S-20150318-AVG | FFTA-MW055S-20150318-D | FFTA-MW055S-20151202 |
| SAMPLE DATE | 20140318 | 20140924 | 20140924 | 20140924 | 20150318 | 20150318 | 20150318 | 20151202 |
| SAMPLE CODE | DUP | ORIG | AVG | DUP | ORIG | AVG | DUP | ORIG |
| **VOLATILES (µg/L)** | | | | | | | | |
| BENZENE | 0.47 J | 0.31 J | 0.31 | 0.31 J | 0.28 J | 0.285 | 0.29 J | 0.26 U |
| CIS-1,2-DICHLOROETHENE | NA | NA | NA | NA | 0.28 J | 0.28 | 0.28 J | NA |
| **SEMIVOLATILES (µg/L)** | | | | | | | | |
| 3&4-METHYLPHENOL | **49** | NA | NA | NA | NA | NA | NA | 15 |
| 4-METHYLPHENOL | NA | 9.7 | 9.75 | 9.8 | 24 | 21.5 | 19 | NA |
| NAPHTHALENE | **44 J** | 15 | 15 | 15 | 1.4 J | 1.17 | 0.94 J | **29 J** |
| **METALS (µg/L)** | | | | | | | | |
| ARSENIC | **26** | **16** | **16.5** | **17** | **26** | **26.5** | **27** | **27.8** |
| MANGANESE | **420** | **200** | **205** | **210** | **300** | **300** | **300** | **294** |
| **DISSOLVED METALS (µg/L)** | | | | | | | | |
| ARSENIC | 23 | 15 | 15.5 | 16 | 27 | 27 | 27 | 25.3 |
| MANGANESE | 410 | 210 | 210 | 210 | 320 | 315 | 310 | 268 |
| **FIELD (MG/L)** | | | | | | | | |
| ALKALINITY | NA | NA | NA | NA | NA | NA | NA | NA |
| DISSOLVED OXYGEN | NA | NA | NA | NA | NA | NA | NA | NA |
| DISSOLVED OXYGEN - HORIBA | NA | NA | NA | NA | NA | NA | NA | NA |
| FERROUS IRON | NA | NA | NA | NA | NA | NA | NA | NA |
| HYDROGEN SULFIDE | NA | NA | NA | NA | NA | NA | NA | NA |
| NITRATE | NA | NA | NA | NA | NA | NA | NA | NA |
| NITRITE | NA | NA | NA | NA | NA | NA | NA | NA |
| SALINITY (%) | NA | NA | NA | NA | NA | NA | NA | NA |
| TEMPERATURE (deg C) | NA | NA | NA | NA | NA | NA | NA | NA |
| SPECIFIC CONDUCTANCE (ms/cm) | NA | NA | NA | NA | NA | NA | NA | NA |
| OXIDATION REDUCTION POTENTIAL (mv) | NA | NA | NA | NA | NA | NA | NA | NA |
| TURBIDITY (ntu) | NA | NA | NA | NA | NA | NA | NA | NA |
| PH (s.u.) | NA | NA | NA | NA | NA | NA | NA | NA |

µg/L- micrograms per liter
mg/L- micrograms per liter

Notes:
1. Cleanup levels were defined for the COCs at the Former Fire Training Area in the ROD.
2. Shaded and **bolded** values indicate a result exceeding the appropriate cleanup level.

**Table A-1**
**LTM Data Summary Table**
**Former Fire Training Area**
**NASA Wallops Flight Facility, Wallops Island, Virginia**


| LOCATION | FFTA-MW055S | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE ID | FFTA-MW055S-20151202-AVG | FFTA-MW055S-20151202-D | FFTA-MW055S-20160927 | FFTA-MW055S-20160927-AVG | FFTA-MW055S-20160927-D | FFTA-MW55S-20170622 | FFTA-MW055S-20180327 | FFTA-MW055S-20181212 |
| SAMPLE DATE | 20151202 | 20151202 | 20160927 | 20160927 | 20160927 | 20170622 | 20180327 | 20181212 |
| SAMPLE CODE | AVG | DUP | ORIG | AVG | DUP | NORMAL | NORMAL | NORMAL |
| **VOLATILES (µg/L)** | | | | | | | | |
| BENZENE | 0.235 | 0.34 J | 0.26 U | 0.26 U | 0.26 U | 0.26 U | 0.26 U | NA |
| CIS-1,2-DICHLOROETHENE | NA | NA | NA | NA | NA | NA | NA | NA |
| **SEMIVOLATILES (µg/L)** | | | | | | | | |
| 3&4-METHYLPHENOL | 17 | 19 | **28 J** | 23 | 18 J | 14 J- | 5.6 | 9 |
| 4-METHYLPHENOL | NA | NA | NA | NA | NA | NA | NA | NA |
| NAPHTHALENE | **35** | **41 J** | **27 J** | **25.5** | **24 J** | 12 J- | **27** | **28** |
| **METALS (µg/L)** | | | | | | | | |
| ARSENIC | **28.85** | **29.9** | **23** | **23.2** | **23.4** | **22** | **15** | **13** |
| MANGANESE | **303** | **312** | **270** | **265** | **260** | **189** | **160** | **146** |
| **DISSOLVED METALS (µg/L)** | | | | | | | | |
| ARSENIC | 26.7 | 28.1 | 22 | 21.5 | 21 | 22 | 13 | 11 |
| MANGANESE | 284 | 300 | 294 | 283.5 | 273 | 194 | 160 | 142 |
| **FIELD (MG/L)** | | | | | | | | |
| ALKALINITY | NA | NA | NA | NA | NA | NA | NA | NA |
| DISSOLVED OXYGEN | NA | NA | NA | NA | NA | NA | 1 | 2 |
| DISSOLVED OXYGEN - HORIBA | NA | NA | NA | NA | NA | NA | 1.21 | 0 |
| FERROUS IRON | NA | NA | NA | NA | NA | NA | NA | NA |
| HYDROGEN SULFIDE | NA | NA | NA | NA | NA | NA | NA | NA |
| NITRATE | NA | NA | NA | NA | NA | NA | NA | NA |
| NITRITE | NA | NA | NA | NA | NA | NA | NA | NA |
| SALINITY (%) | NA | NA | NA | NA | NA | NA | NA | NA |
| TEMPERATURE (deg C) | NA | NA | NA | NA | NA | NA | 13.52 | 17.01 |
| SPECIFIC CONDUCTANCE (ms/cm) | NA | NA | NA | NA | NA | NA | 0.099 | 0.098 |
| OXIDATION REDUCTION POTENTIAL (mv) | NA | NA | NA | NA | NA | NA | -24 | 21 |
| TURBIDITY (ntu) | NA | NA | NA | NA | NA | NA | 3.4 | 3.9 |
| PH (s.u.) | NA | NA | NA | NA | NA | NA | 5.88 | 5.67 |

µg/L- micrograms per liter
mg/L- micrograms per liter

Notes:
1. Cleanup levels were defined for the COCs at the Former Fire Training Area in the ROD.
2. Shaded and **bolded** values indicate a result exceeding the appropriate cleanup level.

**Table A-1**
**LTM Data Summary Table**
**Former Fire Training Area**
**NASA Wallops Flight Facility, Wallops Island, Virginia**


| LOCATION | FFTA-MW055S | | | FFTA-MW056D | | | | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE ID | FFTA-MW055S-20200721 | FFTA-MW055S-20210629 | FFTA-MW055S-20220927 | FFTA-MW056D-20130319 | FFTA-MW056D-20130904 | FFTA-MW056D-20140317 | FFTA-MW056D-20140923 | FFTA-MW056D-20150317 |
| SAMPLE DATE | 20200721 | 20210629 | 20210629 | 20130319 | 20130904 | 20140317 | 20140923 | 20150317 |
| SAMPLE CODE | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL |
| **VOLATILES (µg/L)** | | | | | | | | |
| BENZENE | NA | NA | NA | 0.42 J | 0.8 J | 0.91 J | 0.49 J | 0.36 J |
| CIS-1,2-DICHLOROETHENE | NA | NA | NA | 2.8 | NA | NA | NA | 1.9 |
| **SEMIVOLATILES (µg/L)** | | | | | | | | |
| 3&4-METHYLPHENOL | 20 | NA | NA | 0.099 U | 2 U | 9.6 U | NA | NA |
| 4-METHYLPHENOL | NA | NA | NA | NA | NA | NA | 0.21 U | 0.22 U |
| NAPHTHALENE | **38 J** | **39.4 J-** | 0.30 J | 0.015 U | 1 U | 4.8 U | 0.023 U | 0.1 J |
| **METALS (µg/L)** | | | | | | | | |
| ARSENIC | **20** | **20.2** | 6.1 | 3.3 | 1.2 U | 1.2 U | 2.7 | 0.93 J |
| MANGANESE | **150** | **163** | 24.5 | **700** | **940** | **930** | **910** | **790** |
| **DISSOLVED METALS (µg/L)** | | | | | | | | |
| ARSENIC | 21 | 16.7 | 6.1 | 3.3 | 1.2 U | 1.3 J | 2.4 | 0.88 J |
| MANGANESE | 160 | 141 | 23.6 | 710 | 950 | 920 | 850 | 780 |
| **FIELD (MG/L)** | | | | | | | | |
| ALKALINITY | NA | NA | NA | 27 | 14 | 25 | NA | NA |
| DISSOLVED OXYGEN | 0 | 0.6 | NA | 1 | 1 | 0.8 | NA | NA |
| DISSOLVED OXYGEN - HORIBA | 0.01 | 0 | 1.34 | 1.6 | 0.55 | 0.43 | NA | NA |
| FERROUS IRON | NA | NA | NA | 0.2 | 0 | 0.2 | NA | NA |
| HYDROGEN SULFIDE | NA | NA | NA | 0 | 0 | 0 | NA | NA |
| NITRATE | NA | NA | NA | 0 | 0 | 0 | NA | NA |
| NITRITE | NA | NA | NA | 0 | 0 | 0 | NA | NA |
| SALINITY (%) | NA | NA | NA | NA | NA | 0 | NA | NA |
| TEMPERATURE (deg C) | 22.37 | 24.42 | 19.9 | 15.54 | 16.04 | 12.12 | NA | NA |
| SPECIFIC CONDUCTANCE (ms/cm) | 0.139 | 0.076 | 0.054 | 0.084 | 0.082 | 0.122 | NA | NA |
| OXIDATION REDUCTION POTENTIAL (mv) | -9 | -83 | 104 | 115 | 45 | 52 | NA | NA |
| TURBIDITY (ntu) | 5.4 | 0 | 2.18 | 0.21 | 0.35 | 0.05 | NA | NA |
| PH (s.u.) | 5.42 | 5.8 | 5.41 | 5.99 | 6 | 6.14 | NA | NA |

µg/L- micrograms per liter
mg/L- micrograms per liter

Notes:
1. Cleanup levels were defined for the COCs at the Former Fire Training Area in the ROD.
2. Shaded and **bolded** values indicate a result exceeding the appropriate cleanup level.

**Table A-1**
**LTM Data Summary Table**
**Former Fire Training Area**
**NASA Wallops Flight Facility, Wallops Island, Virginia**


| LOCATION | FFTA-MW056D | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE ID | FFTA-MW056D-20151201 | FFTA-MW056D-20160928 | FFTA-MW56D-20170621 | FFTA-MW56D-20180327 | FFTA-MW56D-20181212 | FFTA-MW56D-20200722 | FFTA-MW56D-20210629 | FFTA-MW56D-20220928 |
| SAMPLE DATE | 20151201 | 20160928 | 20170621 | 20180327 | 20181212 | 20200722 | 20210629 | 20220928 |
| SAMPLE CODE | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL |
| **VOLATILES (µg/L)** | | | | | | | | |
| BENZENE | 0.26 U | 0.26 U | 0.26 U | 0.26 U | NA | NA | NA | NA |
| CIS-1,2-DICHLOROETHENE | NA | NA | NA | NA | NA | NA | NA | NA |
| **SEMIVOLATILES (µg/L)** | | | | | | | | |
| 3&4-METHYLPHENOL | 5.6 U | 0.44 U | 0.42 U | 0.42 U | 0.42 U | 9.5 U | NA | NA |
| 4-METHYLPHENOL | NA | NA | NA | NA | NA | NA | NA | NA |
| NAPHTHALENE | 2.2 U | 0.064 U | 0.060 U | 0.060 U | 0.060 U | 9.5 U | 0.48 U | 0.24 U |
| **METALS (µg/L)** | | | | | | | | |
| ARSENIC | 3.8 U | 2.3 U | 2.5 J | 2.3 U | 2.3 U | **260** | 1.6 J | 2.8 U |
| MANGANESE | **650** | **560** | **303** | **149** | **239** | **41000** | **817** | 121 |
| **DISSOLVED METALS (µg/L)** | | | | | | | | |
| ARSENIC | 2.3 U | 2.3 U | 4 U | 2.3 U | 2.3 U | 3 | 1.3 U | 2.8 U |
| MANGANESE | 644 | 520 | 251 | 129 | 131 | 44 | 121 | 83 |
| **FIELD (MG/L)** | | | | | | | | |
| ALKALINITY | NA | NA | NA | NA | NA | NA | NA | NA |
| DISSOLVED OXYGEN | NA | NA | NA | NA | 2 | 4 | 4 | NA |
| DISSOLVED OXYGEN - HORIBA | NA | NA | NA | NA | 1.38 | 3.95 | 0.41 | 2.83 |
| FERROUS IRON | NA | NA | NA | NA | NA | NA | NA | NA |
| HYDROGEN SULFIDE | NA | NA | NA | NA | NA | NA | NA | NA |
| NITRATE | NA | NA | NA | NA | NA | NA | NA | NA |
| NITRITE | NA | NA | NA | NA | NA | NA | NA | NA |
| SALINITY (%) | NA | NA | NA | NA | NA | NA | NA | NA |
| TEMPERATURE (deg C) | NA | NA | NA | NA | 16.93 | 25.31 | 20.33 | 17.72 |
| SPECIFIC CONDUCTANCE (ms/cm) | NA | NA | NA | NA | 0.089 | 0.082 | 0.061 | 0.066 |
| OXIDATION REDUCTION POTENTIAL (mv) | NA | NA | NA | NA | 242 | 183 | 126 | 342 |
| TURBIDITY (ntu) | NA | NA | NA | NA | 0 | 244 | 0.1 | 16.7 |
| PH (s.u.) | NA | NA | NA | NA | 5.83 | 6.2 | 6.07 | 6.06 |

µg/L- micrograms per liter
mg/L- micrograms per liter

Notes:
1. Cleanup levels were defined for the COCs at the Former Fire Training Area in the ROD.
2. Shaded and **bolded** values indicate a result exceeding the appropriate cleanup level.

**Table A-1**
**LTM Data Summary Table**
**Former Fire Training Area**
**NASA Wallops Flight Facility, Wallops Island, Virginia**


| LOCATION | FFTA-MW057S | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE ID | FFTA-MW057S-20130319 | FFTA-MW057S-20130904 | FFTA-MW057S-20140317 | FFTA-MW057S-20140923 | FFTA-MW057S-20150317 | FFTA-MW057S-20151201 | FFTA-MW057S-20160928 | FFTA-MW57S-20170620 |
| SAMPLE DATE | 20130319 | 20130904 | 20140317 | 20140923 | 20150317 | 20151201 | 20160928 | 20170620 |
| SAMPLE CODE | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL |
| **VOLATILES (µg/L)** | | | | | | | | |
| BENZENE | 0.11 U | 0.45 J | 0.32 J | 0.11 U | 0.11 U | 0.26 U | 0.26 U | 0.26 U |
| CIS-1,2-DICHLOROETHENE | 0.24 U | NA | NA | NA | 0.24 U | NA | NA | NA |
| **SEMIVOLATILES (µg/L)** | | | | | | | | |
| 3&4-METHYLPHENOL | 0.088 U | 1.9 U | 10 U | NA | NA | 5.5 U | 0.45 U | 0.42 U |
| 4-METHYLPHENOL | NA | NA | NA | 0.19 U | 0.21 U | NA | NA | NA |
| NAPHTHALENE | 0.22 | 4.1 J | 5.1 U | 0.49 | 0.33 | 2.2 U | 0.065 U | 0.60 U |
| **METALS (µg/L)** | | | | | | | | |
| ARSENIC | 2.2 | 1.2 U | 1.2 U | 0.29 U | 0.48 J | 2.3 U | 2.3 U | 4 U |
| MANGANESE | 20 | **140** | **220** | **250** | **320** | **188** | **156** | 25.6 |
| **DISSOLVED METALS (µg/L)** | | | | | | | | |
| ARSENIC | 3.2 | 1.2 U | 1.2 U | 0.29 U | 0.49 J | 2.3 U | 2.3 U | 4 U |
| MANGANESE | 7.1 | 130 | 160 | 250 | 280 | 181 | 153 | 24.3 |
| **FIELD (MG/L)** | | | | | | | | |
| ALKALINITY | 10 < | 15 | 20 | NA | NA | NA | NA | NA |
| DISSOLVED OXYGEN | 5 | 1 | 2 | NA | NA | NA | NA | NA |
| DISSOLVED OXYGEN - HORIBA | 5.08 | 0 | 1.53 | NA | NA | NA | NA | NA |
| FERROUS IRON | 0 | 0 | 0 | NA | NA | NA | NA | NA |
| HYDROGEN SULFIDE | 0 | 0.6 | 0 | NA | NA | NA | NA | NA |
| NITRATE | 0 | 0 | 0 | NA | NA | NA | NA | NA |
| NITRITE | 0 | 0 | 0 | NA | NA | NA | NA | NA |
| SALINITY (%) | NA | NA | 0 | NA | NA | NA | NA | NA |
| TEMPERATURE (deg C) | 15.78 | 16.07 | 11.58 | NA | NA | NA | NA | NA |
| SPECIFIC CONDUCTANCE (ms/cm) | 0.116 | 0.75 | 0.081 | NA | NA | NA | NA | NA |
| OXIDATION REDUCTION POTENTIAL (mv) | 232 | 301 | 226 | NA | NA | NA | NA | NA |
| TURBIDITY (ntu) | 0.72 | 0.62 | 3.05 | NA | NA | NA | NA | NA |
| PH (s.u.) | 5.65 | 5.4 | 5.45 | NA | NA | NA | NA | NA |

µg/L- micrograms per liter
mg/L- micrograms per liter

Notes:
1. Cleanup levels were defined for the COCs at the Former Fire Training Area in the ROD.
2. Shaded and **bolded** values indicate a result exceeding the appropriate cleanup level.

**Table A-1**
**LTM Data Summary Table**
**Former Fire Training Area**
**NASA Wallops Flight Facility, Wallops Island, Virginia**


| LOCATION | FFTA-MW057S | | | | | FFTA-MW058S | | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE ID | FFTA-MW57S-20180328 | FFTA-MW57S-20181213 | FFTA-MW57S-20200722 | FFTA-MW57S-20210630 | FFTA-MW57S-20220928 | FFTA-MW058S-20130319 | FFTA-MW058S-20130904 | FFTA-MW058S-20140318 |
| SAMPLE DATE | 20180328 | 20181213 | 20200722 | 20210630 | 20220928 | 20130319 | 20130904 | 20140318 |
| SAMPLE CODE | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL |
| **VOLATILES (µg/L)** | | | | | | | | |
| BENZENE | 0.26 U | NA | NA | NA | NA | 1.1 | 1.6 J | 2.6 J |
| CIS-1,2-DICHLOROETHENE | NA | NA | NA | NA | NA | 0.34 J | NA | NA |
| **SEMIVOLATILES (µg/L)** | | | | | | | | |
| 3&4-METHYLPHENOL | 0.42 U | 0.042 U | 9.5 U | NA | NA | 1 | 1.9 U | 10 U |
| 4-METHYLPHENOL | NA | NA | NA | NA | NA | NA | NA | NA |
| NAPHTHALENE | 0.60 U | 0.060 U | 9.5 U | 0.48 U | 0.23 U | **21** | 16 | **40 J** |
| **METALS (µg/L)** | | | | | | | | |
| ARSENIC | 2.3 U | 2.3 U | 3.0 U | 1.3 U | 2.8 U | 5.7 | 6.7 J | 10 |
| MANGANESE | 0.77 U | **216** | **150** | **436** | **149** | **490** | **1100** | **1800** |
| **DISSOLVED METALS (µg/L)** | | | | | | | | |
| ARSENIC | 3.0 J | 2.3 J | 3.0 U | 1.3 U | 2.8 U | 5.7 | 7.2 J | 9.9 J |
| MANGANESE | 12.8 | 113 | 160 | 1.7 J | 131 | 510 | 1100 | 1700 |
| **FIELD (MG/L)** | | | | | | | | |
| ALKALINITY | NA | NA | NA | NA | NA | 60 | 25 | 50 |
| DISSOLVED OXYGEN | 6 | 3 | 1 | 4 | NA | 1 | 0.4 | 0 |
| DISSOLVED OXYGEN - HORIBA | 6.5 | 1.41 | 0.17 | 1.78 | 1.46 | 0.88 | 0 | 0.55 |
| FERROUS IRON | NA | NA | NA | NA | NA | 2 | 0 | 3.2 |
| HYDROGEN SULFIDE | NA | NA | NA | NA | NA | 0 | 0 | 0 |
| NITRATE | NA | NA | NA | NA | NA | 0 | 0 | 0 |
| NITRITE | NA | NA | NA | NA | NA | 0 | 0 | 0 |
| SALINITY (%) | NA | NA | NA | NA | NA | NA | NA | 0.1 |
| TEMPERATURE (deg C) | 14.15 | 16.09 | 17.61 | 19.92 | 18.03 | 13.1 | 22.32 | 11.07 |
| SPECIFIC CONDUCTANCE (ms/cm) | 0.175 | 0.086 | 0.100 | 0.294 | 0.075 | 0.138 | 0.154 | 0.2 |
| OXIDATION REDUCTION POTENTIAL (mv) | 255 | 261 | 249 | 232 | 320 | -55 | 66 | -85 |
| TURBIDITY (ntu) | 0 | 0 | 0.8 | 4.56 | 0.66 | 3.3 | 0.6 | 0.61 |
| PH (s.u.) | 5.69 | 5.83 | 5.74 | 5.7 | 6.02 | 6.27 | 5.77 | 6.08 |

µg/L- micrograms per liter
mg/L- micrograms per liter

Notes:
1. Cleanup levels were defined for the COCs at the Former Fire Training Area in the ROD.
2. Shaded and **bolded** values indicate a result exceeding the appropriate cleanup level.

**Table A-1**
**LTM Data Summary Table**
**Former Fire Training Area**
**NASA Wallops Flight Facility, Wallops Island, Virginia**


| LOCATION | FFTA-MW058S | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE ID | FFTA-MW058S-20140923 | FFTA-MW058S-20150317 | FFTA-MW058S-20151201 | FFTA-MW058S-20160927 | FFTA-MW58S-20170621 | FFTA-MW58S-20180326 | FFTA-MW58S-20181212 | FFTA-MW58S-20200721 |
| SAMPLE DATE | 20140923 | 20150317 | 20151201 | 20160927 | 20170621 | 20180326 | 20181212 | 20200721 |
| SAMPLE CODE | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL |
| **VOLATILES (µg/L)** | | | | | | | | |
| BENZENE | 1.4 | 1.1 | 0.44 J | 0.79 J | 0.26 U | 0.50 J | NA | NA |
| CIS-1,2-DICHLOROETHENE | NA | 0.24 U | NA | NA | NA | NA | NA | NA |
| **SEMIVOLATILES (µg/L)** | | | | | | | | |
| 3&4-METHYLPHENOL | NA | NA | 5.8 U | 1.1 J | 0.42 U | 2.6 | 2.2 | 9.5 U |
| 4-METHYLPHENOL | 1.5 | 0.23 U | NA | NA | NA | NA | NA | NA |
| NAPHTHALENE | 11 | **17** | 12 | 15 | 11 | **17** | **18** | 12 |
| **METALS (µg/L)** | | | | | | | | |
| ARSENIC | 9.6 | 8.3 | **13** | **17** | 7.9 | **15** | **21** | **20** |
| MANGANESE | **1000** | **1100** | **580** | **425** | **271** | **432** | **663** | **810** |
| **DISSOLVED METALS (µg/L)** | | | | | | | | |
| ARSENIC | 8.7 | 8.5 | 13 | 20 | 7.7 | 17 | 19 | 21 |
| MANGANESE | 1000 | 1100 | 553 | 420 | 271 | 417 | 649 | 820 |
| **FIELD (MG/L)** | | | | | | | | |
| ALKALINITY | NA | NA | NA | NA | NA | NA | NA | NA |
| DISSOLVED OXYGEN | NA | NA | NA | NA | NA | 0 | 0 | 0 |
| DISSOLVED OXYGEN - HORIBA | NA | NA | NA | NA | NA | 0.73 | 0 | 0 |
| FERROUS IRON | NA | NA | NA | NA | NA | NA | NA | NA |
| HYDROGEN SULFIDE | NA | NA | NA | NA | NA | NA | NA | NA |
| NITRATE | NA | NA | NA | NA | NA | NA | NA | NA |
| NITRITE | NA | NA | NA | NA | NA | NA | NA | NA |
| SALINITY (%) | NA | NA | NA | NA | NA | NA | NA | NA |
| TEMPERATURE (deg C) | NA | NA | NA | NA | NA | 14.25 | 16.79 | 26.19 |
| SPECIFIC CONDUCTANCE (ms/cm) | NA | NA | NA | NA | NA | 0.193 | 0.169 | 0.117 |
| OXIDATION REDUCTION POTENTIAL (mv) | NA | NA | NA | NA | NA | -55 | -106 | -78 |
| TURBIDITY (ntu) | NA | NA | NA | NA | NA | 0 | 2.3 | 10.9 |
| PH (s.u.) | NA | NA | NA | NA | NA | 6.4 | 6.52 | 6.6 |

µg/L- micrograms per liter
mg/L- micrograms per liter

Notes:
1. Cleanup levels were defined for the COCs at the Former Fire Training Area in the ROD.
2. Shaded and **bolded** values indicate a result exceeding the appropriate cleanup level.

**Table A-1**
**LTM Data Summary Table**
**Former Fire Training Area**
**NASA Wallops Flight Facility, Wallops Island, Virginia**


| LOCATION | FFTA-MW058S | | FFTA-MW061I | | | | | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE ID | FFTA-MW58S-20210629 | FFTA-MW58S-20220927 | FFTA-MW061I-20130319 | FFTA-MW061I-20130521 | FFTA-MW061I-20130521-AVG | FFTA-MW061I-20130521-D | FFTA-MW061I-20130905 | FFTA-MW061I-20140317 |
| SAMPLE DATE | 20210629 | 20220927 | 20130319 | 20130521 | 20130521 | 20130521 | 20130905 | 20140317 |
| SAMPLE CODE | NORMAL | NORMAL | NORMAL | ORIG | AVG | DUP | NORMAL | NORMAL |
| **VOLATILES (µg/L)** | | | | | | | | |
| BENZENE | NA | NA | 1.3 | NA | NA | NA | 1.1 J | 0.25 U |
| CIS-1,2-DICHLOROETHENE | NA | NA | 0.59 J | NA | NA | NA | NA | NA |
| **SEMIVOLATILES (µg/L)** | | | | | | | | |
| 3&4-METHYLPHENOL | NA | NA | 0.087 U | NA | NA | NA | 1.9 U | 9.7 U |
| 4-METHYLPHENOL | NA | NA | NA | NA | NA | NA | NA | NA |
| NAPHTHALENE | 0.48 U | **21.4** | 11 | NA | NA | NA | 6.8 J | 4.9 U |
| **METALS (µg/L)** | | | | | | | | |
| ARSENIC | 7.7 J | **38.8** | **370** | 6 | 6.15 | 6.3 | **18** | **23** |
| MANGANESE | **835** | **422** | **1400** | **1700** | **1650** | **1600** | **1100** | **960** |
| **DISSOLVED METALS (µg/L)** | | | | | | | | |
| ARSENIC | 7.6 J | 38.4 | 11 | 6.1 | 6.05 | 6 | 8.5 J | 8.4 J |
| MANGANESE | 885 | 441 | 1600 | 1600 | 1600 | 1600 | 1100 | 960 |
| **FIELD (MG/L)** | | | | | | | | |
| ALKALINITY | NA | NA | 32 | NA | NA | NA | 30 | 14 |
| DISSOLVED OXYGEN | 0.8 | NA | 0 | NA | NA | NA | 0 | 0.05 |
| DISSOLVED OXYGEN - HORIBA | 0.01 | 0.02 | 0.41 | NA | NA | NA | 0 | 0.29 |
| FERROUS IRON | NA | NA | 3 | NA | NA | NA | 1.2 | 2.8 |
| HYDROGEN SULFIDE | NA | NA | 0 | NA | NA | NA | 0 | 0 |
| NITRATE | NA | NA | 0 | NA | NA | NA | 0 | 0 |
| NITRITE | NA | NA | 0 | NA | NA | NA | 0 | 0 |
| SALINITY (%) | NA | NA | NA | NA | NA | NA | NA | 0 |
| TEMPERATURE (deg C) | 22.03 | 19.6 | 14.5 | NA | NA | NA | 17.54 | 10.53 |
| SPECIFIC CONDUCTANCE (ms/cm) | 0.068 | 0.141 | 0.28 | NA | NA | NA | 0.096 | 0.117 |
| OXIDATION REDUCTION POTENTIAL (mv) | -24 | -77 | -41 | NA | NA | NA | 40 | -56 |
| TURBIDITY (ntu) | 0 | 4.02 | 0.84 | NA | NA | NA | 5.32 | 9.31 |
| PH (s.u.) | 6.38 | 6.47 | 6.2 | NA | NA | NA | 6.1 | 6.45 |

µg/L- micrograms per liter
mg/L- micrograms per liter

Notes:
1. Cleanup levels were defined for the COCs at the Former Fire Training Area in the ROD.
2. Shaded and **bolded** values indicate a result exceeding the appropriate cleanup level.

**Table A-1**
**LTM Data Summary Table**
**Former Fire Training Area**
**NASA Wallops Flight Facility, Wallops Island, Virginia**


| LOCATION | FFTA-MW061I | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE ID | FFTA-MW061I-20140923 | FFTA-MW061I-20150317 | FFTA-MW061I-20151201 | FFTA-MW061I-20160928 | FFTA-MW61I-20170621 | FFTA-MW61I-20180326 | FFTA-MW61I-20181213 | FFTA-MW61I-20200721 |
| SAMPLE DATE | 20140923 | 20150317 | 20151201 | 20160928 | 20170621 | 20180326 | 20181213 | 20200721 |
| SAMPLE CODE | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL |
| **VOLATILES (µg/L)** | | | | | | | | |
| BENZENE | 0.11 U | 0.11 U | 0.26 U | 0.26 U | 0.26 U | 0.26 U | NA | NA |
| CIS-1,2-DICHLOROETHENE | NA | 0.24 U | NA | NA | NA | NA | NA | NA |
| **SEMIVOLATILES (µg/L)** | | | | | | | | |
| 3&4-METHYLPHENOL | NA | NA | 5.5 U | 0.43 U | 0.42 U | 0.42 U | 0.42 U | 9.6 U |
| 4-METHYLPHENOL | 0.22 U | 0.22 U | NA | NA | NA | NA | NA | NA |
| NAPHTHALENE | 0.41 | 0.22 | 2.2 U | 0.32 | 0.33 | 0.29 | 0.43 | 9.6 U |
| **METALS (µg/L)** | | | | | | | | |
| ARSENIC | 9 | 7.5 | 5.9 U | 3.5 J | **14** | 9.2 | 9.2 | 9.3 |
| MANGANESE | **540** | **740** | **664** | **508** | **1760** | **748** | **1450** | **1200** |
| **DISSOLVED METALS (µg/L)** | | | | | | | | |
| ARSENIC | 7.7 | 7 | 5 U | 4.3 J | 17 | 7.4 | 7.8 | 9.5 |
| MANGANESE | 590 | 740 | 655 | 502 | 1890 | 772 | 1460 | 1200 |
| **FIELD (MG/L)** | | | | | | | | |
| ALKALINITY | NA | NA | NA | NA | NA | NA | NA | NA |
| DISSOLVED OXYGEN | NA | NA | NA | NA | NA | 0 | 0 | 2 |
| DISSOLVED OXYGEN - HORIBA | NA | NA | NA | NA | NA | 11.8 | 0 | 0 |
| FERROUS IRON | NA | NA | NA | NA | NA | NA | NA | NA |
| HYDROGEN SULFIDE | NA | NA | NA | NA | NA | NA | NA | NA |
| NITRATE | NA | NA | NA | NA | NA | NA | NA | NA |
| NITRITE | NA | NA | NA | NA | NA | NA | NA | NA |
| SALINITY (%) | NA | NA | NA | NA | NA | NA | NA | NA |
| TEMPERATURE (deg C) | NA | NA | NA | NA | NA | 14.28 | 16.09 | 24.96 |
| SPECIFIC CONDUCTANCE (ms/cm) | NA | NA | NA | NA | NA | 0.09 | 0.094 | 0.079 |
| OXIDATION REDUCTION POTENTIAL (mv) | NA | NA | NA | NA | NA | -39 | 249 | -43 |
| TURBIDITY (ntu) | NA | NA | NA | NA | NA | 36 | 0 | 7.1 |
| PH (s.u.) | NA | NA | NA | NA | NA | 6.66 | 6.57 | 6.52 |

µg/L- micrograms per liter
mg/L- micrograms per liter

Notes:
1. Cleanup levels were defined for the COCs at the Former Fire Training Area in the ROD.
2. Shaded and **bolded** values indicate a result exceeding the appropriate cleanup level.

**Table A-1**
**LTM Data Summary Table**
**Former Fire Training Area**
**NASA Wallops Flight Facility, Wallops Island, Virginia**


| LOCATION | FFTA-MW061I | | FFTA-MW101S | | | | | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE ID | FFTA-MW61I-20210629 | FFTA-MW61I-20220928 | FFTA-MW101S-20130320 | FFTA-MW101S-20130905 | FFTA-MW101S-20140318 | FFTA-MW101S-20140924 | FFTA-MW101S-20150318 | FFTA-MW101S-20151202 |
| SAMPLE DATE | 20210629 | 20220928 | 20130320 | 20130905 | 20140318 | 20140924 | 20150318 | 20151202 |
| SAMPLE CODE | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL |
| **VOLATILES (µg/L)** | | | | | | | | |
| BENZENE | NA | NA | 0.11 U | 0.25 U | 0.25 U | 0.11 U | 0.11 U | 0.26 U |
| CIS-1,2-DICHLOROETHENE | NA | NA | 0.24 U | NA | NA | NA | 0.24 U | NA |
| **SEMIVOLATILES (µg/L)** | | | | | | | | |
| 3&4-METHYLPHENOL | NA | NA | 5.3 | 8.5 J | 9.5 U | NA | NA | 6.2 U |
| 4-METHYLPHENOL | NA | NA | NA | NA | NA | 0.21 U | 0.2 U | NA |
| NAPHTHALENE | 0.48 U | 0.23 U | 13 | **36** | 11 J | 0.023 U | 0.2 | 2.4 U |
| **METALS (µg/L)** | | | | | | | | |
| ARSENIC | **13.7** | 9.6 | 5.4 | **11** | 2.1 J | 0.29 U | 0.45 J | 2.3 U |
| MANGANESE | **1100** | **1000** | 15 | 35 | 11 | 0.92 J | 0.77 U | 2.5 |
| **DISSOLVED METALS (µg/L)** | | | | | | | | |
| ARSENIC | 7.6 J | 10.2 J | 6.3 | 9.9 J | 2.1 J | 0.29 U | 0.36 J | 2.3 U |
| MANGANESE | 1190 | 1020 | 16 | 34 | 12 | 1.1 J | 1 U | 1 U |
| **FIELD (MG/L)** | | | | | | | | |
| ALKALINITY | NA | NA | 12 | 15 | 14 | NA | NA | NA |
| DISSOLVED OXYGEN | 1 | NA | 3 | 3 | 4 | NA | NA | NA |
| DISSOLVED OXYGEN - HORIBA | 0 | 0 | 3.83 | 1.77 | -1.02 | NA | NA | NA |
| FERROUS IRON | NA | NA | 2 | 1 | 1.3 | NA | NA | NA |
| HYDROGEN SULFIDE | NA | NA | 0 | 0.1 | 0 | NA | NA | NA |
| NITRATE | NA | NA | 0 | 0 | 0 | NA | NA | NA |
| NITRITE | NA | NA | 0 | 0 | 0 | NA | NA | NA |
| SALINITY (%) | NA | NA | NA | NA | 0 | NA | NA | NA |
| TEMPERATURE (deg C) | 20.04 | 18.25 | 13.99 | 23.9 | 13.82 | NA | NA | NA |
| SPECIFIC CONDUCTANCE (ms/cm) | 0.074 | 0.089 | 0.103 | 0.088 | 0.102 | NA | NA | NA |
| OXIDATION REDUCTION POTENTIAL (mv) | -74 | -48 | 82 | 152 | 77 | NA | NA | NA |
| TURBIDITY (ntu) | 4.06 | 0.81 | 0.44 | 2.52 | 0.09 | NA | NA | NA |
| PH (s.u.) | 6.51 | 6.02 | 4.82 | 5.52 | 5.71 | NA | NA | NA |

µg/L- micrograms per liter
mg/L- micrograms per liter

Notes:
1. Cleanup levels were defined for the COCs at the Former Fire Training Area in the ROD.
2. Shaded and **bolded** values indicate a result exceeding the appropriate cleanup level.

**Table A-1**
**LTM Data Summary Table**
**Former Fire Training Area**
**NASA Wallops Flight Facility, Wallops Island, Virginia**


| LOCATION | FFTA-MW101S | | | FFTA-MW102D | | | | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE ID | FFTA-MW101S-20160927 | FFTA-MW101S-20170622 | FFTA-MW101S-20180326 | FFTA-MW102D-20130319 | FFTA-MW102D-20130904 | FFTA-MW102D-20140318 | FFTA-MW102D-20140923 | FFTA-MW102D-20150317 |
| SAMPLE DATE | 20160927 | 20170622 | 20180326 | 20130319 | 20130904 | 20140318 | 20140923 | 20150317 |
| SAMPLE CODE | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL |
| **VOLATILES (µg/L)** | | | | | | | | |
| BENZENE | 0.26 U | 0.26 U | 0.26 U | 0.11 U | 0.25 U | 0.25 U | 0.11 U | 0.11 U |
| CIS-1,2-DICHLOROETHENE | NA | NA | NA | 0.24 U | NA | NA | NA | 0.24 U |
| **SEMIVOLATILES (µg/L)** | | | | | | | | |
| 3&4-METHYLPHENOL | 0.49 U | 0.42 U | 0.42 U | 0.094 U | 1.9 U | 9.8 U | NA | NA |
| 4-METHYLPHENOL | NA | NA | NA | NA | NA | NA | 0.22 U | 0.22 U |
| NAPHTHALENE | 0.071 U | 3.6 | 0.060 U | 0.015 U | 0.95 U | 4.9 U | 0.03 J | 0.024 U |
| **METALS (µg/L)** | | | | | | | | |
| ARSENIC | 2.9 J | 2.6 J | 2.3 U | 2.6 | 1.2 U | 1.2 U | 1.7 | 0.29 U |
| MANGANESE | 4.41 | 15.2 | 45.1 | 5.8 B | 7.9 | 2.7 | 2.4 J | 3 J |
| **DISSOLVED METALS (µg/L)** | | | | | | | | |
| ARSENIC | 2.3 U | 3.3 J | 2.3 U | 3.1 | 1.2 U | 1.2 U | 1.9 | 0.29 U |
| MANGANESE | 4.75 | 15.4 | 21 | 2.2 B | 1.6 J | 1.6 J | 0.97 J | 2.1 J |
| **FIELD (MG/L)** | | | | | | | | |
| ALKALINITY | NA | NA | NA | 10 < | 14 | 10 < | NA | NA |
| DISSOLVED OXYGEN | NA | NA | 5 | 3 | 5 | 2 | NA | NA |
| DISSOLVED OXYGEN - HORIBA | NA | NA | 5.72 | 4.14 | 3.26 | 2.22 | NA | NA |
| FERROUS IRON | NA | NA | NA | 0.2 | 0.2 | 0 | NA | NA |
| HYDROGEN SULFIDE | NA | NA | NA | 0 | 0 | 0 | NA | NA |
| NITRATE | NA | NA | NA | 0 | 0 | 0 | NA | NA |
| NITRITE | NA | NA | NA | 0 | 0 | 0 | NA | NA |
| SALINITY (%) | NA | NA | NA | NA | NA | 0 | NA | NA |
| TEMPERATURE (deg C) | NA | NA | 14.1 | 14.34 | 18.07 | 12.99 | NA | NA |
| SPECIFIC CONDUCTANCE (ms/cm) | NA | NA | 0.067 | 0.098 | 0.09 | 0.094 | NA | NA |
| OXIDATION REDUCTION POTENTIAL (mv) | NA | NA | 87 | 254 | 265 | 279 | NA | NA |
| TURBIDITY (ntu) | NA | NA | 0 | 0.12 | 0.18 | 0 | NA | NA |
| PH (s.u.) | NA | NA | 6.1 | 5.73 | 5.55 | 4.92 | NA | NA |

µg/L- micrograms per liter
mg/L- micrograms per liter

Notes:
1. Cleanup levels were defined for the COCs at the Former Fire Training Area in the ROD.
2. Shaded and **bolded** values indicate a result exceeding the appropriate cleanup level.

**Table A-1**
**LTM Data Summary Table**
**Former Fire Training Area**
**NASA Wallops Flight Facility, Wallops Island, Virginia**


| LOCATION | FFTA-MW102D | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE ID | FFTA-MW102D-20151201 | FFTA-MW102D-20160927 | FFTA-MW102D-20170621 | FFTA-MW102D-20180326 | FFTA-MW102D-20181212 | FFTA-DUP01-20181212 | FFTA-MW102D-20200722 | FFTA-MW102D-20210629 |
| SAMPLE DATE | 20151201 | 20160927 | 20170621 | 20180326 | 20181212 | 20181212 | 20200722 | 20210629 |
| SAMPLE CODE | NORMAL | NORMAL | NORMAL | NORMAL | ORIGINAL | DUPLICATE | NORMAL | NORMAL |
| **VOLATILES (µg/L)** | | | | | | | | |
| BENZENE | 0.26 U | 0.26 U | 0.26 U | 0.26 U | NA | NA | NA | NA |
| CIS-1,2-DICHLOROETHENE | NA | NA | NA | NA | NA | NA | NA | NA |
| **SEMIVOLATILES (µg/L)** | | | | | | | | |
| 3&4-METHYLPHENOL | 5.4 U | 0.43 U | 0.42 U | 0.42 U | 0.42 U | 0.42 U | 9.5 U | NA |
| 4-METHYLPHENOL | NA | NA | NA | NA | NA | NA | NA | NA |
| NAPHTHALENE | 2.1 U | 0.062 U | 0.060 U | 0.060 U | 0.060 U | 0.060 U | 9.5 U | 0.49 U |
| **METALS (µg/L)** | | | | | | | | |
| ARSENIC | 2.3 U | 2.3 U | 4 U | 2.3 U | 2.3 U | 2.3 U | 3.0 U | 1.3 U |
| MANGANESE | 2.4 | 2.6 | 34.9 | 17.1 | 2.2 | 6.88 | 45 | 2.7 U |
| **DISSOLVED METALS (µg/L)** | | | | | | | | |
| ARSENIC | 2.3 U | 2.3 U | 4 U | 2.3 U | 2.3 U | 2.3 U | 3.0 U | 1.3 U |
| MANGANESE | 1.7 U | 1.5 U | 2.8 | 136 | 3.1 | 7.76 | 7.9 | 1.0 J |
| **FIELD (MG/L)** | | | | | | | | |
| ALKALINITY | NA | NA | NA | NA | NA | NA | NA | NA |
| DISSOLVED OXYGEN | NA | NA | NA | 3 | 2 | 2 | 4 | 7 |
| DISSOLVED OXYGEN - HORIBA | NA | NA | NA | 4.14 | 0 | 0 | 4.85 | 3.39 |
| FERROUS IRON | NA | NA | NA | NA | NA | NA | NA | NA |
| HYDROGEN SULFIDE | NA | NA | NA | NA | NA | NA | NA | NA |
| NITRATE | NA | NA | NA | NA | NA | NA | NA | NA |
| NITRITE | NA | NA | NA | NA | NA | NA | NA | NA |
| SALINITY (%) | NA | NA | NA | NA | NA | NA | NA | NA |
| TEMPERATURE (deg C) | NA | NA | NA | 15.29 | 16.09 | 16.09 | 22.86 | 21.81 |
| SPECIFIC CONDUCTANCE (ms/cm) | NA | NA | NA | 0.112 | 0.116 | 0.116 | 0.129 | 0.093 |
| OXIDATION REDUCTION POTENTIAL (mv) | NA | NA | NA | 223 | 249 | 249 | 258 | 183 |
| TURBIDITY (ntu) | NA | NA | NA | 2.8 | 0 | 0 | 57 | 57 |
| PH (s.u.) | NA | NA | NA | 5.73 | 5.53 | 5.53 | 5.42 | 5.56 |

µg/L- micrograms per liter
mg/L- micrograms per liter

Notes:
1. Cleanup levels were defined for the COCs at the Former Fire Training Area in the ROD.
2. Shaded and **bolded** values indicate a result exceeding the appropriate cleanup level.

**Table A-1**
**LTM Data Summary Table**
**Former Fire Training Area**
**NASA Wallops Flight Facility, Wallops Island, Virginia**


| LOCATION | FFTA-MW103D | | FFTA-MW103I | | FFTA-MW103S | | FFTA-MW105D | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE ID | FFTA-MW103D-20130320 | FFTA-MW103D-20130904 | FFTA-MW103I-20130320 | FFTA-MW103I-20130904 | FFTA-MW103S-20130320 | FFTA-MW103S-20130904 | FFTA-MW105D-20130319 | FFTA-MW105D-20130904 |
| SAMPLE DATE | 20130320 | 20130904 | 20130320 | 20130904 | 20130320 | 20130904 | 20130319 | 20130904 |
| SAMPLE CODE | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL |
| **VOLATILES (µg/L)** | | | | | | | | |
| BENZENE | 0.11 U | 0.25 U | 0.11 U | 0.25 U | 0.11 U | 0.25 U | 0.11 U | 0.25 U |
| CIS-1,2-DICHLOROETHENE | 0.41 J | NA | 1.2 | NA | 0.24 U | NA | 0.24 U | NA |
| **SEMIVOLATILES (µg/L)** | | | | | | | | |
| 3&4-METHYLPHENOL | 0.085 U | 1.9 U | 0.085 U | 1.9 U | 0.085 U | 1.9 U | 0.086 U | 1.9 U |
| 4-METHYLPHENOL | NA | NA | NA | NA | NA | NA | NA | NA |
| NAPHTHALENE | 0.013 U | 0.95 U | 0.013 U | 0.96 U | 0.1 J | 0.95 U | 0.013 U | 0.95 U |
| **METALS (µg/L)** | | | | | | | | |
| ARSENIC | 1.5 | 1.2 U | 1.9 | 1.2 U | 1.8 | 1.2 U | 2.5 | 1.2 U |
| MANGANESE | 2.9 B | 3.7 | 21 | 43 | 0.5 B | 1.1 J | 1.6 B | 1.3 J |
| **DISSOLVED METALS (µg/L)** | | | | | | | | |
| ARSENIC | 3.2 | 1.2 U | 3 | 1.2 U | 2.1 | 1.2 U | 3.3 | 1.2 U |
| MANGANESE | 3.1 B | 4.1 | 0.68 B | 0.31 J | 0.59 B | 0.89 J | 1.4 B | 2.8 |
| **FIELD (MG/L)** | | | | | | | | |
| ALKALINITY | 10 < | 10 < | 22 | 0 | 15 | 0 | 10 < | 10 |
| DISSOLVED OXYGEN | 1 | 1.5 | 3 | 4 | 4 | 4 | 3 | 2 |
| DISSOLVED OXYGEN - HORIBA | 1.43 | 3.03 | 4.59 | 2.67 | 7.27 | 2.98 | 3.95 | 2.72 |
| FERROUS IRON | 0.2 | 0 | 0.2 | 0 | 0.2 | 0 | 0.2 | 0 |
| HYDROGEN SULFIDE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NITRATE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NITRITE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SALINITY (%) | NA | NA | NA | NA | NA | NA | NA | NA |
| TEMPERATURE (deg C) | 14.08 | 16.52 | 13.92 | 18.61 | 10.66 | 18.05 | 15.67 | 16.72 |
| SPECIFIC CONDUCTANCE (ms/cm) | 0.103 | 0.071 | 0.141 | 0.098 | 0.084 | 0.225 | 0.081 | 0.07 |
| OXIDATION REDUCTION POTENTIAL (mv) | 260 | 243 | 230 | 196 | 262 | 191 | 285 | 338 |
| TURBIDITY (ntu) | 0.25 | 0 | 0.7 | 0.3 | 2.79 | 2.31 | 0.03 | 0.39 |
| PH (s.u.) | 5.49 | 5.54 | 5.76 | 6.01 | 5.36 | 6.16 | 5.32 | 5.18 |

µg/L- micrograms per liter
mg/L- micrograms per liter

Notes:
1. Cleanup levels were defined for the COCs at the Former Fire Training Area in the ROD.
2. Shaded and **bolded** values indicate a result exceeding the appropriate cleanup level.

**Table A-1**
**LTM Data Summary Table**
**Former Fire Training Area**
**NASA Wallops Flight Facility, Wallops Island, Virginia**


| LOCATION | FFTA-MW105D | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE ID | FFTA-MW105D-20140317 | FFTA-MW105D-20140923 | FFTA-MW105D-20150317 | FFTA-MW105D-20151201 | FFTA-MW105D-20160928 | FFTA-MW105D-20170620 | FFTA-MW105D-20180328 | FFTA-MW105D-20181213 |
| SAMPLE DATE | 20140317 | 20140923 | 20150317 | 20151201 | 20160928 | 20170620 | 20180328 | 20181213 |
| SAMPLE CODE | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL |
| **VOLATILES (µg/L)** | | | | | | | | |
| BENZENE | 0.25 U | 0.11 U | 0.11 U | 0.26 U | 0.26 U | 0.26 U | 0.26 U | NA |
| CIS-1,2-DICHLOROETHENE | NA | NA | 0.24 U | NA | NA | NA | NA | NA |
| **SEMIVOLATILES (µg/L)** | | | | | | | | |
| 3&4-METHYLPHENOL | 9.6 U | NA | NA | 5.8 U | 0.43 UJ | 0.42 U | 0.42 U | 0.42 U |
| 4-METHYLPHENOL | NA | 0.2 U | 0.22 U | NA | NA | NA | NA | NA |
| NAPHTHALENE | 4.8 U | 0.022 U | 0.03 J | 2.3 U | 0.063 UJ | 0.060 U | 0.060 U | 0.060 U |
| **METALS (µg/L)** | | | | | | | | |
| ARSENIC | 1.2 U | 0.29 U | 0.29 U | 2.3 U | 2.3 U | 4 U | 2.3 U | 2.3 U |
| MANGANESE | 1.6 J | 1.4 J | 1.2 U | 2.2 | 1.6 U | 1.6 J | 9.34 | 6.23 |
| **DISSOLVED METALS (µg/L)** | | | | | | | | |
| ARSENIC | 1.2 U | 0.94 J | 0.29 U | 2.3 U | 2.3 U | 2.4 J | 2.3 U | 2.3 U |
| MANGANESE | 7.5 | 1.2 J | 1.2 U | 1.7 U | 2.4 | 1.8 U | 7.76 | 1.7 J |
| **FIELD (MG/L)** | | | | | | | | |
| ALKALINITY | 10 | NA | NA | NA | NA | NA | NA | NA |
| DISSOLVED OXYGEN | 1 | NA | NA | NA | NA | NA | 3 | 3 |
| DISSOLVED OXYGEN - HORIBA | 2.47 | NA | NA | NA | NA | NA | 3.72 | 2.25 |
| FERROUS IRON | 0 | NA | NA | NA | NA | NA | NA | NA |
| HYDROGEN SULFIDE | 0 | NA | NA | NA | NA | NA | NA | NA |
| NITRATE | 0 | NA | NA | NA | NA | NA | NA | NA |
| NITRITE | 0 | NA | NA | NA | NA | NA | NA | NA |
| SALINITY (%) | 0 | NA | NA | NA | NA | NA | NA | NA |
| TEMPERATURE (deg C) | 10.07 | NA | NA | NA | NA | NA | 13.69 | 15.27 |
| SPECIFIC CONDUCTANCE (ms/cm) | 0.081 | NA | NA | NA | NA | NA | 0.104 | 0.107 |
| OXIDATION REDUCTION POTENTIAL (mv) | 305 | NA | NA | NA | NA | NA | 267 | 302 |
| TURBIDITY (ntu) | 3.08 | NA | NA | NA | NA | NA | 0 | 0 |
| PH (s.u.) | 5.05 | NA | NA | NA | NA | NA | 5.62 | 5.44 |

µg/L- micrograms per liter
mg/L- micrograms per liter

Notes:
1. Cleanup levels were defined for the COCs at the Former Fire Training Area in the ROD.
2. Shaded and **bolded** values indicate a result exceeding the appropriate cleanup level.

**Table A-1**
**LTM Data Summary Table**
**Former Fire Training Area**
**NASA Wallops Flight Facility, Wallops Island, Virginia**


| LOCATION | FFTA-MW105D | | FFTA-MW106 | | | | | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE ID | FFTA-MW105D-20200722 | FFTA-MW105D-20210630 | FFTA-MW106-20130320 | FFTA-MW106-20130904 | FFTA-MW106-20140317 | FFTA-MW106-20140923 | FFTA-MW106-20150317 | FFTA-MW106-20151201 |
| SAMPLE DATE | 20200722 | 20210630 | 20130320 | 20130904 | 20140317 | 20140923 | 20150317 | 20151201 |
| SAMPLE CODE | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL |
| **VOLATILES (µg/L)** | | | | | | | | |
| BENZENE | NA | NA | 0.11 U | 0.25 U | 0.25 U | 0.11 U | 0.11 U | 0.26 U |
| CIS-1,2-DICHLOROETHENE | NA | NA | 0.24 U | NA | NA | NA | 0.24 U | NA |
| **SEMIVOLATILES (µg/L)** | | | | | | | | |
| 3&4-METHYLPHENOL | 9.5 U | NA | 0.086 U | 1.9 U | 10 U | NA | NA | 6.2 U |
| 4-METHYLPHENOL | NA | NA | NA | NA | NA | 0.22 U | 0.22 U | NA |
| NAPHTHALENE | 9.5 U | 0.48 U | 0.013 U | 0.95 U | 5.1 U | 0.024 U | 0.024 U | 2.4 U |
| **METALS (µg/L)** | | | | | | | | |
| ARSENIC | 3.0 U | 1.3 U | 1.3 | 1.2 U | 1.2 U | 1.6 U | 0.29 U | 2.3 U |
| MANGANESE | 5.0 U | 1.5 J | 0.44 B | 1 J | 0.87 J | 0.7 J | 1.2 U | 0.92 J |
| **DISSOLVED METALS (µg/L)** | | | | | | | | |
| ARSENIC | 3.0 U | 1.3 U | 2.4 | 1.2 U | 1.2 U | 1.5 U | 0.29 U | 2.3 U |
| MANGANESE | 5.0 U | 1.2 J | 0.69 B | 0.74 J | 0.65 J | 0.78 J | 0.88 U | 1 U |
| **FIELD (MG/L)** | | | | | | | | |
| ALKALINITY | NA | NA | 5 | 12 | 24 | NA | NA | NA |
| DISSOLVED OXYGEN | 4 | 3 | 8 | 7 | 8 | NA | NA | NA |
| DISSOLVED OXYGEN - HORIBA | 5.21 | 3.18 | 6.2 | 9.14 | 10.25 | NA | NA | NA |
| FERROUS IRON | NA | NA | 0.6 | 0 | 0 | NA | NA | NA |
| HYDROGEN SULFIDE | NA | NA | 0 | 0.1 | 0 | NA | NA | NA |
| NITRATE | NA | NA | 0 | 0 | 0 | NA | NA | NA |
| NITRITE | NA | NA | 0 | 0 | 0 | NA | NA | NA |
| SALINITY (%) | NA | NA | NA | NA | 0 | NA | NA | NA |
| TEMPERATURE (deg C) | 23.76 | 17.43 | 14.57 | 19.09 | 8.67 | NA | NA | NA |
| SPECIFIC CONDUCTANCE (ms/cm) | 0.084 | 0.82 | 0.143 | 0.077 | 0.086 | NA | NA | NA |
| OXIDATION REDUCTION POTENTIAL (mv) | 288 | 272 | 204 | 195 | 314 | NA | NA | NA |
| TURBIDITY (ntu) | 3.2 | 2.5 | 0.32 | 0.18 | 1.69 | NA | NA | NA |
| PH (s.u.) | 5.43 | 5.4 | 6.22 | 6.19 | 5.81 | NA | NA | NA |

µg/L- micrograms per liter
mg/L- micrograms per liter

Notes:
1. Cleanup levels were defined for the COCs at the Former Fire Training Area in the ROD.
2. Shaded and **bolded** values indicate a result exceeding the appropriate cleanup level.

**Table A-1**
**LTM Data Summary Table**
**Former Fire Training Area**
**NASA Wallops Flight Facility, Wallops Island, Virginia**


| LOCATION | FFTA-MW106 | | | | | | FFTA-MW107 | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE ID | FFTA-MW106-20160927 | FFTA-MW106-20170621 | FFTA-MW106-20180327 | FFTA-MW106-20181212 | FFTA-MW106-20200721 | FFTA-MW106-20210629 | FFTA-MW107-20130320 | FFTA-MW107-20130905 |
| SAMPLE DATE | 20160927 | 20170621 | 20180327 | 20181212 | 20200721 | 20210629 | 20130320 | 20130905 |
| SAMPLE CODE | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL |
| **VOLATILES (µg/L)** | | | | | | | | |
| BENZENE | 0.26 U | 0.26 U | 0.26 U | NA | NA | NA | **6.6** | 4.7 J |
| CIS-1,2-DICHLOROETHENE | NA | NA | NA | NA | NA | NA | 1.6 | NA |
| **SEMIVOLATILES (µg/L)** | | | | | | | | |
| 3&4-METHYLPHENOL | 0.44 U | 0.42 U | 0.42 U | 0.42 U | 9.5 U | NA | 7.1 | 7.9 J |
| 4-METHYLPHENOL | NA | NA | NA | NA | NA | NA | NA | NA |
| NAPHTHALENE | 0.063 U | 0.060 U | 0.060 U | 0.060 U | 9.5 U | 0.48 U | **72** | **40** |
| **METALS (µg/L)** | | | | | | | | |
| ARSENIC | 2.3 U | 4 U | 2.3 U | 2.3 U | 3.0 U | 1.3 U | **27** | **35** |
| MANGANESE | 1.3 U | 1 J | 1.3 U | 3.2 J | 5.0 U | 2.0 J | **520** | **500** |
| **DISSOLVED METALS (µg/L)** | | | | | | | | |
| ARSENIC | 2.3 U | 4 U | 2.3 U | 2.3 U | 3.0 U | 1.3 U | 26 | 35 |
| MANGANESE | 1.4 U | 0.91 J | 0.81 U | 3.4 J | 5.0 U | 1.0 U | 510 | 480 |
| **FIELD (MG/L)** | | | | | | | | |
| ALKALINITY | NA | NA | NA | NA | NA | NA | 100 | 35 |
| DISSOLVED OXYGEN | NA | NA | 8 | 6 | 6 | 8 | 0 | 0 |
| DISSOLVED OXYGEN - HORIBA | NA | NA | 7.75 | 6.06 | 9.48 | 4.51 | 0 | 0 |
| FERROUS IRON | NA | NA | NA | NA | NA | NA | 7 | 2 |
| HYDROGEN SULFIDE | NA | NA | NA | NA | NA | NA | 0 | 0 |
| NITRATE | NA | NA | NA | NA | NA | NA | 0 | 0 |
| NITRITE | NA | NA | NA | NA | NA | NA | 0 | 0 |
| SALINITY (%) | NA | NA | NA | NA | NA | NA | NA | NA |
| TEMPERATURE (deg C) | NA | NA | 13.77 | 17.35 | 23.76 | 19.15 | 14.77 | 21.67 |
| SPECIFIC CONDUCTANCE (ms/cm) | NA | NA | 0.099 | 0.118 | 0.108 | 0.074 | 0.185 | 0.299 |
| OXIDATION REDUCTION POTENTIAL (mv) | NA | NA | 133 | 231 | 288 | 171 | -121 | -75 |
| TURBIDITY (ntu) | NA | NA | 0 | 0 | 0 | 0 | 3.85 | 0.52 |
| PH (s.u.) | NA | NA | 6.32 | 6.15 | 5.83 | 6.27 | 6.48 | 6.35 |

µg/L- micrograms per liter
mg/L- micrograms per liter

Notes:
1. Cleanup levels were defined for the COCs at the Former Fire Training Area in the ROD.
2. Shaded and **bolded** values indicate a result exceeding the appropriate cleanup level.

**Table A-1**
**LTM Data Summary Table**
**Former Fire Training Area**
**NASA Wallops Flight Facility, Wallops Island, Virginia**


| LOCATION | FFTA-MW107 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE ID | FFTA-MW107-20140317 | FFTA-MW107-20140923 | FFTA-MW107-20150317 | FFTA-MW107-20151201 | FFTA-MW107-20160927 | FFTA-MW107-20170621 | FFTA-MW107-20180326 | FFTA-MW107-20181212 |
| SAMPLE DATE | 20140317 | 20140923 | 20150317 | 20151201 | 20160927 | 20170621 | 20180326 | 20181212 |
| SAMPLE CODE | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL |
| **VOLATILES (µg/L)** | | | | | | | | |
| BENZENE | 3.5 J | **5.2** | 3.3 | 2.7 | 2.3 | 1.5 | 1.2 | NA |
| CIS-1,2-DICHLOROETHENE | NA | NA | 0.24 U | NA | NA | NA | NA | NA |
| **SEMIVOLATILES (µg/L)** | | | | | | | | |
| 3&4-METHYLPHENOL | 11 U | NA | NA | 9.2 J | 4.6 | 4.6 J- | 4.1 | 2.7 J |
| 4-METHYLPHENOL | NA | 20 | 6 | NA | NA | NA | NA | NA |
| NAPHTHALENE | **83** | **41** | **39** | **80** | **66** | **41 J-** | **39 J** | **38 J** |
| **METALS (µg/L)** | | | | | | | | |
| ARSENIC | **27** | **30** | **28** | **36.6** | **35.8** | **35.8** | **35.1** | **39.2** |
| MANGANESE | **620** | **510** | **490** | **407** | **515** | **405** | **437** | **630** |
| **DISSOLVED METALS (µg/L)** | | | | | | | | |
| ARSENIC | 25 | 26 | 26 | 38.3 | 41.6 | 36.4 | 34.7 | 40.1 |
| MANGANESE | 580 | 520 | 500 | 411 | 354 | 390 | 452 | 671 |
| **FIELD (MG/L)** | | | | | | | | |
| ALKALINITY | 45 | NA | NA | NA | NA | NA | NA | NA |
| DISSOLVED OXYGEN | 0 | NA | NA | NA | NA | NA | 0 | 0 |
| DISSOLVED OXYGEN - HORIBA | 0 | NA | NA | NA | NA | NA | 4.58 | 0 |
| FERROUS IRON | 2.2 | NA | NA | NA | NA | NA | NA | NA |
| HYDROGEN SULFIDE | 0 | NA | NA | NA | NA | NA | NA | NA |
| NITRATE | 0 | NA | NA | NA | NA | NA | NA | NA |
| NITRITE | 0 | NA | NA | NA | NA | NA | NA | NA |
| SALINITY (%) | 0.1 | NA | NA | NA | NA | NA | NA | NA |
| TEMPERATURE (deg C) | 11.4 | NA | NA | NA | NA | NA | 13.47 | 17.13 |
| SPECIFIC CONDUCTANCE (ms/cm) | 0.278 | NA | NA | NA | NA | NA | 0.180 | 0.197 |
| OXIDATION REDUCTION POTENTIAL (mv) | -116 | NA | NA | NA | NA | NA | -105 | -85 |
| TURBIDITY (ntu) | 0.37 | NA | NA | NA | NA | NA | 2.3 | 0 |
| PH (s.u.) | 6.45 | NA | NA | NA | NA | NA | 6.65 | 6.39 |

µg/L- micrograms per liter
mg/L- micrograms per liter

Notes:
1. Cleanup levels were defined for the COCs at the Former Fire Training Area in the ROD.
2. Shaded and **bolded** values indicate a result exceeding the appropriate cleanup level.

**Table A-1**
**LTM Data Summary Table**
**Former Fire Training Area**
**NASA Wallops Flight Facility, Wallops Island, Virginia**


| LOCATION | FFTA-MW107 | | | | | FFTA-MW108 | | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE ID | FFTA-MW107-20200722 | FFTA-MW107-20210629 | FFTA-DUP01-20210629 | FFTA-MW107-20220927 | FFTA-DUP01-20220927 | FFTA-MW108-20130320 | FFTA-MW108-20130905 | FFTA-MW108-20140318 |
| SAMPLE DATE | 20200722 | 20210629 | 20210629 | 20220927 | 20220927 | 20130320 | 20130905 | 20140318 |
| SAMPLE CODE | NORMAL | ORIGINAL | DUPLICATE | ORIGINAL | DUPLICATE | NORMAL | NORMAL | NORMAL |
| **VOLATILES (µg/L)** | | | | | | | | |
| BENZENE | NA | NA | NA | NA | NA | 0.11 U | 0.25 U | 0.25 U |
| CIS-1,2-DICHLOROETHENE | NA | NA | NA | NA | NA | 0.24 U | NA | NA |
| **SEMIVOLATILES (µg/L)** | | | | | | | | |
| 3&4-METHYLPHENOL | 9.5 U | NA | NA | NA | NA | 0.09 U | 1.9 U | 10 U |
| 4-METHYLPHENOL | NA | NA | NA | NA | NA | NA | NA | NA |
| NAPHTHALENE | **33** | 0.48 U | 0.48 U | **38.3** | **33** | 0.014 U | 0.97 U | 5.1 U |
| **METALS (µg/L)** | | | | | | | | |
| ARSENIC | **43** | **39.6** | **40.3** | **40.4** | **40.6** | 3.3 | 1.2 U | 1.2 U |
| MANGANESE | **250** | **329** | **327** | **239** | **243** | 0.56 B | 0.39 J | 0.25 J |
| **DISSOLVED METALS (µg/L)** | | | | | | | | |
| ARSENIC | 50 | 40.4 | 42.3 | 42.3 | 42.7 | 3.2 | 1.2 U | 1.2 U |
| MANGANESE | 270 | 332 | 246 | 246 | 232 | 0.77 B | 0.39 J | 0.35 J |
| **FIELD (MG/L)** | | | | | | | | |
| ALKALINITY | NA | NA | NA | NA | NA | 11 | 12 | 10 < |
| DISSOLVED OXYGEN | 0 | 0.1 | 0.1 | NA | NA | 2 | 6 | 4 |
| DISSOLVED OXYGEN - HORIBA | 0 | 0 | 0 | 0 | 0 | 6.9 | 4.55 | 4.5 |
| FERROUS IRON | NA | NA | NA | NA | NA | 0.2 | 0 | 0 |
| HYDROGEN SULFIDE | NA | NA | NA | NA | NA | 0 | 0 | 0 |
| NITRATE | NA | NA | NA | NA | NA | 0 | 0 | 0 |
| NITRITE | NA | NA | NA | NA | NA | 0 | 0 | 0 |
| SALINITY (%) | NA | NA | NA | NA | NA | NA | NA | 0 |
| TEMPERATURE (deg C) | 18.68 | 18.8 | 18.8 | 20.75 | 20.75 | 13.61 | 17.02 | 13.33 |
| SPECIFIC CONDUCTANCE (ms/cm) | 0.146 | 0.128 | 0.128 | 0.117 | 0.117 | 0.089 | 0.065 | 0.066 |
| OXIDATION REDUCTION POTENTIAL (mv) | -74 | -67 | -67 | -110 | -110 | 212 | 219 | 293 |
| TURBIDITY (ntu) | 4.4 | 6.49 | 6.49 | 3.22 | 3.22 | 0.62 | 0.35 | 0 |
| PH (s.u.) | 6.37 | 6.41 | 6.41 | 5.8 | 5.8 | 5.55 | 5.83 | 5.03 |

µg/L- micrograms per liter
mg/L- micrograms per liter

Notes:
1. Cleanup levels were defined for the COCs at the Former Fire Training Area in the ROD.
2. Shaded and **bolded** values indicate a result exceeding the appropriate cleanup level.

**Table A-1**
**LTM Data Summary Table**
**Former Fire Training Area**
**NASA Wallops Flight Facility, Wallops Island, Virginia**


| LOCATION | FFTA-MW108 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE ID | FFTA-MW108-20140924 | FFTA-MW108-20150318 | FFTA-MW108-20151202 | FFTA-MW108-20160927 | FFTA-MW108-20161130 | FFTA-MW108-20170622 | FFTA-MW108-20200722 | FFTA-DUP01-20200722 |
| SAMPLE DATE | 20140924 | 20150318 | 20151202 | 20160927 | 20161130 | 20170622 | 20200722 | 20200722 |
| SAMPLE CODE | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | ORIGINAL | DUPLICATE |
| **VOLATILES (µg/L)** | | | | | | | | |
| BENZENE | 0.11 U | 0.11 U | 0.26 U | 0.26 U | NA | 0.26 U | NA | NA |
| CIS-1,2-DICHLOROETHENE | NA | 0.24 U | NA | NA | NA | NA | NA | NA |
| **SEMIVOLATILES (µg/L)** | | | | | | | | |
| 3&4-METHYLPHENOL | NA | NA | 5.3 U | 0.42 U | NA | 0.42 U | 9.5 U | 9.5 U |
| 4-METHYLPHENOL | 0.23 U | 0.21 U | NA | NA | NA | NA | NA | NA |
| NAPHTHALENE | 0.025 U | 0.023 U | 2.1 U | 0.061 U | NA | 0.06 U | 9.5 U | 9.5 U |
| **METALS (µg/L)** | | | | | | | | |
| ARSENIC | 0.29 U | 0.29 U | 2.3 U | 2.3 U | NA | 4 U | 3.0 U | 3.0 U |
| MANGANESE | 0.4 U | 0.48 U | 1.9 U | 1.2 U | NA | 2.6 | 5.0 U | 5.0 U |
| **DISSOLVED METALS (µg/L)** | | | | | | | | |
| ARSENIC | 0.29 U | 0.29 U | 2.3 U | 2.3 U | NA | 4 U | 3.0 U | 3.0 U |
| MANGANESE | 0.32 U | 0.63 U | 1.2 J | 1.5 U | NA | 0.89 J | 5.0 U | 5.0 U |
| **FIELD (MG/L)** | | | | | | | | |
| ALKALINITY | NA | NA | NA | NA | NA | NA | NA | NA |
| DISSOLVED OXYGEN | NA | NA | NA | NA | NA | NA | 6 | 6 |
| DISSOLVED OXYGEN - HORIBA | NA | NA | NA | NA | NA | NA | 8.58 | 8.58 |
| FERROUS IRON | NA | NA | NA | NA | NA | NA | NA | NA |
| HYDROGEN SULFIDE | NA | NA | NA | NA | NA | NA | NA | NA |
| NITRATE | NA | NA | NA | NA | NA | NA | NA | NA |
| NITRITE | NA | NA | NA | NA | NA | NA | NA | NA |
| SALINITY (%) | NA | NA | NA | NA | NA | NA | NA | NA |
| TEMPERATURE (deg C) | NA | NA | NA | NA | NA | NA | 18.16 | 18.16 |
| SPECIFIC CONDUCTANCE (ms/cm) | NA | NA | NA | NA | NA | NA | 0.084 | 0.084 |
| OXIDATION REDUCTION POTENTIAL (mv) | NA | NA | NA | NA | NA | NA | 256 | 256 |
| TURBIDITY (ntu) | NA | NA | NA | NA | NA | NA | 0 | 0 |
| PH (s.u.) | NA | NA | NA | NA | NA | NA | 5.61 | 5.61 |

µg/L- micrograms per liter
mg/L- micrograms per liter

Notes:
1. Cleanup levels were defined for the COCs at the Former Fire Training Area in the ROD.
2. Shaded and **bolded** values indicate a result exceeding the appropriate cleanup level.

**Table A-1**
**LTM Data Summary Table**
**Former Fire Training Area**
**NASA Wallops Flight Facility, Wallops Island, Virginia**


| LOCATION | FFTA-MW108 |
|---|---|
| SAMPLE ID | FFTA-MW108-20210630 |
| SAMPLE DATE | 20210630 |
| SAMPLE CODE | NORMAL |
| **VOLATILES (µg/L)** | |
| BENZENE | NA |
| CIS-1,2-DICHLOROETHENE | NA |
| **SEMIVOLATILES (µg/L)** | |
| 3&4-METHYLPHENOL | NA |
| 4-METHYLPHENOL | NA |
| NAPHTHALENE | 0.48 U |
| **METALS (µg/L)** | |
| ARSENIC | 1.3 U |
| MANGANESE | 1.0 U |
| **DISSOLVED METALS (µg/L)** | |
| ARSENIC | 1.3 U |
| MANGANESE | 1.0 U |
| **FIELD (MG/L)** | |
| ALKALINITY | NA |
| DISSOLVED OXYGEN | 9 |
| DISSOLVED OXYGEN - HORIBA | 6.56 |
| FERROUS IRON | NA |
| HYDROGEN SULFIDE | NA |
| NITRATE | NA |
| NITRITE | NA |
| SALINITY (%) | NA |
| TEMPERATURE (deg C) | 19.12 |
| SPECIFIC CONDUCTANCE (ms/cm) | 0.056 |
| OXIDATION REDUCTION POTENTIAL (mv) | 247 |
| TURBIDITY (ntu) | 4.71 |
| PH (s.u.) | 5.95 |

µg/L- micrograms per liter
mg/L- micrograms per liter

Notes:
1. Cleanup levels were defined for the COCs at the Former Fire Training Area in the ROD.
2. Shaded and **bolded** values indicate a result exceeding the appropriate cleanup level.

**TABLE A-2**
**PFAS SUMMARY DATA TABLE**
**FFTA (PFAS AREA 9)**
**NASA WALLOPS FLIGHT FACILITY, WALLOPS ISLAND, VIRGINIA**


| Sample Location | Sample ID | Sample Depth (Feet bgs) | Sample Date | PFOA | PFOS | PFBS | PFDA | PFDoA or PFDoDA | PFHpA | PFHxS | PFHxA | PFNA | PFTA or PFTetA | PFTrDA | PFUnA or PFUDA | NEtFOSAA | NMeFOSAA | HFPO-DA | ADONA | 9Cl-PF3ONS | 11Cl-PF3OUdS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Soil Human Health Screening Levels (µg/kg)** | | | | 19[1] | 13[1] | 1,900[1] | NSL | NSL | NSL | 130[1] | 3,200[1] | 19[1] | NSL | NSL | NSL | NSL | NSL | 23[1] | NSL | NSL | NSL |
| **Soil ESVs (µg/kg)** | | | | 3,840[2] | 8.7[2] | 817[2] | 67.7[2] | NESV | 1,000[2] | 2.8[2] | 6,200[2] | 24.2[2] | NESV | NESV | NESV | NESV | NESV | NESV | NESV | NESV | NESV |
| HCS-SB01 | HCS-SB01-0002 | 0 - 2 | 5/8/2019 | 0.26 | 0.73 | 0.027 U | 0.21 | 0.072 U | 0.24 | 0.051 J | 0.17 J | 0.39 | 0.058 U | 0.054 U | 0.18 J | 0.4 U | 0.42 U | -- | -- | -- | -- |
| | HCS-SB01-0002-D | | | 0.25 | 0.98 | 0.027 U | 0.23 | 0.072 U | 0.22 | 0.05 J | 0.19 J | 0.43 | 0.058 U | 0.055 U | 0.19 J | 0.4 U | 0.42 U | -- | -- | -- | -- |
| | HCS-SB01-0406 | 4 - 6 | 5/8/2019 | 0.088 U | 0.2 U | 0.025 U | 0.022 U | 0.068 U | 0.035 J | 0.032 U | 0.043 U | 0.05 J | 0.055 U | 0.052 U | 0.037 U | 0.38 U | 0.4 U | -- | -- | -- | -- |
| HCS-SB02 | HCS-SB02-0002 | 0 - 2 | 5/8/2019 | 0.11 J | 0.21 J | 0.026 U | 0.023 U | 0.071 U | 0.05 J | 0.033 U | 0.044 U | 0.16 J | 0.057 U | 0.054 U | 0.041 J | 0.39 U | 0.41 U | -- | -- | -- | -- |
| | HCS-SB02-0406 | 4 - 6 | 5/8/2019 | 0.091 U | 0.21 U | 0.026 U | 0.023 U | 0.071 U | 0.031 U | 0.033 U | 0.044 U | 0.073 J | 0.057 U | 0.054 U | 0.038 U | 0.39 U | 0.41 U | -- | -- | -- | -- |
| | HCS-SB02-0406-D | | | 0.092 U | 0.21 U | 0.027 U | 0.023 U | 0.071 U | 0.031 U | 0.033 U | 0.045 U | 0.038 U | 0.058 U | 0.054 U | 0.038 U | 0.39 U | 0.42 U | -- | -- | -- | -- |
| HCS-SB03 | HCS-SB03-0002 | 0 - 2 | 5/8/2019 | 0.3 | 0.55 | 0.027 U | 0.044 J | 0.071 U | 0.14 J | 0.033 J | 0.085 J | 0.46 | 0.057 U | 0.054 U | 0.038 U | 0.39 U | 0.41 U | -- | -- | -- | -- |
| | HCS-SB03-0406 | 4 - 6 | 5/8/2019 | 0.093 U | 0.22 U | 0.027 U | 0.024 U | 0.072 U | 0.031 U | 0.033 U | 0.045 U | 0.039 U | 0.058 U | 0.055 U | 0.039 U | 0.4 U | 0.42 U | -- | -- | -- | -- |
| FFTA-SB01 | FFTA-SB01-0002 | 0 - 2 | 5/1/2019 | 1.6 | ***330*** | 0.078 J | 2.3 | 0.55 | 0.45 | 2.8 | 0.69 | 6.8 | 0.27 | 1.4 | 4 | 0.4 U | 0.42 U | -- | -- | -- | -- |
| | FFTA-SB01-0406 | 4 - 6 | 5/1/2019 | 5.7 | ***970*** | 0.13 U | 0.68 J | 0.35 U | 1.2 | *8.1* | 0.58 J | 7 | 0.29 U | 0.27 U | 0.31 J | 2 U | 2.1 U | -- | -- | -- | -- |
| | FFTA-SB01-0406-D | | | 6.6 | ***1,100*** | 0.13 UJ | 0.77 J | 0.36 U | 0.9 J | *8.5* | 0.62 J | 9 | 0.29 U | 0.27 U | 0.33 J | 2 U | 2.1 U | -- | -- | -- | -- |
| | FFTA-SB01-1314 | 13 - 14 | 5/1/2019 | 2.5 | ***750*** | 0.13 U | 0.35 J | 0.36 U | 0.79 J | *11* | 0.55 J | 1.5 | 0.29 U | 0.28 U | 0.19 U | 2 U | 2.1 U | -- | -- | -- | -- |
| FFTA-SB02 | FFTA-SB02-0002 | 0 - 2 | 5/1/2019 | 0.58 | ***21*** | 0.026 U | 3.3 | 0.069 U | 1.3 | 0.66 | 0.18 J | 1.6 | 0.056 U | 0.054 J | 0.52 | 0.38 U | 0.4 U | -- | -- | -- | -- |
| | FFTA-SB02-0406 | 4 - 6 | 5/1/2019 | 0.43 | 8.6 | 0.027 U | 0.62 | 0.072 U | 0.41 | 0.23 | 0.16 J | 1.3 | 0.058 U | 0.055 U | 0.11 J | 0.4 U | 0.42 U | -- | -- | -- | -- |
| | FFTA-SB02-1213 | 12 - 13 | 5/1/2019 | 0.24 | ***51*** | 0.026 U | 0.023 U | 0.07 U | 0.14 J | 0.17 J | 0.067 J | 2.3 | 0.057 U | 0.053 U | 0.038 U | 0.39 U | 0.41 U | -- | -- | -- | -- |
| FFTA-SB03 | FFTA-SB03-0002 | 0 - 2 | 5/1/2019 | 0.6 | *11* | 0.027 U | 3.8 | 0.089 J | 0.31 | 0.54 | 0.38 | 3.1 | 0.057 U | 0.28 | 6.1 | 0.39 U | 0.41 U | -- | -- | -- | -- |
| | FFTA-SB03-0406 | 4 - 6 | 5/1/2019 | 6.1 | ***36*** | 0.025 U | 0.98 | 0.068 U | 2.6 | 1.1 | 2.6 | 3.6 | 0.055 U | 0.052 U | 0.3 | 0.38 U | 0.4 U | -- | -- | -- | -- |
| | FFTA-SB03-1213 | 12 - 13 | 5/1/2019 | 0.53 | 0.62 | 0.025 U | 0.11 J | 0.068 U | 0.21 | 0.12 J | 0.41 | 0.24 | 0.055 U | 0.052 U | 0.037 U | 0.38 U | 0.4 U | -- | -- | -- | -- |
| | FFTA-SB03-1213-D | | | 0.65 | 0.9 | 0.027 U | 0.15 J | 0.073 U | 0.26 | 0.16 J | 0.46 | 0.29 | 0.058 U | 0.055 U | 0.039 U | 0.4 U | 0.42 U | -- | -- | -- | -- |
| FFTA-SB04 | FFTA-SB04-0002 | 0 - 2 | 5/1/2019 | 0.26 | 4 | 0.026 U | 0.2 J | 0.07 U | 0.21 | 0.47 | 0.21 | 0.17 J | 0.056 U | 0.1 J | 0.78 | 0.39 U | 0.41 U | -- | -- | -- | -- |
| | FFTA-SB04-0406 | 4 - 6 | 5/1/2019 | 0.24 | 3.9 | 0.027 U | 0.14 J | 0.072 U | 0.12 J | 0.66 | 0.35 | 0.15 J | 0.058 U | 0.055 U | 0.052 J | 0.4 U | 0.42 U | -- | -- | -- | -- |
| | FFTA-SB04-1213 | 12 - 13 | 5/1/2019 | 0.33 | ***16 J*** | 0.039 J | 0.023 U | 0.07 U | 2 | 0.9 | 11 J- | 0.064 J | 0.056 U | 0.053 U | 0.037 U | 0.38 U | 0.41 U | -- | -- | -- | -- |
| FFTA-SB05 | FFTA-SB05-0002 | 0 - 2 | 5/1/2019 | 2.1 | *10* | 0.027 U | 6.4 | 0.13 J | 0.88 | 0.72 | 0.7 | 4.6 | 0.058 U | 0.063 J | 2.8 | 0.4 U | 0.42 U | -- | -- | -- | -- |
| | FFTA-SB05-0406 | 4 - 6 | 5/1/2019 | 14 | *12* | 0.068 J | 1.4 | 0.073 U | 9.2 | *4.4* | 5.1 | 6.7 | 0.059 U | 0.056 U | 0.17 J | 0.4 U | 0.42 U | -- | -- | -- | -- |
| | FFTA-SB05-1213 | 12 - 13 | 5/1/2019 | 1.1 | 0.76 | 0.026 U | 0.12 J | 0.069 U | 0.56 | 0.26 | 0.8 | 0.16 J | 0.056 U | 0.053 U | 0.037 U | 0.38 U | 0.4 U | -- | -- | -- | -- |
| FFTA-SB06 | FFTA-SB06-0002 | 0 - 2 | 5/1/2019 | 1.4 | ***41*** | 0.057 J | 9.1 | 4.2 | 0.69 | *3.7* | 1.9 | 1.9 | 1.6 | 3 | 49 | 0.39 U | 0.42 U | -- | -- | -- | -- |
| | FFTA-SB06-0406 | 4 - 6 | 5/1/2019 | 3 | ***260*** | 0.027 U | 3.1 | 0.073 U | 0.24 | 2.8 | 0.76 | 2.7 | 0.059 U | 0.055 U | 0.87 | 0.4 U | 0.42 U | -- | -- | -- | -- |
| | FFTA-SB06-1213 | 12 - 13 | 5/1/2019 | 1.8 | ***110*** | 0.026 U | 0.11 J | 0.069 U | 0.53 | *2.9* | 0.21 | 0.85 | 0.056 U | 0.053 U | 0.037 U | 0.38 U | 0.4 U | -- | -- | -- | -- |
| FFTA-SB07 | FFTA-SB07-0002 | 0 - 2 | 5/1/2019 | 0.12 J | ***9.8*** | 0.025 U | 0.26 | 0.068 U | 0.078 J | 0.047 J | 0.066 J | 0.65 | 0.055 U | 0.052 U | 0.1 J | 0.38 U | 0.4 U | -- | -- | -- | -- |
| | FFTA-SB07-0406 | 4 - 6 | 5/1/2019 | 0.099 J | 2.4 J | 0.026 U | 0.05 J | 0.07 U | 0.069 J | 0.047 J | 0.056 J | 0.3 | 0.056 U | 0.053 U | 0.038 U | 0.39 U | 0.41 U | -- | -- | -- | -- |
| | FFTA-SB07-1314 | 13 - 14 | 5/1/2019 | 0.092 U | 0.87 J | 0.027 U | 0.024 U | 0.072 U | 0.031 U | 0.033 U | 0.045 U | 0.18 J | 0.058 U | 0.055 U | 0.039 U | 0.4 U | 0.42 U | -- | -- | -- | -- |
| FFTA-SB101 | FFTA-SB101-0002 | 0 - 2 | 8/28/2021 | 1.2 | 5.4 | 0.28 U | 1.1 | 0.28 U | 0.71 J | 0.47 J | 0.29 J | 1.3 | 0.28 U | 0.3 U | 0.39 J | 0.28 U | 0.28 U | 0.28 U | 0.28 U | 0.33 U | 0.3 U |
| | FFTA-SB101-0406 | 4 - 6 | 8/28/2021 | 1.1 J | 3.3 | 0.3 U | 0.3 U | 0.3 U | 0.3 U | 0.39 J | 0.3 U | 0.84 J | 0.3 U | 0.32 U | 0.3 U | 0.3 U | 0.3 U | 0.3 U | 0.3 U | 0.35 U | 0.31 U |
| | FFTA-SB101-1416 | 14 - 16 | 8/28/2021 | 0.61 J | *9.5* | 0.32 U | 0.32 U | 0.32 U | 0.33 J | 0.45 J | 0.32 U | 0.36 J | 0.32 U | 0.34 U | 0.32 U | 0.32 U | 0.32 U | 0.32 U | 0.32 U | 0.37 U | 0.33 U |
| FFTA-SB102 | FFTA-SB102-0002 | 0 - 2 | 8/28/2021 | 0.33 U | 4.1 | 0.33 U | 0.33 U | 0.33 U | 0.33 U | 0.33 U | 0.33 U | 0.85 J | 0.33 U | 0.35 U | 0.33 U | 0.33 U | 0.33 U | 0.33 U | 0.33 U | 0.38 U | 0.34 U |
| | FFTA-SB102-0406 | 4 - 6 | 8/28/2021 | 0.47 J | 3.5 | 0.33 U | 0.33 U | 0.33 U | 0.33 U | 0.33 U | 0.33 U | 1.4 | 0.33 U | 0.35 U | 0.33 U | 0.33 U | 0.33 U | 0.33 U | 0.33 U | 0.38 U | 0.34 U |
| | FFTA-SB102-0911 | 9 - 11 | 8/28/2021 | 0.33 U | 4.3 | 0.33 U | 0.33 U | 0.33 U | 0.33 U | 0.33 U | 0.33 U | 2.4 | 0.33 U | 0.35 U | 0.33 U | 0.33 U | 0.33 U | 0.33 U | 0.33 U | 0.38 U | 0.34 U |
| FFTA-SB103 | FFTA-SB103-0006 | 0 - 6 | 8/28/2021 | 0.33 U | 0.73 J | 0.33 U | 0.33 U | 0.33 U | 0.33 U | 0.33 U | 0.33 U | 0.33 U | 0.33 U | 0.35 U | 0.33 U | 0.33 UJ | 0.33 UJ | 0.33 U | 0.33 U | 0.38 U | 0.34 U |
| | FFTA-SB103-0406 | 4 - 6 | 8/28/2021 | 0.32 U | 1.9 | 0.32 U | 0.32 U | 0.32 U | 0.32 U | 0.32 U | 0.32 U | 0.36 J | 0.32 U | 0.34 U | 0.32 U | 0.32 U | 0.32 U | 0.32 U | 0.32 U | 0.38 U | 0.34 U |
| | FFTA-SB103-1113 | 11 - 13 | 8/28/2021 | 0.33 U | 1.4 | 0.33 U | 0.33 U | 0.33 U | 0.33 U | 0.33 U | 0.33 U | 0.33 U | 0.33 U | 0.35 U | 0.33 U | 0.33 U | 0.33 U | 0.33 U | 0.33 U | 0.38 U | 0.34 U |
| FFTA-SB104 | FFTA-SB104-0002 | 0 - 2 | 8/29/2021 | 0.34 U | 1.1 J | 0.34 U | 0.34 U | 0.34 U | 0.34 U | 0.34 U | 0.34 U | 0.34 U | 0.34 U | 0.36 U | 1.9 | 0.34 U | 0.34 U | 0.34 U | 0.34 U | 0.39 U | 0.35 U |
| | FFTA-SB104-0406 | 4 - 6 | 8/29/2021 | 0.3 U | 0.3 U | 0.3 U | 0.3 U | 0.3 U | 0.3 U | 0.3 U | 0.3 U | 0.3 U | 0.3 U | 0.32 U | 0.3 U | 0.3 U | 0.3 U | 0.3 U | 0.3 U | 0.35 U | 0.32 U |
| | FFTA-SB104-1315 | 13 - 15 | 8/29/2021 | 0.33 U | 0.36 J | 0.33 U | 0.33 U | 0.33 U | 0.33 U | 0.33 U | 0.33 U | 0.33 U | 0.33 U | 0.35 U | 0.33 U | 0.33 U | 0.33 U | 0.33 U | 0.33 U | 0.38 U | 0.34 U |
| FFTA-SB105 | FFTA-SB105-0103 | 1 - 3 | 8/29/2021 | 0.3 U | 0.3 U | 0.3 U | 0.3 U | 0.3 U | 0.3 U | 0.3 U | 0.3 U | 0.3 U | 0.3 U | 0.32 U | 0.3 U | 0.3 U | 0.3 U | 0.3 U | 0.3 U | 0.35 U | 0.31 U |
| | FFTA-SB105-0406 | 4 - 6 | 8/29/2021 | 0.31 U | 0.82 J | 0.31 U | 0.31 U | 0.31 U | 0.31 U | 0.31 U | 0.31 U | 0.31 U | 0.31 U | 0.33 U | 0.31 U | 0.31 U | 0.31 U | 0.31 U | 0.31 U | 0.36 U | 0.32 U |
| | FFTA-SB105-1315 | 13 - 15 | 8/29/2021 | 0.3 U | ***50.1*** | 0.3 U | 0.32 J | 0.3 U | 0.3 U | 0.3 U | 0.3 U | 0.3 U | 0.3 U | 0.32 U | 1.3 | 0.3 U | 0.3 U | 0.3 U | 0.3 U | 0.35 U | 0.31 U |
| FFTA-SB106 | FFTA-SB106-0103 | 1 - 3 | 8/29/2021 | 1 J | ***286*** | 0.32 U | 0.64 J | 0.32 U | 0.32 U | 1.1 J | 0.32 U | 0.81 J | 0.32 U | 0.34 U | 0.32 U | 0.32 U | 0.32 U | 0.32 U | 0.32 U | 0.37 U | 0.33 U |
| | FFTA-SB106-0406 | 4 - 6 | 8/29/2021 | 0.44 J | ***144*** | 0.31 U | 0.31 U | 0.31 U | 0.51 J | 1.4 | 0.32 J | 0.31 U | 0.31 U | 0.33 U | 0.31 U | 0.31 U | 0.31 U | 0.31 U | 0.31 U | 0.36 U | 0.33 U |
| | FFTA-SB106-1315 | 13 - 15 | 8/29/2021 | 0.32 J | ***122*** | 0.28 U | 0.28 U | 0.28 U | 0.28 U | 0.7 J | 0.28 U | 0.58 J | 0.28 U | 0.3 U | 0.28 U | 0.28 U | 0.28 U | 0.28 U | 0.28 U | 0.33 U | 0.29 U |
| FFTA-SB107 | FFTA-SB107-0103 | 1 - 3 | 10/6/2021 | 0.28 U | 0.28 U | 0.28 U | 0.28 U | 0.28 U | 0.28 U | 0.28 U | 0.28 U | 0.28 U | 0.28 U | 0.3 U | 0.28 U | 0.28 U | 0.28 U | 0.28 U | 0.28 U | 0.33 U | 0.29 U |
| | FFTA-SB107-0406 | 4 - 6 | 10/6/2021 | 0.29 U | 0.29 U | 0.29 U | 0.29 U | 0.29 U | 0.29 U | 0.29 U | 0.29 U | 0.29 U | 0.29 U | 0.31 U | 0.29 U | 0.29 U | 0.29 U | 0.29 U | 0.29 U | 0.34 U | 0.3 U |
| | FFTA-SB107-1315 | 13 - 15 | 10/6/2021 | 0.27 U | ***15.2*** | 0.27 U | 0.27 U | 0.27 U | 0.27 U | 0.27 U | 0.27 U | 0.27 U | 0.27 U | 0.28 U | 0.27 U | 0.27 U | 0.27 U | 0.27 U | 0.27 U | 0.31 U | 0.28 U |
| FFTA-SB108 | FFTA-SB108-0002 | 0 - 2 | 10/6/2021 | 1.2 | 6.4 | 0.26 U | 2.1 | 0.26 U | 0.91 J | 0.26 U | 0.43 J | 1.7 | 0.26 U | 0.27 U | 0.66 J | 0.26 U | 0.26 U | 0.26 U | 0.26 U | 0.3 U | 0.27 U |
| | FFTA-SB108-0406 | 4 - 6 | 10/6/2021 | 0.85 J | 5 | 0.29 U | 0.31 J | 0.29 U | 0.38 J | 0.29 U | 0.29 U | 1 J | 0.29 U | 0.31 U | 0.29 U | 0.29 U | 1.5 U | 0.29 U | 0.29 U | 0.34 U | 0.3 U |
| | FFTA-SB108-0406-D | 4 - 6 | 10/6/2021 | 0.36 J | 0.76 J | 0.26 U | 0.26 U | 0.26 U | 0.36 J | 0.26 U | 0.26 U | 0.26 U | 0.26 U | 0.27 U | 0.26 U | 0.26 U | 0.26 U | 0.26 U | 0.26 U | 0.3 U | 0.27 U |
| | FFTA-SB108-1315 | 13 - 15 | 10/6/2021 | 0.33 J | 2.5 | 0.25 U | 0.25 U | 0.25 U | 0.25 U | 0.25 U | 0.25 U | 0.25 J | 0.25 U | 0.27 U | 0.25 U | 0.25 U | 0.25 U | 0.25 U | 0.25 U | 0.29 U | 0.26 U |

**TABLE A-2**
**PFAS SUMMARY DATA TABLE**
**FFTA (PFAS AREA 9)**
**NASA WALLOPS FLIGHT FACILITY, WALLOPS ISLAND, VIRGINIA**


| Sample Location | Sample ID | Sample Depth (Feet bgs) | Sample Date | PFOA | PFOS | PFBS | PFDA | PFDoA or PFDoDA | PFHpA | PFHxS | PFHxA | PFNA | PFTA or PFTetA | PFTrDA | PFUnA or PFUDA | NEtFOSAA | NMeFOSAA | HFPO-DA | ADONA | 9Cl-PF3ONS | 11Cl-PF3OUdS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Groundwater Human Health Screening Levels (ng/L)** | | | | 6[3] | 4[3] | 600[3] | NSL | NSL | NSL | 39[3] | 990[3] | 5.9[3] | NSL | NSL | NSL | NSL | NSL | 6[3] | NSL | NSL | NSL |
| HCS-TW01 | HCS-TW01-1721 | 17 - 21 | 5/8/2019 | **28** | **250** | 1.2 J | 5.8 | 0.51 U | 42 | 8.8 | 36 | **28** | 0.4 U | 1.2 U | 1 U | 1.8 U | 2.9 U | -- | -- | -- | -- |
| HCS-TW02 | HCS-TW02-1620 | 16 - 20 | 5/8/2019 | 5.7 | **73** | 0.96 J | 0.45 J | 0.51 U | 6.7 | 3.5 | 10 J | **6.9** | 0.3 U | 1.2 U | 1 U | 1.8 U | 2.9 U | -- | -- | -- | -- |
| | HCS-TW02-1620-D | | | 6 | **73** | 0.87 J | 0.29 U | 0.52 U | 6.5 | 3.8 | 9.5 J | **7.3** | 0.35 U | 1.2 U | 1 U | 1.8 U | 2.9 U | -- | -- | -- | -- |
| HCS-TW03 | HCS-TW03-1620 | 16 - 20 | 5/8/2019 | **63** | **1,200** | 2.4 J | 2.8 J | 6.3 | 110 | 21 | 74 | **130** | 3.9 J- | 8.3 | 4.4 J | 3.5 U | 5.8 U | -- | -- | -- | -- |
| HCS-TW04 | HCS-TW04-1620 | 16 - 20 | 5/8/2019 | 4.8 | **48** | 0.54 J | 0.29 U | 0.51 U | 1.7 J | 3.1 | 3.9 J | 1.7 J | 0.27 U | 1.2 U | 1 U | 1.7 U | 2.9 U | -- | -- | -- | -- |
| FFTA-TW01 | FFTA-TW01-1822 | 18 - 22 | 5/11/2019 | **7.2** | **24** | 0.71 J | 0.48 J | 0.5 U | 7.6 | 7.4 | 12 | 2 | 0.27 U | 1.2 U | 1 U | 1.7 U | 2.8 U | -- | -- | -- | -- |
| FFTA-TW02 | FFTA-TW02-2428 | 24 - 28 | 5/10/2019 | **6.1** | **15** | 7.9 | 0.3 U | 0.53 U | 5.8 | 10 | 7.1 | 1.3 J | 0.28 U | 1.2 U | 1.1 U | 1.8 U | 3 U | -- | -- | -- | -- |
| FFTA-TW03 | FFTA-TW03-2024 | 20 - 24 | 5/10/2019 | **10** | **30** | 0.39 J | 0.29 U | 0.51 U | 7.1 | 2.4 | 7.2 | **6.9** | 0.27 U | 1.2 U | 1 U | 1.8 U | 2.9 U | -- | -- | -- | -- |
| FFTA-TW04 | FFTA-TW04-1115 | 11 - 15 | 5/3/2019 | **40** | **52** | 0.7 J | 0.3 U | 0.53 U | 12 | **45** | 5 | 3.2 | 0.41 U | 1.2 U | 1.1 U | 1.8 U | 3 U | -- | -- | -- | -- |
| FFTA-TW05 | FFTA-TW05-1014 | 10 - 14 | 5/3/2019 | **44** | **130** | 1.6 J | 0.29 U | 0.51 U | 11 | 34 | 8 | **6.6** | 0.27 U | 1.2 U | 1 U | 1.8 U | 2.9 U | -- | -- | -- | -- |
| FFTA-TW06 | FFTA-TW06-2630 | 26 - 30 | 5/10/2019 | **13** | **160** | 0.34 J | 0.29 U | 0.51 U | 6.3 | 7.8 | 6.8 | **8.8** | 0.27 U | 1.2 U | 1 U | 1.8 U | 2.9 U | -- | -- | -- | -- |
| | FFTA-TW06-3337 | 33 - 37 | 5/10/2019 | **1,000** | **7,400** | 78 | 1.5 U | 2.6 U | 980 | **1,600** | **1,400** | **330** | 1.4 U | 6.2 U | 5.2 U | 9 U | 15 U | -- | -- | -- | -- |
| FFTA-TW07 | FFTA-TW07-2226 | 22 - 26 | 5/10/2019 | 1.1 J | **6.3** | 1 J | 0.29 U | 0.51 U | 0.62 J | 12 | 1.8 | 0.25 U | 0.27 U | 1.2 U | 1 U | 1.8 U | 2.9 U | -- | -- | -- | -- |
| | FFTA-TW07-2933 | 29 - 33 | 5/9/2019 | 0.81 U | 1.6 J | 1.2 J | 0.29 U | 0.52 U | 0.81 J | 6.1 | 1.5 J | 0.26 U | 0.27 U | 1.2 U | 1 U | 1.8 U | 2.9 U | -- | -- | -- | -- |
| FFTA-TW08 | FFTA-TW08-1721 | 17 - 21 | 5/9/2019 | 0.9 J | 0.6 J | 0.19 U | 0.29 U | 1.2 J | 0.56 J | 0.37 U | 0.54 U | 0.25 U | 1.7 J | 2.8 | 1 U | 1.8 U | 2.9 U | -- | -- | -- | -- |
| FFTA-TW101 | FFTA-TW101-2024 | 20 - 24 | 8/27/2021 | 2 U | **8.4** | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 UJ | 2 U | 2 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| | FFTA-TW101-5054 | 50 - 54 | 8/27/2021 | **12.2** | **21.7** | 5.1 J | 2.8 U | 2.8 U | 8.6 J | 33 | 16.8 | 2.8 U | 2.8 U | 2.8 U | 2.8 U | 5.6 U | 5.6 U | 5.6 U | 5.6 U | 5.6 U | 5.6 U |
| FFTA-TW102 | FFTA-TW102-2529 | 25 - 29 | 9/12/2021 | **209** | **286** | 20.7 | 2.1 U | 2.1 U | 283 | **268** | 358 | **38.9** | 2.1 U | 2.1 U | 2.1 U | 4.2 U | 4.2 U | 4.2 U | 4.2 U | 4.2 U | 4.2 U |
| | FFTA-TW102-4549 | 45 - 49 | 9/12/2021 | **13.5** | **48.4** | 7.5 J | 2.3 U | 2.3 U | 10.5 | **49.2** | 21.7 | 2.3 U | 2.3 U | 2.3 U | 2.3 U | 4.5 U | 4.5 U | 4.5 U | 4.5 U | 4.5 U | 4.5 U |
| 14-MW001 | 14-MW001-20210818 | 15 - 30 | 8/18/2021 | **7.1 J** | **353** | 2.1 J | 2 U | 2 U | 5 J | **42.1** | 5.5 J | **14.3** | 2 U | 2 U | 2 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| | 14-MW001-20210818-D | | | **7.2 J** | **322** | 2 U | 2 U | 2 U | 4.8 J | **40.9** | 5.1 J | **13.4** | 2 U | 2 U | 2 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| 14-MW002 | 14-MW002-20211012 | 15 - 30 | 10/12/2021 | **22.9** | **43** | 6.4 J | 2 U | 2 U | 39.1 | **72.2** | 61.4 | 2.8 J | 2 U | 2 U | 2 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| 14-MW005 | 14-MW005-20190410 | 1 - 6 | 4/10/2019 | **1,100** | **21,000** | 240 | 9.6 | 0.54 U | 1,000 | **3,100** | **1,800** | **200** | 0.29 U | 1.3 U | 1.1 U | 1.9 U | 3.1 U | -- | -- | -- | -- |
| | 14-MW005-20211012 | 1 - 6 | 10/12/2021 | **664** | **11,200** | 74.1 | 33.6 | 40 U | 581 | **1,160** | 781 | **281** | 40 U | 40 U | 2 U | 4 U | 4 U | 4 U | 4 U | 4 U | 80 U |
| FFTA-MW002 | FFTA-MW002S-20161130 | 10 - 30 | 11/30/2016 | **1,500** | **10,000** | 52 | -- | -- | 670 | **820** | -- | **340** | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | FFTA-MW002S-20210817 | 10 - 30 | 8/17/2021 | **1,270** | **17,300** | 39.2 | 70.6 | 2 U | 798 | **2,880** | **1,150** | **268** | 2 U | 2 U | 11.4 | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| FFTA-MW055 | FFTA-MW055S-20161130 | 8 - 23 | 11/30/2016 | **2,700** | **20,000** | 25 | -- | -- | 3,100 | **1,700** | -- | **1,200** | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | FFTA-MW055S-20161130-D | | | **2,800** | **20,000** | 26 | -- | -- | 3,200 | **1,800** | -- | **1,300** | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | FFTA-MW055S-20210816 | 8 - 23 | 8/16/2021 | **1,170** | **5,050** | 12.9 | 14.8 | 2 U | 1,320 | **640** | **1,130** | **462** | 40 U | 2 U | 2 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| | FFTA-MW055D-20161130 | 14 - 29 | 11/30/2016 | **3,100** | **18,000** | 8 | -- | -- | 2,600 | **800** | -- | **3,200** | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | FFTA-MW055D-20210816 | 14 - 29 | 8/16/2021 | **416** | **2,110** | 4.2 J | 2.1 J | 2 U | 559 | **187** | 380 | **235** | 2 U | 2 U | 2 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| FFTA-MW056 | FFTA-MW056D-20161201 | 28 - 43 | 12/1/2016 | **870** | **24,000** | 110 | -- | -- | 830 | **1,800** | -- | **930** | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | FFTA-MW056D-20210817 | 28 - 43 | 8/17/2021 | **1,680** | **46,200** | 65.1 | 18.1 | 2 U | 1,320 | **4,030** | **1,590** | **1,150** | 2 U | 2 U | 2 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| FFTA-MW057 | FFTA-MW057S-20161201 | 9 - 24 | 12/1/2016 | **12** | **35** | 12 | -- | -- | 9.2 | **97** | -- | 0.61 U | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | FFTA-MW057S-20210817 | 9 - 24 | 8/17/2021 | **386** | **8,400** | 15.5 | 14.9 | 2 U | 332 | **839** | 313 | **205** | 2 U | 2 U | 2 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| FFTA-MW058 | FFTA-MW058S-20161201 | 8 - 23 | 12/1/2016 | **520** | **3,500** | 18 | -- | -- | 430 | **500** | -- | **230** | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | FFTA-MW058S-20210817 | 8 - 23 | 8/17/2021 | **389** | **5,880** | 8.3 | 7.2 J | 2 U | 398 | **293** | 378 | **301** | 20 U | 2 U | 2 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| FFTA-MW059 | FFTA-MW059S-20210817 | 11 - 26 | 8/17/2021 | **457** | **10,400** | 24.3 | 6.7 J | 2 U | 324 | **1,160** | 210 | **170** | 2 U | 2 U | 2 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| FFTA-MW060 | FFTA-MW060I-20210817 | 20 - 35 | 8/17/2021 | **473** | **12,000** | 20.5 | 30.2 | 2 U | 606 | **846** | 612 | **201** | 2 U | 2 U | 6.6 J | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| FFTA-MW061 | FFTA-MW061I-20161201 | 18 - 33 | 12/1/2016 | **780** | **19,000** | 120 | -- | -- | 740 | **2,000** | -- | **910** | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | FFTA-MW061I-20210817 | 18 - 33 | 8/17/2021 | **867** | **25,800** | 46 | 19.3 | 2 U | 691 | **2,230** | 989 | **734** | 2 U | 2 U | 5.9 J | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| FFTA-MW101 | FFTA-MW101S-20161201 | 12 - 22 | 11/30/2016 | **3,600** | **20,000** | 54 | -- | -- | 3,900 | **2,200** | -- | **940** | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | FFTA-MW101S-20210816 | 12 - 22 | 8/16/2021 | **918** | **14,200** | 12.9 | 13.3 | 2 U | 807 | **695** | 639 | **805** | 2 U | 2 U | 2 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| FFTA-MW102 | FFTA-MW102D-20190409 | 37 - 47 | 4/9/2019 | 1.8 J | **8.5 J** | 0.67 J | 0.29 U | 0.51 U | 1.7 J | 5.4 | 3.7 | 0.35 J | 0.27 U | 1.2 U | 1 U | 1.8 U | 2.9 U | -- | -- | -- | -- |
| | FFTA-MW102D-20210817 | 37 - 47 | 8/17/2021 | 2 U | **8** | 2 U | 2 U | 2 U | 2 U | 5 J | 2.5 J | 2 U | 2 U | 2 U | 2 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| | FFTA-MW102D-20210817-D | | | 2 U | **8.8** | 2 U | 2 U | 2 U | 2 U | 5.5 J | 2.8 J | 2 U | 2 U | 2 U | 2 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| FFTA-MW103 | FFTA-MW103S-20161201 | 10.5 - 15.5 | 12/1/2016 | **20** | **570** | 61 | -- | -- | 45 | **440** | -- | **10** | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | FFTA-MW103S-20210823 | 10.5 - 15.5 | 8/23/2021 | **14.4** | **35.5** | 65.3 | 2 U | 2 U | 21.5 | **2,060** | 54.1 | 2 J | 2 U | 2 U | 2 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| | FFTA-MW103I-20161201 | 20 - 25 | 12/1/2016 | **1,100** | **23,000** | 300 | -- | -- | 1,000 | **2,700** | -- | **440** | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | FFTA-MW103I-20210823 | 20 - 25 | 8/23/2021 | **1,130** | **25,800** | 126 | 34.3 | 2 U | 950 | **2,340** | **1,230** | **349** | 2 U | 2 U | 2 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| | FFTA-MW103D-20190410 | 38 - 48 | 4/10/2019 | **8.2** | **99** | 1.3 J | 0.28 U | 0.5 U | 6 | 18 | 11 | 2.1 | 0.31 U | 1.2 U | 1 U | 1.7 U | 2.8 U | -- | -- | -- | -- |
| | FFTA-MW103D-20210823 | 38 - 48 | 8/23/2021 | **7.1 J** | **71** | 2 U | 2 U | 2 U | 5.1 J | 15.6 | 7.6 J | 2 U | 2 U | 2 U | 2 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| FFTA-MW105 | FFTA-MW105D-20161201 | 41 - 51 | 12/1/2016 | **17** | **170** | 4.8 | -- | -- | 13 | **63** | -- | **6.4** | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | FFTA-MW105D-20210817 | 41 - 51 | 8/17/2021 | 5.4 J | **36.1** | 2 U | 2 U | 2 U | 4 J | 11.7 | 8.8 | 2 U | 2 U | 2 U | 2 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| FFTA-MW106 | FFTA-MW106-20210816 | 13 - 23 | 8/16/2021 | **386** | **2,690** | 5.3 J | 3 J | 2 U | 273 | **367** | 220 | **219** | 2 U | 2 U | 2 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| FFTA-MW107 | FFTA-MW107-20161201 | 13 - 23 | 12/1/2016 | **2,300** | **10,000** | 40 | -- | -- | 1,500 | **1,300** | -- | **1,100** | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | FFTA-MW107-20210816 | 13 - 23 | 8/16/2021 | **1,030** | **6,680** | 17.8 | 18.1 | 2 U | 1,260 | **574** | **1,190** | **655** | 2 U | 2 U | 2 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| FFTA-MW108 | FFTA-MW108-20161201 | 13 - 23 | 11/30/2016 | **140** | **490** | 2.7 | -- | -- | 110 | **110** | -- | **67** | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | FFTA-MW108-20210816 | 13 - 23 | 8/16/2021 | **173** | **867** | 2.4 J | 2.1 U | 2.1 U | 91 | **81.7** | 69.7 | **48** | 2.1 U | 2.1 U | 2.1 U | 4.2 U | 4.2 U | 4.2 U | 4.2 U | 4.2 U | 4.2 U |

**TABLE A-2**
**PFAS SUMMARY DATA TABLE**
**FFTA (PFAS AREA 9)**
**NASA WALLOPS FLIGHT FACILITY, WALLOPS ISLAND, VIRGINIA**


| Sample Location | Sample ID | Sample Depth (Feet bgs) | Sample Date | PFOA | PFOS | PFBS | PFDA | PFDoA or PFDoDA | PFHpA | PFHxS | PFHxA | PFNA | PFTA or PFTetA | PFTrDA | PFUnA or PFUDA | NEtFOSAA | NMeFOSAA | HFPO-DA | ADONA | 9Cl-PF3ONS | 11Cl-PF3OUdS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Groundwater Human Health Screening Levels (ng/L)** | | | | 6[3] | 4[3] | 600[3] | NSL | NSL | NSL | 39[3] | 990[3] | 5.9[3] | NSL | NSL | NSL | NSL | NSL | 6[3] | NSL | NSL | NSL |
| FFTA-MW109 | FFTA-MW109-20161201 | 15 - 30 | 11/30/2016 | **76** | **7,000** | 1.2 J | -- | -- | 44 | 26 | -- | **79** | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | FFTA-MW109-20211012 | 15 - 30 | 10/12/2021 | 4.2 J | **25.8** | 7.1 J | 2 U | 2 U | 2.5 J | 6.6 J | 2.8 J | 2 U | 2 U | 2 U | 2 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| | FFTA-MW109-20211012-D | | | 4.1 J | **24.9** | 6.1 J | 2 U | 2 U | 2.6 J | 5.6 J | 2.8 J | 2 U | 2 U | 2 U | 2 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| FFTA-MW110 | FFTA-MW110-20190716 | 15 - 25 | 7/16/2019 | **52** | **100** | 11 | 0.28 U | 0.49 U | 73 | **82** | 150 | 5.4 | 0.26 U | 1.2 U | 0.99 U | 1.7 U | 2.8 U | -- | -- | -- | -- |
| FFTA-MW201 | FFTA-MW201I-20211014 | 31 - 41 | 10/14/2021 | **31** | **73.7** | 5.9 J | 2 U | 2 U | 39.8 | **48.3** | 63.1 | 3.4 J | 2 U | 2 U | 2 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| | FFTA-MW201D-20211014 | 53 - 63 | 10/14/2021 | **13** | **71.2** | 10 | 2 U | 2 U | 6.5 J | **42.8** | 14.7 | 2 U | 2 U | 2 U | 2 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| FFTA-MW202 | FFTA-MW202I-20211014 | 35 - 45 | 10/14/2021 | **1,000** | **8,990** | 34.5 | 3.8 J | 2 U | 901 | **1,100** | 917 | **310** | 2 U | 2 U | 2 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| | FFTA-MW202I-20211014-D | | | **992** | **10,300** | 34.4 | 3.8 J | 2 U | 874 | **1,200** | 912 | **304** | 2 U | 2 U | 2 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| | FFTA-MW202D-20211014 | 55 - 65 | 10/14/2021 | **6.7 J** | **40.6** | 2.1 U | 2.1 U | 2.1 U | 5.2 J | 9 | 7.6 J | 2.1 U | 2.1 U | 2.1 U | 2.1 U | 4.2 U | 4.2 U | 4.2 U | 4.2 U | 4.2 U | 4.2 U |
| FFTA-MW204 | FFTA-MW204S-20211011 | 9 - 14 | 10/11/2021 | **1,180** | **7,330** | 379 | 8.7 | 2 U | 761 | **6,790** | **2,080** | **167** | 2 U | 2 U | 2 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| | FFTA-MW204I-20211011 | 25 - 35 | 10/11/2021 | **7.8 J** | **135** | 2.8 J | 2 U | 2 U | 4.6 J | 11.6 | 6.7 J | **12.5** | 2 U | 2 U | 2 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| | FFTA-MW204D-20211011 | 39 - 49 | 10/11/2021 | 5.6 J | **9.3** | 2 U | 2 U | 2 U | 2.6 J | 4.3 J | 3.8 J | 2 U | 2 U | 2 U | 2 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| FFTA-MW205 | FFTA-MW205S-20211015 | 25 - 35 | 10/15/2021 | 2.2 J | **21.3** | 2 U | 2 U | 2 U | 2 U | 5.5 J | 2 U | 2 U | 2 U | 2 U | 2 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| FFTA-MW206 | FFTA-MW206S-20211011 | 25 - 35 | 10/11/2021 | 4.4 J | **14.9** | 2 U | 2 U | 2 U | 2.9 J | 2.3 J | 2.7 J | 2 U | 2 U | 2 U | 2 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| FFTA-MW207 | FFTA-MW207I-20211012 | 33 - 43 | 10/12/2021 | **404** | **3,180** | 21.5 | 2 U | 2 U | 360 | **666** | 472 | **236** | 2 U | 2 U | 2 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| FFTA-PZ01 | FFTA-PZ01-20211012 | 15 - 25 | 10/12/2021 | **285** | **4,720** | 117 | 2.2 J | 2 U | 244 | **1,970** | 459 | **57.8** | 2 U | 2 U | 2 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| FFTA-PZ02 | FFTA-PZ02-20211012 | 5 - 15 | 10/12/2021 | **445** | **3,710** | 27.6 | 3.4 J | 2.1 U | 411 | **792** | 522 | **364** | 2.1 U | 2.1 U | 2.1 U | 4.2 U | 4.2 U | 4.2 U | 4.2 U | 4.2 U | 4.2 U |
| FFTA-PZ03 | FFTA-PZ03-20211012 | 5 - 15 | 10/12/2021 | **386** | **2,920** | 10 | 2 U | 2 U | 394 | **472** | 345 | **155** | 2 U | 2 U | 2 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| WFF-PMW01 | WFF-PMW01S-20190409 | 40 - 55 | 4/9/2019 | **18** | **47** | 3.9 | 0.3 U | 0.53 U | 20 | **26** | 37 | 1.6 J | 0.28 U | 1.2 U | 1.1 U | 1.8 U | 3 U | -- | -- | -- | -- |
| | WFF-PMW01S-20211014 | | 10/14/2021 | **10.3 J** | **34.2 J** | 3.6 J | 2 UJ | 2 UJ | 11.7 J | **19.3 J** | 22.1 J | 2 UJ | 2 UJ | 2 UJ | 2 UJ | 4 UJ | 4 UJ | 4 UJ | 4 UJ | 4 UJ | 4 UJ |
| | WFF-PMW01D-20190409 | 83 - 98 | 4/9/2019 | 0.81 U | 0.51 U | 0.19 U | 0.32 J | 27 | 0.24 U | 0.31 U | 0.59 U | 0.26 U | 21 | 43 | 3.3 | 1.8 U | 3 U | -- | -- | -- | -- |
| | WFF-PMW01D-20211014 | | 10/14/2021 | 2 UJ | 2 UJ | 2 UJ | 2 UJ | 2 UJ | 2 UJ | 2 UJ | 2 UJ | 2 UJ | 2 UJ | 2 UJ | 2 UJ | 4 UJ | 4 UJ | 4 UJ | 4 UJ | 4 UJ | 4 UJ |
| **Surface Water Human Health Screening Levels (ng/L)** | | | | 88[4] | 58[4] | 8,700[4] | NSL | NSL | NSL | 530[4] | 14,000[4] | 79[4] | NSL | NSL | NSL | NSL | NSL | 88[4] | NSL | NSL | NSL |
| **Surface Water ESVs (ng/L)** | | | | 307,000[5] | 117[5] | 400,000[5] | 660[5] | 72,000[5] | 870,000[5] | 5,500[5] | 28,800[5] | 2,080[5] | NESV | NESV | 49,000[5] | NESV | NESV | NESV | NESV | NESV | NESV |
| **Outfall** | | | | | | | | | | | | | | | | | | | | | |
| Outfall003 | OUTFALL003-A-20190717 | NA | 7/17/2019 | 3.7 | 5.2 J | 0.7 U | 0.31 U | 0.55 U | 2.4 | 6 | 3.1 | 0.6 U | 0.29 U | 1.3 U | 1.1 U | 1.9 U | 3.1 U | -- | -- | -- | -- |
| | OUTFALL003-B-20190717 | NA | 7/17/2019 | 9.5 | **71** | 9.3 | 0.28 U | 0.49 U | 7.7 | 21 | 9.3 | 2.3 | 0.26 U | 1.2 U | 0.98 U | 1.7 U | 2.8 U | -- | -- | -- | -- |
| **Drainage Channel** | | | | | | | | | | | | | | | | | | | | | |
| Outfall003 | OUTFALL003-20190410 | NA | 4/10/2019 | **95** | ***4,300*** | 31 | 0.91 J | 0.51 J | 85 | 460 | 180 | 28 | 0.36 U | 1.2 U | 1 U | 1.8 U | 2.9 U | -- | -- | -- | -- |
| FFTA-SW01 | FFTA-SW01-20190501 | 0 - 1 | 5/1/2019 | 87 | ***3,500*** | 28 | 1.9 J | 0.92 U | 81 | 430 | 140 | 29 | 0.48 U | 2.2 U | 1.8 U | 3.2 U | 5.2 U | -- | -- | -- | -- |
| FFTA-SW02 | FFTA-SW02-20190501 | 0 - 1 | 5/1/2019 | 65 | ***1,200*** | 13 | 0.74 J | 0.47 U | 65 | 180 | 97 | 23 | 0.25 U | 1.1 U | 0.94 U | 1.6 U | 2.6 U | -- | -- | -- | -- |
| | FFTA-SW02-20190501-D | | | 77 | ***1,300*** | 16 | 0.88 J | 0.51 U | 83 | 240 | 120 | 28 | 0.27 U | 1.2 U | 1 U | 1.8 U | 2.9 U | -- | -- | -- | -- |
| FFTA-SW03 | FFTA-SW03-20190501 | 0 - 1 | 5/1/2019 | 71 | ***1,100*** | 15 | 0.83 J | 0.5 U | 70 | 210 | 110 | 25 | 0.26 U | 1.2 U | 0.99 U | 1.7 U | 2.8 U | -- | -- | -- | -- |
| FFTA-SW04 | FFTA-SW04-20190501 | 0 - 1 | 5/1/2019 | 19 | ***210*** | 7.2 | 0.25 U | 0.45 U | 19 | 55 | 24 | 6.3 | 0.24 U | 1.1 U | 0.9 U | 1.6 U | 2.5 U | -- | -- | -- | -- |
| FFTA-SW05 | FFTA-SW05-HIGH-20190515 | 0 - 1 | 5/15/2019 | 4.2 J | 31 | 2.2 U | 3.4 U | 2.6 U | 5.3 J | 5.5 J | 6.4 J | 1.2 U | 4.1 UJ | 2.7 U | 2.4 U | 6.7 U | 7.5 U | -- | -- | -- | -- |
| | FFTA-SW05-LOW-20190515 | 0 - 1 | 5/15/2019 | 12 | **110 J** | 2.9 J | 3.4 U | 2.6 U | 13 | 39 | 23 | 3.6 J | 4.1 UJ | 2.6 U | 2.3 U | 6.6 U | 7.5 U | -- | -- | -- | -- |
| | FFTA-SW05-LOW-20190515-D | | | 9.8 J | **67 J** | 20 J- | 6.7 U | 5.2 UJ | 15 J | 37 | 19 | 2.4 U | 8 UJ | 5.2 UJ | 4.6 U | 13 U | 15 UJ | -- | -- | -- | -- |
| **Seep** | | | | | | | | | | | | | | | | | | | | | |
| FFTA-SEEP01 | FFTA-SEEP01-20210812 | NA | 8/12/2021 | **156** | ***529*** | 25.5 | 2.5 U | 2.5 U | 155 | 227 | 196 | **81.6** | 2.5 U | 2.5 U | 2.5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| FFTA-SEEP02 | FFTA-SEEP02-20211101 | NA | 11/1/2021 | 13.3 | 29.5 | 2.2 J | 2.1 U | 2.1 U | 15.3 | 20 | 16.4 | 2.7 J | 2.1 U | 2.1 U | 2.1 U | 4.2 U | 4.2 U | 4.2 U | 4.2 U | 4.2 U | 4.2 U |
| OUTFALL003-SEEP | OUTFALL003-SEEP-20190717 | NA | 7/17/2019 | **590** | ***23,000*** | 230 | 5.9 U | 4.8 U | 570 | **4,600** | 1,300 | **170** | 2.5 U | 11 U | 9.6 U | 17 U | 27 U | -- | -- | -- | -- |
| | OUTFALL003-SEEP-20210811 | NA | 8/11/2021 | **569** | ***19,400*** | 281 | 7.6 J | 2.1 U | 637 | **4,410** | 1,320 | **201** | 2.1 U | 2.1 U | 2.1 U | 4.2 U | 4.2 U | 4.2 U | 4.2 U | 4.2 U | 4.2 U |
| **Surface Water Body** | | | | | | | | | | | | | | | | | | | | | |
| LMC-SW07 | LMC-SW07-20190718 | 0 - 1 | 7/18/2019 | 3.6 | 19 | 0.97 J | 0.27 U | 0.48 U | 2.7 | 6 | 4.8 | 1.9 | 0.58 J | 1.1 U | 0.95 U | 1.6 U | 2.7 U | -- | -- | -- | -- |

**TABLE A-2**
**PFAS SUMMARY DATA TABLE**
**FFTA (PFAS AREA 9)**
**NASA WALLOPS FLIGHT FACILITY, WALLOPS ISLAND, VIRGINIA**


| Sample Location | Sample ID | Sample Depth (Feet bgs) | Sample Date | PFOA | PFOS | PFBS | PFDA | PFDoA or PFDoDA | PFHpA | PFHxS | PFHxA | PFNA | PFTA or PFTetA | PFTrDA | PFUnA or PFUDA | NEtFOSAA | NMeFOSAA | HFPO-DA | ADONA | 9Cl-PF3ONS | 11Cl-PF3OUdS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sediment Health Screening Levels (µg/kg)** | | | | 130[6] | 85[6] | 13,000[6] | NSL | NSL | NSL | 850[6] | 21,000[6] | 130[6] | NSL | NSL | NSL | NSL | NSL | 160[6] | NSL | NSL | NSL |
| **Sediment ESVs (µg/kg)** | | | | 6[7] | 1.4[7] | 730[7] | NESV | NESV | NESV | NESV | 1,800[7] | 10[7] | NESV | NESV | NESV | NESV | NESV | NESV | NESV | NESV | NESV |
| FFTA-SD01 | FFTA-SD01-0006 | 0 - 0.5 | 5/1/2019 | 0.14 J | *4.2 J* | 0.032 U | 0.028 U | 0.085 U | 0.095 J | 0.29 | 0.16 J | 0.062 J | 0.068 U | 0.065 U | 0.046 U | 0.47 U | 0.49 U | -- | -- | -- | -- |
| FFTA-SD02 | FFTA-SD02-0006 | 0 - 0.5 | 5/1/2019 | 0.11 U | 0.89 J | 0.031 U | 0.027 U | 0.083 U | 0.048 J | 0.11 J | 0.083 J | 0.045 U | 0.067 U | 0.063 U | 0.045 U | 0.46 U | 0.48 U | -- | -- | -- | -- |
| | FFTA-SD02-0006-D | | | 0.1 U | *2.4 J* | 0.03 U | 0.027 U | 0.081 U | 0.049 J | 0.17 J | 0.14 J | 0.044 U | 0.065 U | 0.062 U | 0.044 U | 0.45 U | 0.47 U | -- | -- | -- | -- |
| FFTA-SD03 | FFTA-SD03-0006 | 0 - 0.5 | 5/1/2019 | 0.32 UJ | *20 J* | 0.093 UJ | 0.082 UJ | 0.25 UJ | 0.18 J | 0.55 J | 0.16 UJ | 0.21 J | 0.2 UJ | 0.19 UJ | 0.13 UJ | 1.4 UJ | 1.5 UJ | -- | -- | -- | -- |
| FFTA-SD04 | FFTA-SD04-0006 | 0 - 0.5 | 5/1/2019 | 0.12 U | 1 J | 0.034 U | 0.03 U | 0.091 U | 0.04 U | 0.092 J | 0.057 U | 0.049 U | 0.074 U | 0.07 U | 0.049 U | 0.5 U | 0.53 U | -- | -- | -- | -- |
| FFTA-SD05 | FFTA-SD05-0006 | 0 - 0.5 | 5/15/2019 | 0.28 U | *4* | 0.08 U | 0.071 U | 0.21 U | 0.093 U | 0.19 J | 0.13 U | 0.12 U | 0.17 U | 0.16 U | 0.12 U | 1.2 U | 1.3 U | -- | -- | -- | -- |
| | FFTA-SD05-0006-D | | | 0.21 U | *2.3* | 0.062 U | 0.055 U | 0.17 U | 0.072 U | 0.13 J | 0.1 U | 0.09 U | 0.13 U | 0.13 U | 0.09 U | 0.92 U | 0.97 U | -- | -- | -- | -- |
| LMC-SD07 | LMC-SD07-0006 | 0 - 0.5 | 7/18/2019 | 0.3 UJ | *2.9 J* | 0.088 UJ | 0.078 UJ | 0.24 UJ | 0.1 UJ | 0.11 U | 0.15 UJ | 0.14 J | 0.19 UJ | 0.18 UJ | 0.13 J | 1.3 UJ | 1.4 UJ | -- | -- | -- | -- |

**Notes:**

"-D" indicates duplicate sample
ESV - ecological screening value
J - estimated value
J- - estimated value biased low
ng/L - nanograms per liter
NESV - no ecological screening value
NSL - no screening levels
U - non-detect value
µg/kg - micrograms per kilogram

PFOA - Perfluorooctanoic acid
PFOS - Perfluorooctanesulfonic acid
PFBS - Perfluorobutanesulfonic acid
PFDA - Perfluorodecanoic acid
PFDoA or PFDoDA - Perfluorododecanoic acid
PFHpA - Perfluoroheptanoic acid
PFHxS - Perfluorohexanesulfonic acid
PFHxA - Perfluorohexanoic acid
PFNA - Perfluorononanoic acid
PFTA or PFTetA - Perfluorotetradecanoic acid
PFTrDA - Perfluorotridecanoic acid
PFUnA or PFUDA - Perfluoroundecanoic acid
NEtFOSAA - N-ethyl perfluorooctanesulfonamidoacetic acid
NMeFOSAA - N-methyl perfluorooctanesulfonamidoacetic acid
HFPO-DA - Hexafluoropropylene oxide dimer acid
ADONA - 4,8-Dioxa-3H-perfluorononanoic acid
9Cl-PF3ONS - 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid
11Cl-PF3OUdS - 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid

**Bolded and shaded values indicate an exceedance of the human health screening levels**
*Italicized, underlined, and lightly shaded values indicate exceedance of ESVs*

1 - USEPA Regional Screening Level (RSL) (May 2023) for Residential Soil and a hazard quotient (HQ) of 0.1 due to noncancer additive effects.

2 - Soil ESVs were derived from the lowest risked-based screening levels for plants, soil invertebrates, birds, or mammals from Grippo, et al. (2021), if available. Otherwise, the lower of the screening levels from the two Strategic Environmental Research and Development Program (SERDP) documents (Condor, et al. [2020] and Divine, et al. [2020]) was selected.

3 - USEPA RSL (May 2023) for Tapwater and an HQ of 0.1 due to noncancer additive effects.

4 - Calculated using the USEPA's RSL Calculator Surface Water Module for a recreational receptor with site-specific assumptions for swimming exposure. The RSL is based on an HQ of 0.1 and the most conservative child receptor (0 to 6 years) for this scenario. The following default factors for a child receptor in the surface water module of the RSL calculator were applied: child body weight (15 kg), ingestion rate (0.12 L/hour), exposed skin area (6,365 cm2), and exposure duration (6 years). The following scenario-specific assumptions were applied: exposure frequency of 52 days/year (1 day per weekend), an exposure time of 3 hours per event, and an event frequency of 1 event per day. Screening levels are not available for wastewater. Therefore, to be conservative the surface water screening levels will be applied to wastewater because exposures to wastewater are anticipated to be less frequent than surface water.

5 - Surface water ESVs were derived from the lowest of the aquatic organism, mammal, or bird values from Grippo, et al. (2021), if available. Otherwise, the lower of the screening levels from the two SERDP documents (Condor, et al. [2020] and Divine, et al. [2020]) was selected. PFDoA/PFDoDA, PFHpA, and PFUnA/PFUDA were not evaluated in Grippo, et al. (2021); therefore, the minimum value from Divine, et al. (2020) (excluding values for the harbor seal) was selected for those compounds.

6 - Calculated using the USEPA's RSL Calculator Soil/Sediment Module for a recreational receptor with site-specific assumptions for sediment exposure. The RSL is based on an HQ of 0.1 and the most conservative child receptor (0 to 6 years) for this scenario. The following default factors for a child receptor in the soil/sediment module of the RSL calculator were applied: child body weight (15 kg), exposure duration (6 years), incidental ingestion rate (200 mg/day), exposed skin area (2,373 cm2), and skin adherence factor (0.2 mg/cm2). The following scenario-specific assumptions were applied: exposure frequency of 52 days per year (1 day per weekend) and an exposure time of 3 hours per day.

7 - The only sediment ESV for sediment invertebrates was derived from the Environmental Agency (2004) for PFOS. Additional sediment screening values were developed for birds and mammals as presented in Table 11a of Divine et al. (2020) from which the lowest of the sediment invertebrate, mammal, or bird screening values was selected as the ESV.

**Table A-3**
**LTM Data Summary Table**
**Waste Oil Dump**
**NASA Wallops Flight Facility, Wallops Island, Virginia**


| LOCATION | Cleanup Level (µg/L) | 15-MW001 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SAMPLE ID | | 15-MW001-20130319 | 15-MW001-20130903 | 15-MW001-20140319 | 15-MW001_20140922 | 15-MW001-20150316 | 15-MW001-20150923 | 15-MW001-20160412 | 15-MW001-20160926 |
| SAMPLE DATE | | 20130319 | 20130903 | 20140319 | 20140922 | 20150316 | 20150923 | 20160412 | 20160926 |
| SAMPLE CODE | | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL |
| MATRIX | | GW | GW | GW | GW | GW | GW | GW | GW |
| **VOLATILES (µg/L)** | | | | | | | | | |
| BENZENE | 5 | 0.11 U | 0.25 U | 0.25 U | NA | NA | NA | NA | NA |
| **METALS (µg/L)** | | | | | | | | | |
| ARSENIC | 10 | **11** | **13** | **11** | 8 J | **12** | **15** | **18** | **20** |
| **DISSOLVED METALS (µg/L)** | | | | | | | | | |
| ARSENIC | 10 | 11 | 11 | 10 | 9.8 | 11 | 14 | 17 | 19 |
| **FIELD (MG/L)** | | | | | | | | | |
| DISSOLVED OXYGEN | NA | 1 | 0.1 | 0.4 | NA | NA | NA | NA | NA |
| DISSOLVED OXYGEN - HORIBA | NA | 0.59 | 0 | 0 | NA | NA | NA | NA | NA |
| SALINITY (%) | NA | NA | NA | 0.1 | NA | NA | NA | NA | NA |
| TEMPERATURE (deg C) | NA | 11.2 | 20.58 | 10.86 | NA | NA | NA | NA | NA |
| SPECIFIC CONDUCTANCE (ms/cm) | NA | 0.16 | 0.122 | 0.135 | NA | NA | NA | NA | NA |
| OXIDATION REDUCTION POTENTIAL (mv) | NA | -32 | 175 | 4 | NA | NA | NA | NA | NA |
| TURBIDITY (ntu) | NA | 2.1 | 2.3 | 1.06 | NA | NA | NA | NA | NA |
| PH (s.u.) | NA | 5.99 | 5.55 | 5.79 | NA | NA | NA | NA | NA |

µg/L- micrograms per liter
mg/L- miligrams per liter

Notes:
1. Cleanup levels are defined in the 2008 Record of Decision (ROD).
2. Shadded and **bolded** values indicate exceedance of appropriate ROD cleanup levels.

**Table A-3**
**LTM Data Summary Table**
**Waste Oil Dump**
**NASA Wallops Flight Facility, Wallops Island, Virginia**


| LOCATION | 15-MW001 | | | 15-MW002 | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SAMPLE ID | 15-MW001-20171017 | 15-MW001-20200721 | 15-MW001-20220907 | 15-MW002-20130319 | 15-MW002-20130903 | 15-MW002-20140319 | 15-MW002-20140922 | 15-MW002-20150316 | 15-MW002-20150923 |
| SAMPLE DATE | 20171017 | 20200701 | 20220907 | 20130319 | 20130903 | 20140319 | 20140922 | 20150316 | 20150923 |
| SAMPLE CODE | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL |
| MATRIX | GW | GW | GW | GW | GW | GW | GW | GW | GW |
| **VOLATILES (µg/L)** | | | | | | | | | |
| BENZENE | NA | NA | NA | 0.11 U | 0.25 U | 0.25 U | NA | NA | NA |
| **METALS (µg/L)** | | | | | | | | | |
| ARSENIC | **21** | **30** | **39** | 1.9 | 5.1 J | 2.8 J | 3.2 J | 1.6 | 4.3 J |
| **DISSOLVED METALS (µg/L)** | | | | | | | | | |
| ARSENIC | 21 | 34 | 41 | 1.7 | 4.8 J | 2.5 U | 4 | 3.1 | 4 J |
| **FIELD (MG/L)** | | | | | | | | | |
| DISSOLVED OXYGEN | NA | 0 | NA | 0.2 | 0.1 | 0.6 | NA | NA | NA |
| DISSOLVED OXYGEN - HORIBA | NA | 0 | 0.36 | 0.12 | 0 | 0 | NA | NA | NA |
| SALINITY (%) | NA | NA | NA | NA | NA | 0 | NA | NA | NA |
| TEMPERATURE (deg C) | NA | 16.56 | 18.3 | 10.8 | 20.41 | 8.31 | NA | NA | NA |
| SPECIFIC CONDUCTANCE (ms/cm) | NA | 0.156 | 0.205 | 0.125 | 0.093 | 0.085 | NA | NA | NA |
| OXIDATION REDUCTION POTENTIAL (mv) | NA | -14 | -169.3 | 64 | 260 | 19 | NA | NA | NA |
| TURBIDITY (ntu) | NA | 1.36 | 2.22 | 81.7 | 3.72 | 52.9 | NA | NA | NA |
| PH (s.u.) | NA | 6.3 | 6.56 | 4.53 | 5 | 5.55 | NA | NA | NA |

µg/L- micrograms per liter
mg/L- miligrams per liter

Notes:
1. Cleanup levels are defined in the 2008 Record of Decision (ROD).
2. Shadded and **bolded** values indicate exceedance of appropriate ROD cleanup levels.

**Table A-3**
**LTM Data Summary Table**
**Waste Oil Dump**
**NASA Wallops Flight Facility, Wallops Island, Virginia**


| LOCATION | 15-MW002 | | | | 15-MW007 | | | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE ID | 15-MW002-20160412 | 15-MW002-20160926 | 15-MW002-20171017 | 15-MW002-20200721 | 15-MW007-20130318 | 15-MW007-20130318-AVG | 15-MW007-20130318-D | 15-MW007-20130903 |
| SAMPLE DATE | 20160412 | 20160926 | 20171017 | 20200721 | 20130318 | 20130318 | 20130318 | 20130903 |
| SAMPLE CODE | NORMAL | NORMAL | NORMAL | NORMAL | ORIG | AVG | DUP | ORIG |
| MATRIX | GW | GW | GW | GW | GW | GW | GW | GW |
| **VOLATILES (µg/L)** | | | | | | | | |
| BENZENE | NA | NA | NA | NA | 0.11 U | 0.11 U | 0.11 U | 0.51 J |
| **METALS (µg/L)** | | | | | | | | |
| ARSENIC | 5 U | 4.8 J | 5.5 | 5.4 | 0.29 U | 0.3275 | 0.51 J | 3.3 J |
| **DISSOLVED METALS (µg/L)** | | | | | | | | |
| ARSENIC | 2.9 U | 7 | 4.4 J | 5.4 | 1.9 | 1.0225 | 0.29 U | 3.2 J |
| **FIELD (MG/L)** | | | | | | | | |
| DISSOLVED OXYGEN | NA | NA | NA | 9 | 0.4 | 0.4 | NA | 4 |
| DISSOLVED OXYGEN - HORIBA | NA | NA | NA | 19.26 | 0.55 | 0.55 | NA | 5.09 |
| SALINITY (%) | NA | NA | NA | NA | NA | NA | NA | NA |
| TEMPERATURE (deg C) | NA | NA | NA | 19.55 | 12.67 | 12.67 | NA | 21.71 |
| SPECIFIC CONDUCTANCE (ms/cm) | NA | NA | NA | 0.092 | 0.096 | 0.096 | NA | 0.074 |
| OXIDATION REDUCTION POTENTIAL (mv) | NA | NA | NA | 6 | 101 | 101 | NA | -122 |
| TURBIDITY (ntu) | NA | NA | NA | 5.12 | 23.8 | 23.8 | NA | 3.02 |
| PH (s.u.) | NA | NA | NA | 6.33 | 4.61 | 4.61 | NA | 4.95 |

µg/L- micrograms per liter
mg/L- miligrams per liter

Notes:
1. Cleanup levels are defined in the 2008 Record of Decision (ROD).
2. Shadded and **bolded** values indicate exceedance of appropriate ROD cleanup levels.

**Table A-3**
**LTM Data Summary Table**
**Waste Oil Dump**
**NASA Wallops Flight Facility, Wallops Island, Virginia**


| LOCATION | 15-MW007 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE ID | 15-MW007-20130903-AVG | 15-MW007-20130903-D | 15-MW007-20140319 | 15-MW007-20140319-AVG | 15-MW007-20140319-D | 15-MW007_20140922 | 15-MW007_20140922-AVG | 15-MW007_20140922-D |
| SAMPLE DATE | 20130903 | 20130903 | 20140319 | 20140319 | 20140319 | 20140922 | 20140922 | 20140922 |
| SAMPLE CODE | AVG | DUP | ORIG | AVG | DUP | ORIG | AVG | DUP |
| MATRIX | GW | GW | GW | GW | GW | GW | GW | GW |
| **VOLATILES (µg/L)** | | | | | | | | |
| BENZENE | 0.525 | 0.54 J | 0.5 J | 0.48 | 0.46 J | NA | NA | NA |
| **METALS (µg/L)** | | | | | | | | |
| ARSENIC | 3.05 | 2.8 J | 4.1 J | 4.05 | 4 J | 3.3 J | 3.8 | 4.3 J |
| **DISSOLVED METALS (µg/L)** | | | | | | | | |
| ARSENIC | 3.05 | 2.9 J | 3.3 U | 3.35 U | 3.4 U | 1.7 | 2.3 | 2.9 |
| **FIELD (MG/L)** | | | | | | | | |
| DISSOLVED OXYGEN | 4 | NA | 0.3 | 0.3 | NA | NA | NA | NA |
| DISSOLVED OXYGEN - HORIBA | 5.09 | NA | 0 | 0 | NA | NA | NA | NA |
| SALINITY (%) | NA | NA | 0 | 0 | NA | NA | NA | NA |
| TEMPERATURE (deg C) | 21.71 | NA | 15.12 | 15.12 | NA | NA | NA | NA |
| SPECIFIC CONDUCTANCE (ms/cm) | 0.074 | NA | 0.094 | 0.094 | NA | NA | NA | NA |
| OXIDATION REDUCTION POTENTIAL (mv) | -122 | NA | -5 | -5 | NA | NA | NA | NA |
| TURBIDITY (ntu) | 3.02 | NA | 4.31 | 4.31 | NA | NA | NA | NA |
| PH (s.u.) | 4.95 | NA | 5.12 | 5.12 | NA | NA | NA | NA |

µg/L- micrograms per liter
mg/L- miligrams per liter

Notes:
1. Cleanup levels are defined in the 2008 Record of Decision (ROD).
2. Shadded and **bolded** values indicate exceedance of appropriate ROD cleanup levels.

**Table A-3**
**LTM Data Summary Table**
**Waste Oil Dump**
**NASA Wallops Flight Facility, Wallops Island, Virginia**


| LOCATION | 15-MW007 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE ID | 15-MW007-20150316 | 15-MW007-20150316-AVG | 15-MW007-20150316-D | 15-MW007-20150923 | 15-MW007-20150923-AVG | 15-MW007-20150923-D | 15-MW007-20160412 | 15-MW007-20160412-AVG |
| SAMPLE DATE | 20150316 | 20150316 | 20150316 | 20150923 | 20150923 | 20150923 | 20160412 | 20160412 |
| SAMPLE CODE | ORIG | AVG | DUP | ORIG | AVG | DUP | ORIG | AVG |
| MATRIX | GW | GW | GW | GW | GW | GW | GW | GW |
| **VOLATILES (µg/L)** | | | | | | | | |
| BENZENE | NA | NA | NA | NA | NA | NA | NA | NA |
| **METALS (µg/L)** | | | | | | | | |
| ARSENIC | 10 | 10 | 10 | 5.4 | 5.75 | 6.1 | 3.4 U | 4.05 |
| **DISSOLVED METALS (µg/L)** | | | | | | | | |
| ARSENIC | 9.1 | 9.1 | 9.1 | 5 J | 5.2 | 5.4 | 3.9 U | 4.1 U |
| **FIELD (MG/L)** | | | | | | | | |
| DISSOLVED OXYGEN | NA | NA | NA | NA | NA | NA | NA | NA |
| DISSOLVED OXYGEN - HORIBA | NA | NA | NA | NA | NA | NA | NA | NA |
| SALINITY (%) | NA | NA | NA | NA | NA | NA | NA | NA |
| TEMPERATURE (deg C) | NA | NA | NA | NA | NA | NA | NA | NA |
| SPECIFIC CONDUCTANCE (ms/cm) | NA | NA | NA | NA | NA | NA | NA | NA |
| OXIDATION REDUCTION POTENTIAL (mv) | NA | NA | NA | NA | NA | NA | NA | NA |
| TURBIDITY (ntu) | NA | NA | NA | NA | NA | NA | NA | NA |
| PH (s.u.) | NA | NA | NA | NA | NA | NA | NA | NA |

µg/L- micrograms per liter
mg/L- miligrams per liter

Notes:
1. Cleanup levels are defined in the 2008 Record of Decision (ROD).
2. Shadded and **bolded** values indicate exceedance of appropriate ROD cleanup levels.

**Table A-3**
**LTM Data Summary Table**
**Waste Oil Dump**
**NASA Wallops Flight Facility, Wallops Island, Virginia**


| LOCATION | 15-MW007 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE ID | 15-MW007-20160412-D | 15-MW007-20160926 | 15-MW007-20160926-AVG | 15-MW007-20160926-D | 15-MW007-20171017 | 15-MW007-20171017-AVG | 15-MW007-20171017-D | 15-MW007-20200720 |
| SAMPLE DATE | 20160412 | 20160926 | 20160926 | 20160926 | 20171017 | 20171017 | 20171017 | 20200720 |
| SAMPLE CODE | DUP | ORIG | AVG | DUP | ORIG | AVG | DUP | ORIG |
| MATRIX | GW | GW | GW | GW | GW | GW | GW | GW |
| **VOLATILES (µg/L)** | | | | | | | | |
| BENZENE | NA | NA | NA | NA | NA | NA | NA | NA |
| **METALS (µg/L)** | | | | | | | | |
| ARSENIC | 6.4 | 3.4 J | 3.2 | 3 J | 6.4 | 6 | 5.6 | **51** |
| **DISSOLVED METALS (µg/L)** | | | | | | | | |
| ARSENIC | 4.3 U | 3.6 J | 4.9 | 6.2 | 4.4 J | 4.65 | 4.9 J | 54 |
| **FIELD (MG/L)** | | | | | | | | |
| DISSOLVED OXYGEN | NA | NA | NA | NA | NA | NA | NA | 0 |
| DISSOLVED OXYGEN - HORIBA | NA | NA | NA | NA | NA | NA | NA | 0 |
| SALINITY (%) | NA | NA | NA | NA | NA | NA | NA | NA |
| TEMPERATURE (deg C) | NA | NA | NA | NA | NA | NA | NA | 21.67 |
| SPECIFIC CONDUCTANCE (ms/cm) | NA | NA | NA | NA | NA | NA | NA | 0.266 |
| OXIDATION REDUCTION POTENTIAL (mv) | NA | NA | NA | NA | NA | NA | NA | -79 |
| TURBIDITY (ntu) | NA | NA | NA | NA | NA | NA | NA | 2.04 |
| PH (s.u.) | NA | NA | NA | NA | NA | NA | NA | 6.34 |

µg/L- micrograms per liter
mg/L- miligrams per liter

Notes:
1. Cleanup levels are defined in the 2008 Record of Decision (ROD).
2. Shadded and **bolded** values indicate exceedance of appropriate ROD cleanup levels.

**Table A-3**
**LTM Data Summary Table**
**Waste Oil Dump**
**NASA Wallops Flight Facility, Wallops Island, Virginia**


| LOCATION | 15-MW007 | | WOD-MW001 | | WOD-MW002D | | | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE ID | 15-MW007-DUP01-20200720 | 15-MW007-20220907 | WOD-MW001-20130318 | WOD-MW001-20130904 | WOD-MW002D-20130318 | WOD-MW002D-20130903 | WOD-MW002D-20140319 | WOD-MW002D-20140922 |
| SAMPLE DATE | 20200720 | 20220907 | 20130318 | 20130904 | 20130318 | 20130903 | 20140319 | 20140922 |
| SAMPLE CODE | DUP | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL |
| MATRIX | GW | GW | GW | GW | GW | GW | GW | GW |
| **VOLATILES (µg/L)** | | | | | | | | |
| BENZENE | NA | NA | 0.11 U | 0.25 U | 4.5 | 2 J | 1.2 J | NA |
| **METALS (µg/L)** | | | | | | | | |
| ARSENIC | **59** | **29** | 0.29 U | 5 J | **13** | **16** | **11** | 9 J |
| **DISSOLVED METALS (µg/L)** | | | | | | | | |
| ARSENIC | 56 | 28 | 0.29 U | 1.2 U | 9 | 15 | 8.8 J | 8.7 |
| **FIELD (MG/L)** | | | | | | | | |
| DISSOLVED OXYGEN | 0 | NA | 3 | NA | 0.1 | 1 < | 0.6 | NA |
| DISSOLVED OXYGEN - HORIBA | 0 | 0.43 | 8.19 | NA | 0.01 | 0.2 | 0 | NA |
| SALINITY (%) | NA | NA | NA | NA | NA | NA | 0 | NA |
| TEMPERATURE (deg C) | 21.67 | 19.4 | 12.58 | NA | 11.66 | 21.68 | 13.05 | NA |
| SPECIFIC CONDUCTANCE (ms/cm) | 0.266 | 0.181 | 0.232 | NA | 0.237 | 0.115 | 0.159 | NA |
| OXIDATION REDUCTION POTENTIAL (mv) | -79 | -136.9 | 271 | NA | -34 | -83 | -33 | NA |
| TURBIDITY (ntu) | 2.04 | 4.35 | 0.62 | NA | 17.3 | 7.58 | 24.6 | NA |
| PH (s.u.) | 6.34 | 5.90 | 5.82 | NA | 6.25 | 6.05 | 6.23 | NA |

µg/L- micrograms per liter
mg/L- miligrams per liter

Notes:
1. Cleanup levels are defined in the 2008 Record of Decision (ROD).
2. Shadded and **bolded** values indicate exceedance of appropriate ROD cleanup levels.

**Table A-3**
**LTM Data Summary Table**
**Waste Oil Dump**
**NASA Wallops Flight Facility, Wallops Island, Virginia**


| LOCATION | WOD-MW002D | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE ID | WOD-MW002D-20150316 | WOD-MW002D-20150923 | WOD-MW002D-20160411 | WOD-MW002D-20160926 | WOD-MW002D-20171017 | WOD-MW002D-20200720 | WOD-MW002D-20220907 | WOD-DUP01-20220907 |
| SAMPLE DATE | 20150316 | 20150923 | 20160411 | 20160926 | 20171017 | 20200720 | 20220907 | 20220907 |
| SAMPLE CODE | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | ORIGINAL | DUPLICATE |
| MATRIX | GW | GW | GW | GW | GW | GW | GW | GW |
| **VOLATILES (µg/L)** | | | | | | | | |
| BENZENE | NA | NA | NA | NA | NA | NA | NA | NA |
| **METALS (µg/L)** | | | | | | | | |
| ARSENIC | 9.1 | **11** | **16** | **14** | **11** | 6.2 | 2.6 | 2.6 |
| **DISSOLVED METALS (µg/L)** | | | | | | | | |
| ARSENIC | 9.5 | 11 | 15 | 14 | 9.4 | 7.2 | 2.3 | 2.6 |
| **FIELD (MG/L)** | | | | | | | | |
| DISSOLVED OXYGEN | NA | NA | NA | NA | NA | 4 | NA | NA |
| DISSOLVED OXYGEN - HORIBA | NA | NA | NA | NA | NA | 0.80 | 0.93 | 0.93 |
| SALINITY (%) | NA | NA | NA | NA | NA | NA | NA | NA |
| TEMPERATURE (deg C) | NA | NA | NA | NA | NA | 17.92 | 18.4 | 18.4 |
| SPECIFIC CONDUCTANCE (ms/cm) | NA | NA | NA | NA | NA | 0.11 | 0.107 | 0.107 |
| OXIDATION REDUCTION POTENTIAL (mv) | NA | NA | NA | NA | NA | 36 | -40.7 | -40.7 |
| TURBIDITY (ntu) | NA | NA | NA | NA | NA | 2.9 | 0.23 | 0.23 |
| PH (s.u.) | NA | NA | NA | NA | NA | 5.86 | 6.30 | 6.30 |

µg/L- micrograms per liter
mg/L- miligrams per liter

Notes:
1. Cleanup levels are defined in the 2008 Record of Decision (ROD).
2. Shadded and **bolded** values indicate exceedance of appropriate ROD cleanup levels.

**Table A-3**
**LTM Data Summary Table**
**Waste Oil Dump**
**NASA Wallops Flight Facility, Wallops Island, Virginia**


| LOCATION | WOD-MW002S | | | | | | |
|---|---|---|---|---|---|---|---|
| SAMPLE ID | WOD-MW002S-20130318 | WOD-MW002S-20130903 | WOD-MW002S-20140319 | WOD-MW002S_20140922 | WOD-MW002S-20150316 | WOD-MW002S-20150923 | WOD-MW002S-20160412 |
| SAMPLE DATE | 20130318 | 20130903 | 20140319 | 20140922 | 20150316 | 20150923 | 20160412 |
| SAMPLE CODE | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL |
| MATRIX | GW | GW | GW | GW | GW | GW | GW |
| **VOLATILES (µg/L)** | | | | | | | |
| BENZENE | 0.11 U | 0.25 U | 0.25 U | NA | NA | NA | NA |
| **METALS (µg/L)** | | | | | | | |
| ARSENIC | 0.29 U | 5.4 J | 1.7 J | 2.8 J | 3.8 | 7.3 | 3.8 U |
| **DISSOLVED METALS (µg/L)** | | | | | | | |
| ARSENIC | 2 | 4.4 J | 1.3 U | 6.6 | 2.3 | 5.5 | 2.3 U |
| **FIELD (MG/L)** | | | | | | | |
| DISSOLVED OXYGEN | 1 | 2 | 3 | NA | NA | NA | NA |
| DISSOLVED OXYGEN - HORIBA | 3.15 | 1.91 | 2.44 | NA | NA | NA | NA |
| SALINITY (%) | NA | NA | 0 | NA | NA | NA | NA |
| TEMPERATURE (deg C) | 10.52 | 19.2 | 11.62 | NA | NA | NA | NA |
| SPECIFIC CONDUCTANCE (ms/cm) | 0.313 | 0.141 | 0.244 | NA | NA | NA | NA |
| OXIDATION REDUCTION POTENTIAL (mv) | 9 | -26 | 28 | NA | NA | NA | NA |
| TURBIDITY (ntu) | 4.03 | 19.2 | 17.76 | NA | NA | NA | NA |
| PH (s.u.) | 6.73 | 6.35 | 6.45 | NA | NA | NA | NA |

µg/L- micrograms per liter
mg/L- miligrams per liter

Notes:
1. Cleanup levels are defined in the 2008 Record of Decision (ROD).
2. Shadded and **bolded** values indicate exceedance of appropriate ROD cleanup levels.

**Table A-3**
**LTM Data Summary Table**
**Waste Oil Dump**
**NASA Wallops Flight Facility, Wallops Island, Virginia**


| LOCATION | WOD-MW002S | | WOD-MW003R | | | | |
|---|---|---|---|---|---|---|---|
| SAMPLE ID | WOD-MW002S-20160926 | WOD-MW002S-20171017 | WOD-MW003R-20130318 | WOD-MW003R-20130903 | WOD-MW003R-20140319 | WOD-MW003R_20140922 | WOD-MW003R-20150316 |
| SAMPLE DATE | 20160926 | 20171017 | 20130318 | 20130903 | 20140319 | 20140922 | 20150316 |
| SAMPLE CODE | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL |
| MATRIX | GW | GW | GW | GW | GW | GW | GW |
| **VOLATILES (µg/L)** | | | | | | | |
| BENZENE | NA | NA | 0.11 U | 0.25 U | 0.25 U | NA | NA |
| **METALS (µg/L)** | | | | | | | |
| ARSENIC | 2.9 J | 2.3 U | 1.2 | 1.2 U | 1.2 U | 0.29 UJ | 0.29 U |
| **DISSOLVED METALS (µg/L)** | | | | | | | |
| ARSENIC | 2.3 U | 2.3 U | 0.75 J | 1.2 U | 1.2 U | 0.29 U | 0.34 J |
| **FIELD (MG/L)** | | | | | | | |
| DISSOLVED OXYGEN | NA | NA | 10 | 6 | 6 | NA | NA |
| DISSOLVED OXYGEN - HORIBA | NA | NA | 7.74 | 5.61 | 5.99 | NA | NA |
| SALINITY (%) | NA | NA | NA | NA | 0 | NA | NA |
| TEMPERATURE (deg C) | NA | NA | 13.09 | 22.49 | 14.6 | NA | NA |
| SPECIFIC CONDUCTANCE (ms/cm) | NA | NA | 0.119 | 0.056 | 0.061 | NA | NA |
| OXIDATION REDUCTION POTENTIAL (mv) | NA | NA | 354 | 173 | 208 | NA | NA |
| TURBIDITY (ntu) | NA | NA | 0.6 | 7.14 | 0.17 | NA | NA |
| PH (s.u.) | NA | NA | 6.26 | 6.01 | 5.8 | NA | NA |

µg/L- micrograms per liter
mg/L- miligrams per liter

Notes:
1. Cleanup levels are defined in the 2008 Record of Decision (ROD).
2. Shadded and **bolded** values indicate exceedance of appropriate ROD cleanup levels.

**Table A-3**
**LTM Data Summary Table**
**Waste Oil Dump**
**NASA Wallops Flight Facility, Wallops Island, Virginia**


| LOCATION | WOD-MW003R | | | | WOD-MW008 | | |
|---|---|---|---|---|---|---|---|
| SAMPLE ID | WOD-MW003R-20150923 | WOD-MW003R-20160926 | WOD-MW003R-20171017 | WOD-MW003R-20200721 | WOD-MW008-20130318 | WOD-MW008-20130903 | WOD-MW008-20140319 |
| SAMPLE DATE | 20150923 | 20160926 | 20171017 | 20200721 | 20130318 | 20130903 | 20140319 |
| SAMPLE CODE | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL |
| MATRIX | GW | GW | GW | GW | GW | GW | GW |
| **VOLATILES (µg/L)** | | | | | | | |
| BENZENE | NA | NA | NA | NA | 0.11 U | 0.25 U | 0.25 U |
| **METALS (µg/L)** | | | | | | | |
| ARSENIC | 2.3 U | 2.3 U | 2.3 U | 3.0 U | 0.29 U | 1.2 U | 1.2 U |
| **DISSOLVED METALS (µg/L)** | | | | | | | |
| ARSENIC | 2.3 U | 2.3 U | 2.3 U | 3.0 U | 0.29 U | 1.2 U | 1.2 U |
| **FIELD (MG/L)** | | | | | | | |
| DISSOLVED OXYGEN | NA | NA | NA | 7 | 2 | 7 | 5 |
| DISSOLVED OXYGEN - HORIBA | NA | NA | NA | 8.27 | 7.69 | 6.65 | 5.43 |
| SALINITY (%) | NA | NA | NA | NA | NA | NA | 0 |
| TEMPERATURE (deg C) | NA | NA | NA | 19.22 | 10.98 | 22.71 | 13.22 |
| SPECIFIC CONDUCTANCE (ms/cm) | NA | NA | NA | 0.089 | 0.097 | 0.06 | 0.098 |
| OXIDATION REDUCTION POTENTIAL (mv) | NA | NA | NA | 258 | 231 | 366 | 222 |
| TURBIDITY (ntu) | NA | NA | NA | 0 | 0.15 | 1.7 | 2.98 |
| PH (s.u.) | NA | NA | NA | 5.95 | 5.34 | 4.91 | 5.44 |

µg/L- micrograms per liter
mg/L- miligrams per liter

Notes:
1. Cleanup levels are defined in the 2008 Record of Decision (ROD).
2. Shadded and **bolded** values indicate exceedance of appropriate ROD cleanup levels.

**Table A-3**
**LTM Data Summary Table**
**Waste Oil Dump**
**NASA Wallops Flight Facility, Wallops Island, Virginia**


| LOCATION | WOD-MW008 | | | | | | |
|---|---|---|---|---|---|---|---|
| SAMPLE ID | WOD-MW008-20140922 | WOD-MW008-20150316 | WOD-MW008-20150923 | WOD-MW008-20160411 | WOD-MW008-20160926 | WOD-MW008-20171017 | WOD-MW008-20200720 |
| SAMPLE DATE | 20140922 | 20150316 | 20150923 | 20160411 | 20160926 | 20171017 | 20200720 |
| SAMPLE CODE | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL |
| MATRIX | GW | GW | GW | GW | GW | GW | GW |
| **VOLATILES (µg/L)** | | | | | | | |
| BENZENE | NA | NA | NA | NA | NA | NA | NA |
| **METALS (µg/L)** | | | | | | | |
| ARSENIC | 0.29 UJ | 0.34 J | 2.3 U | 2.3 U | 2.3 U | 2.3 U | 3.0 U |
| **DISSOLVED METALS (µg/L)** | | | | | | | |
| ARSENIC | 1.7 | 0.29 U | 2.3 U | 2.3 U | 2.3 U | 2.3 U | 3.0 U |
| **FIELD (MG/L)** | | | | | | | |
| DISSOLVED OXYGEN | NA | NA | NA | NA | NA | NA | 6 |
| DISSOLVED OXYGEN - HORIBA | NA | NA | NA | NA | NA | NA | 8.62 |
| SALINITY (%) | NA | NA | NA | NA | NA | NA | NA |
| TEMPERATURE (deg C) | NA | NA | NA | NA | NA | NA | 18.64 |
| SPECIFIC CONDUCTANCE (ms/cm) | NA | NA | NA | NA | NA | NA | 0.087 |
| OXIDATION REDUCTION POTENTIAL (mv) | NA | NA | NA | NA | NA | NA | 319 |
| TURBIDITY (ntu) | NA | NA | NA | NA | NA | NA | 0 |
| PH (s.u.) | NA | NA | NA | NA | NA | NA | 6.22 |

µg/L- micrograms per liter
mg/L- miligrams per liter

Notes:
1. Cleanup levels are defined in the 2008 Record of Decision (ROD).
2. Shadded and **bolded** values indicate exceedance of appropriate ROD cleanup levels.

**TABLE A-4**
**PFAS SUMMARY DATA TABLE**
**WOD**
**NASA WALLOPS FLIGHT FACILITY**
**WALLOPS ISLAND, VIRGINIA**

| Sample ID | Sample Depth (feet) | Sample Date | PFOA | PFOS | Total PFOA/PFOS | PFBS | PFDA | PFDoA or PFDoDA | PFHpA | PFHxS | PFHxA | PFNA | PFTA or PFTetA | PFTrDA | PFUnA or PFUDA | NEtFOSAA | NMeFOSAA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Groundwater (ng/L)** | | Screening Levels | 6[(1)] | 4[(1)] | NSL | 600[(1)] | NSL | NSL | NSL | 39[(1)] | 990[(1)] | 5.9[(1)] | NSL | NSL | NSL | NSL | NSL |
| 15-MW007-20190410 | 15 - 30 | 4/10/2019 | 1.7 J | 0.74 J | 2.44 | 1.7 J | 0.52 J | 0.52 U | 0.24 U | 8.8 | 2.4 J | 0.55 J | 0.53 U | 1.2 UJ | 1 UJ | 1.8 U | 3 U |
| 15-MW007-20190410-D | | | 0.77 U | 0.49 U | ND | 1.4 J | 0.28 U | 0.5 U | 0.23 U | 8.1 | 2.4 | 0.25 U | 0.26 U | 1.2 U | 1 U | 1.7 U | 2.8 U |
| WOD-MW002D-20190409 | 23 - 28 | 4/9/2010 | 4.9 | **5.8 J** | 10.7 | 0.18 U | 0.28 U | 0.58 J | 5.3 | 3.4 | 3.5 | 3 | 0.7 U | 1.2 U | 1 U | 1.7 U | 2.8 U |
| WOD-MW008-20190409 | 18 - 28 | 4/9/2019 | **11** | **21** | 32 | 0.18 U | 0.27 U | 0.48 U | 8.9 | 4.7 | 5.6 | **6.2** | 0.25 U | 1.1 U | 0.97 U | 1.7 U | 2.7 U |

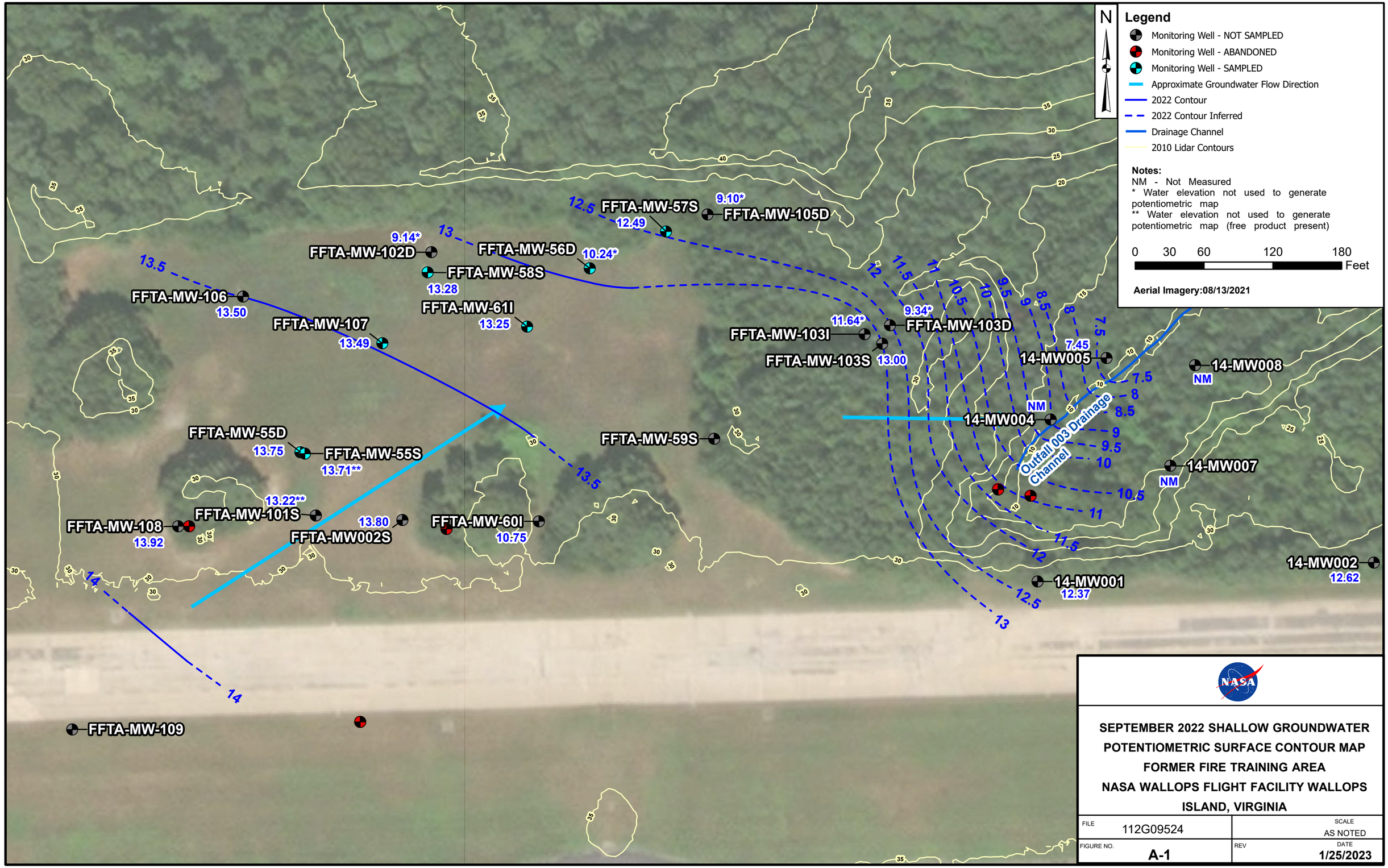
**Notes:**

**Bolded and shaded values indicate an exceedance of the human health screening levels**

1. USEPA RSL (May 2023) for Tapwater and an HQ of 0.1 due to noncancer additive effects.

ng/L - nanograms per liter
-D - duplicate sample
J - estimated value
U - non-detect value
ND - not detected
NSL - no screening level

PFOA - Perfluorooctanoic acid
PFOS - Perfluorooctanesulfonic acid
PFBS - Perfluorobutanesulfonic acid
PFDA - Perfluorodecanoic acid
PFDoA or PFDoDA- Perfluorododecanoic acid
PFHpA - Perfluoroheptanoic acid
PFHxS - Perfluorohexanesulfonic acid
PFHxA - Perfluorohexanoic acid
PFNA - Perfluorononanoic acid
PFTA or PFTetA - Perfluorotetradecanoic acid
PFTrDA - Perfluorotridecanoic acid
PFUnA or PFUDA - Perfluoroundecanoic acid
NEtFOSAA - N-ethyl perfluorooctanesulfonamidoacetic acid
NMeFOSAA - N-methyl perfluorooctanesulfonamidoacetic acid




NASA

**SEPTEMBER 2022 SHALLOW GROUNDWATER POTENTIOMETRIC SURFACE CONTOUR MAP FORMER FIRE TRAINING AREA NASA WALLOPS FLIGHT FACILITY WALLOPS ISLAND, VIRGINIA**

| FILE | SCALE |
|---|---|
| 112G09524 | AS NOTED |
| FIGURE NO. | REV / DATE |
| A-1 | 1/25/2023 |

NOR: G:\GIS_files\NASA WI\MXD\PRO2022\FFTA_LTM\FFTA_LTM_MAS aprx SKS

WOD-MW004-2
Dry
WOD-MW003
Dry
WOD-MW008
3.61
WOD-MW006
2.17
15-MW001
2.54
WOD-MW002S
3.80
WOD-MW002D
3.67
WOD-MW001
Dry
15-MW002
2.81
15-MW007
4.26
15-MW003
3.39
WOD-MW003R
4.58
3.5
3.5
2.5
3
3
4
4.5

N

**Legend**

- Monitoring Well - NOT SAMPLED
- Monitoring Well - SAMPLED
- Elevation (Feet MSL)
- Groundwater Contour
- Surface Water Line

0 75 150 300 Feet

NASA

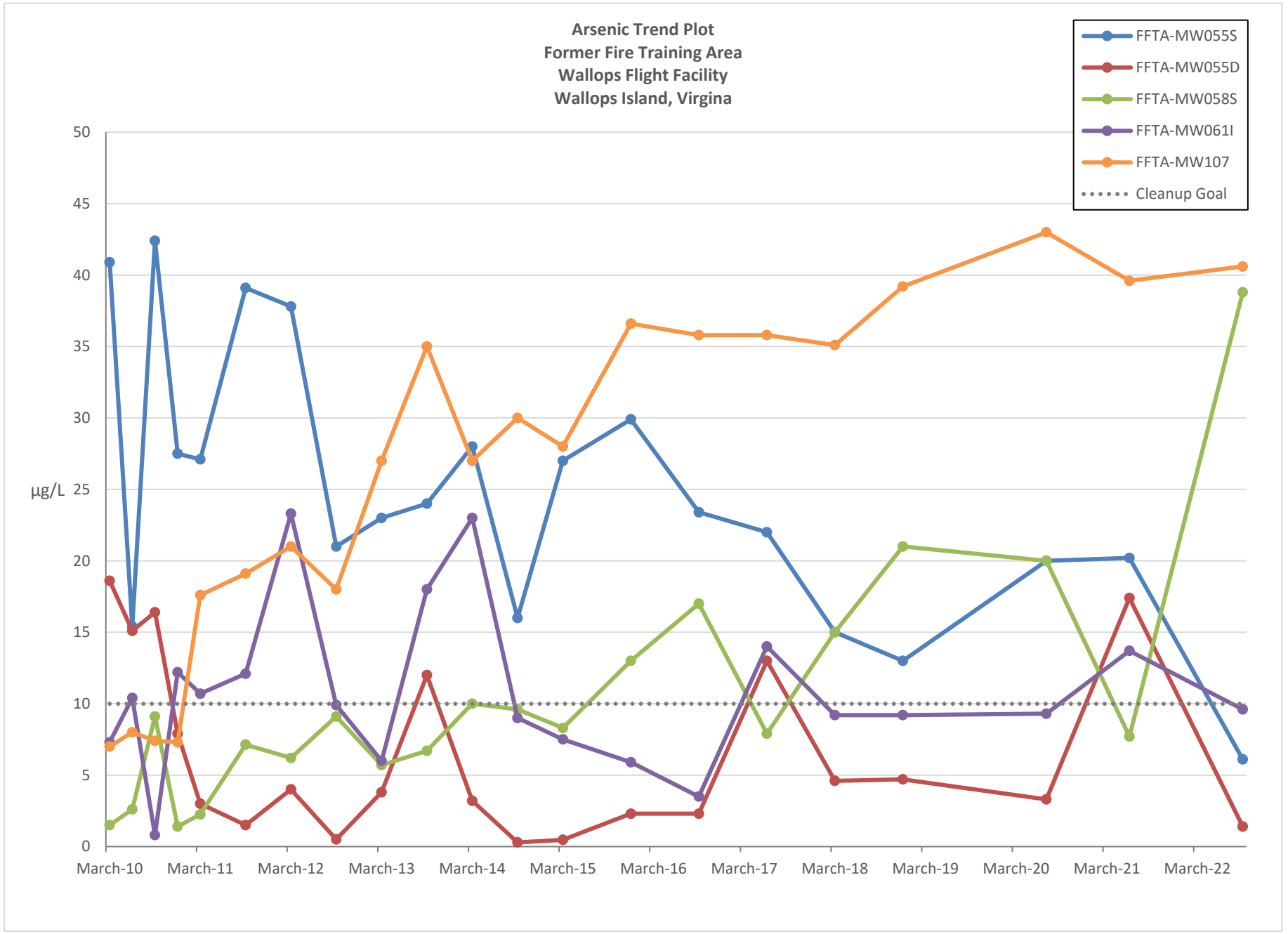
**SEPTEMBER 2022 SHALLOW GROUNDWATER POTENTIOMETRIC SURFACE CONTOUR MAP**
**WASTE OILD DUMP**
**NASA WALLOPS FLIGHT FACILITY WALLOPS ISLAND, VIRGINIA**

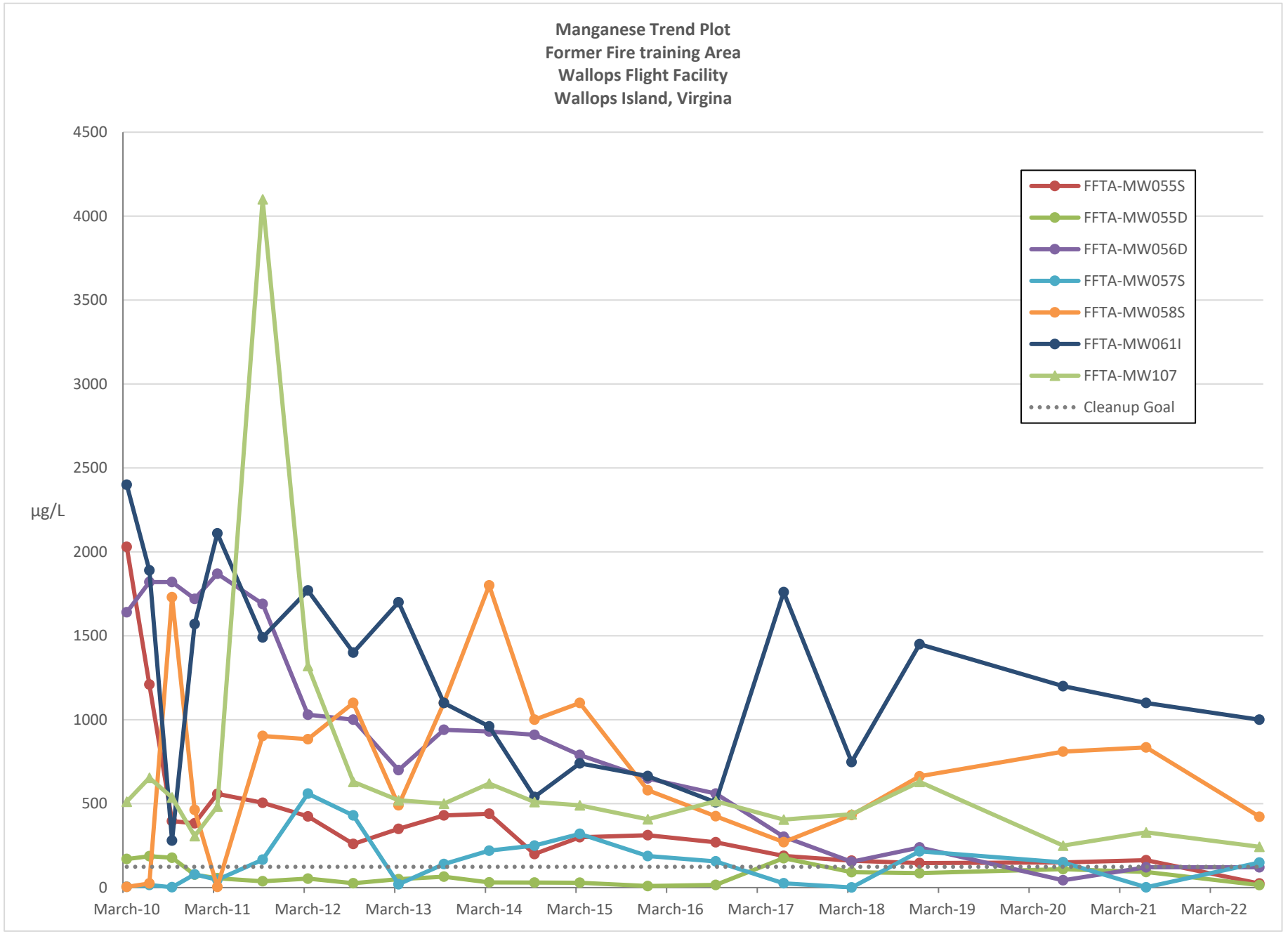
| FILE | SCALE |
|---|---|
| 112G09524 | AS NOTED |
| FIGURE NO. | REV / DATE |
| A-2 | 10/6/2023 |

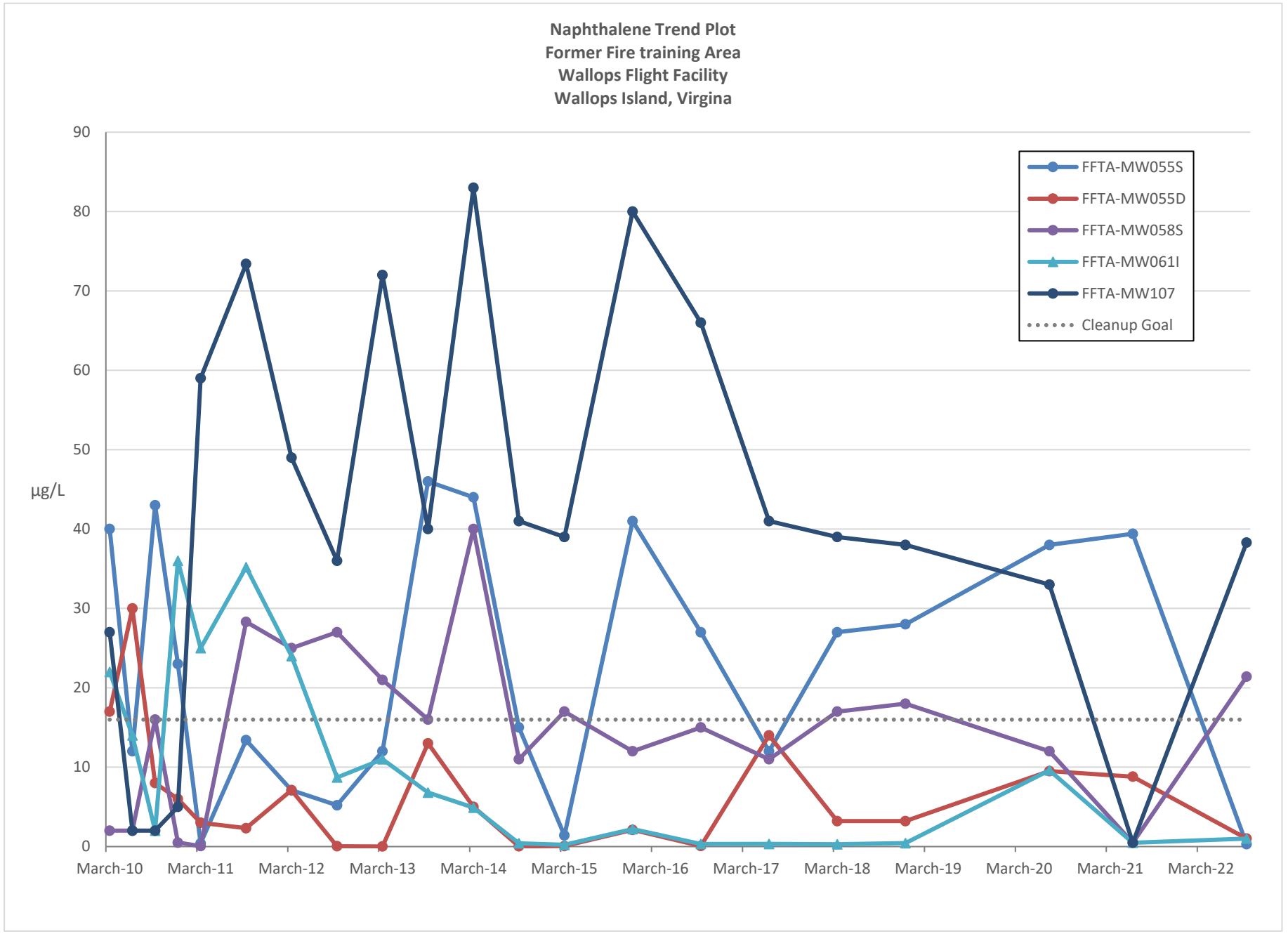
# APPENDIX B

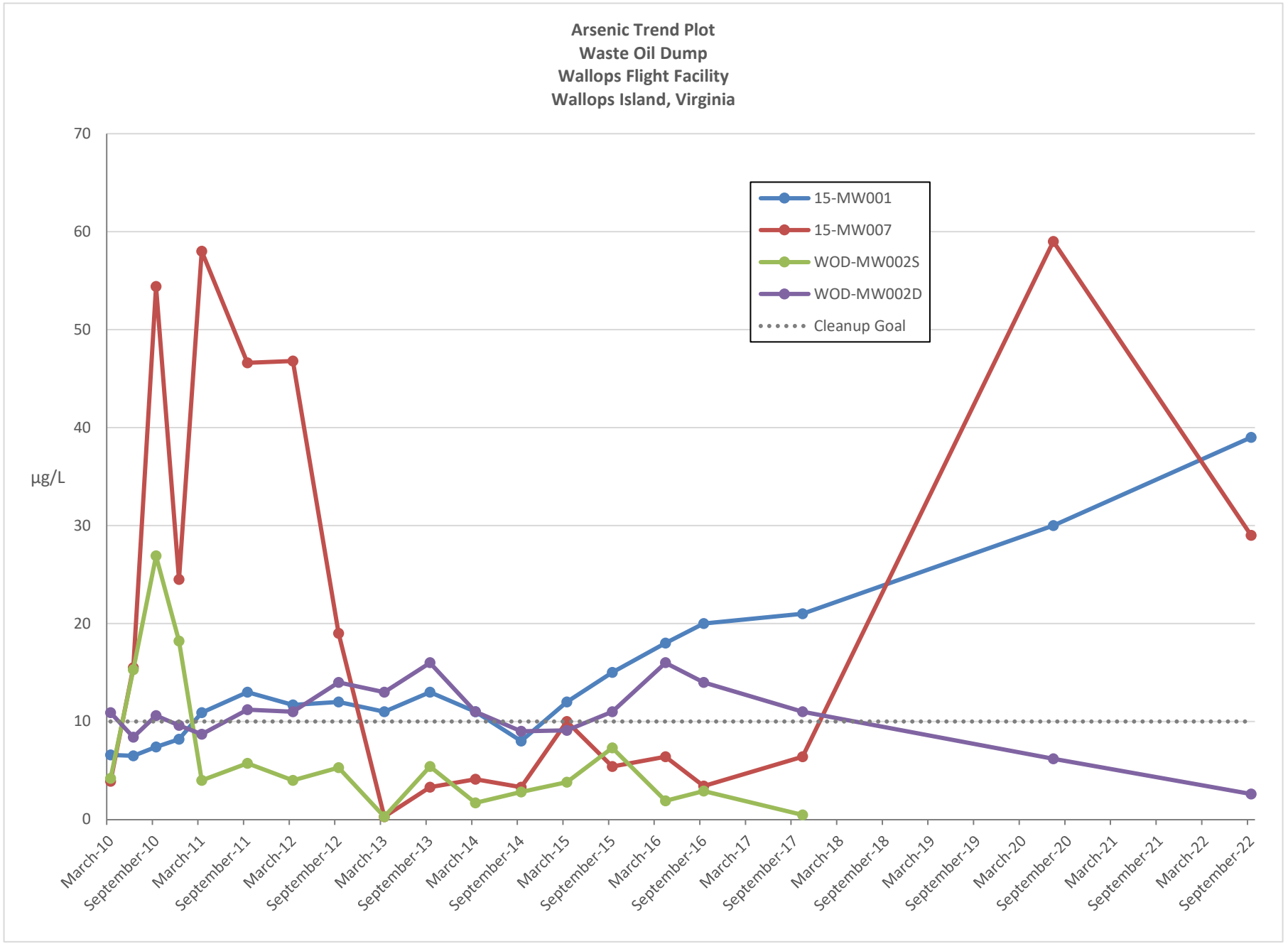
# ANALYTICAL DATA GRAPHS

This page intentionally left blank


Arsenic Trend Plot
Former Fire Training Area
Wallops Flight Facility
Wallops Island, Virgina
FFTA-MW055S
FFTA-MW055D
FFTA-MW058S
FFTA-MW061I
FFTA-MW107
Cleanup Goal
µg/L
50
45
40
35
30
25
20
15
10
5
0
March-10
March-11
March-12
March-13
March-14
March-15
March-16
March-17
March-18
March-19
March-20
March-21
March-22


Manganese Trend Plot
Former Fire training Area
Wallops Flight Facility
Wallops Island, Virgina
µg/L
4500
4000
3500
3000
2500
2000
1500
1000
500
0
March-10
March-11
March-12
March-13
March-14
March-15
March-16
March-17
March-18
March-19
March-20
March-21
March-22
FFTA-MW055S
FFTA-MW055D
FFTA-MW056D
FFTA-MW057S
FFTA-MW058S
FFTA-MW061I
FFTA-MW107
Cleanup Goal


Naphthalene Trend Plot
Former Fire training Area
Wallops Flight Facility
Wallops Island, Virgina
µg/L
90
80
70
60
50
40
30
20
10
0
March-10
March-11
March-12
March-13
March-14
March-15
March-16
March-17
March-18
March-19
March-20
March-21
March-22
FFTA-MW055S
FFTA-MW055D
FFTA-MW058S
FFTA-MW061I
FFTA-MW107
Cleanup Goal


Arsenic Trend Plot
Waste Oil Dump
Wallops Flight Facility
Wallops Island, Virginia
µg/L
70
60
50
40
30
20
10
0
15-MW001
15-MW007
WOD-MW002S
WOD-MW002D
Cleanup Goal
March-10
September-10
March-11
September-11
March-12
September-12
March-13
September-13
March-14
September-14
March-15
September-15
March-16
September-16
March-17
September-17
March-18
September-18
March-19
September-19
March-20
September-20
March-21
September-21
March-22
September-22

# APPENDIX C

# SITE PHOTOGRAPHS

This page intentionally left blank

## FFTA - FIVE-YEAR REVIEW PHOTOGRAPHIC LOG

| Date: | View: | Photographer: |
|---|---|---|
| 5/17/2023 | East | J. Martone (Tetra Tech; contractor for NASA) |

Standing west of monitoring well FFTA-MW106 looking across the site. Several other FFTA monitoring wells are visible in the distance.

| Date: | View: | Photographer: |
|---|---|---|
| 5/17/2023 | Southwest | J. Martone (Tetra Tech; contractor for NASA) |

Standing adjacent to FFTA-MW102D looking across the site back towards the abandoned taxiway. Several other FFTA monitoring well are visible in the distance.

## FFTA - FIVE-YEAR REVIEW PHOTOGRAPHIC LOG

| Date: | View: | Photographer: |
|---|---|---|
| 5/17/2023 | Northeast | J. Martone (Tetra Tech; contractor for NASA) |

Standing near FFTA-MW105D. The brush has encroached on FFTA-MW105D and needs to be cleared/cut back.

| Date: | View: | Photographer: |
|---|---|---|
| 5/17/2023 | Northeast | J. Martone (Tetra Tech; contractor for NASA) |

View of the FFTA-MW103 monitoring well cluster.

## FFTA - FIVE-YEAR REVIEW PHOTOGRAPHIC LOG

| **Date:** | **View:** | **Photographer:** |
|---|---|---|
| 5/17/2023 | Northwest | J. Martone (Tetra Tech; contractor for NASA) |

Standing southeast of FFTA-MW059S looking across site. Several FFTA monitoring wells are visible in the distance.


| Date: | View: | Photographer: |
|---|---|---|
| 5/17/2023 | NA | J. Martone (Tetra Tech; contractor for NASA) |

View of FFTA-MW056D. The well is in good condition other than some rust.

## FFTA - FIVE-YEAR REVIEW PHOTOGRAPHIC LOG

| Date: | View: | Photographer: |
|---|---|---|
| 5/17/2023 | South | J. Martone (Tetra Tech; contractor for NASA) |

Stairway to access to the two monitoring wells (14-MW004 and 14-MW005) by the creek on the east side of FFTA. A PFAS treatability study system associated with Seep003 is also located in this area.

| Date: | View: | Photographer: |
|---|---|---|
| 5/17/2023 | North | J. Martone (Tetra Tech; contractor for NASA) |

View of creek on the east side of FFTA near well 14-MW005.

## FFTA - FIVE-YEAR REVIEW PHOTOGRAPHIC LOG

| Date: | View: | Photographer: |
|---|---|---|
| 5/17/23 | NA | J. Martone (Tetra Tech; contractor for NASA) |

View of FFTA-MW109. Flush mount completion in grass on south side of abandoned taxiway.

| Date: | View: | Photographer: |
|---|---|---|
| 5/17/23 | NA | J. Martone (Tetra Tech; contractor for NASA) |

View of FFTA-MW055S and FFTA-MW055D. Other than some rust the well are in good condition.

## FFTA - FIVE-YEAR REVIEW PHOTOGRAPHIC LOG


| Date: | View: | Photographer: |
|---|---|---|
| 5/17/23 | NA | J. Martone (Tetra Tech; contractor for NASA) |

View of FFTA-MW101S. The protective casing's cap has rusted through and needs replaced.


| Date: | View: | Photographer: |
|---|---|---|
| 5/17/23 | NA | J. Martone (Tetra Tech; contractor for NASA) |

View of 14-MW005. There is no protective casing installed for this well due to the location.

## FFTA - FIVE-YEAR REVIEW PHOTOGRAPHIC LOG

| Date: | View: | Photographer: |
|---|---|---|
| 5/17/23 | NA | J. Martone (Tetra Tech; contractor for NASA) |

View of 14-MW001. The protective casing's cap has rusted, is no longer attached to well casing, and needs replaced. Brush has encroached on 14-MW001 and needs to be cleared/cut back.

| Date: | View: | Photographer: |
|---|---|---|
| 5/17/23 | NA | J. Martone (Tetra Tech; contractor for NASA) |

View of path to near 14-MW004 and 14-MW005. Several trees have fallen over and may need to be cleared in the future.

## WOD - FIVE-YEAR REVIEW PHOTOGRAPHIC LOG

| Date: | View: | Photographer: |
|---|---|---|
| 5/17/2023 | Northeast | J. Martone (Tetra Tech; contractor for NASA) |

Standing near WOD-MW003R looking across the site.

| Date: | View: | Photographer: |
|---|---|---|
| 5/17/2023 | NA | J. Martone (Tetra Tech; contractor for NASA) |

View of WOD-MW003R. The protective casing's cap has rusted through and needs replaced.

## WOD - FIVE-YEAR REVIEW PHOTOGRAPHIC LOG

| Date: | View: | Photographer: |
|---|---|---|
| 5/17/2023 | Northwest | J. Martone (Tetra Tech; contractor for NASA) |

Standing next to 15-MW007 looking at brushy fringe. The brush has encroached on 15-MW007 and needs to be cleared/cut back.

| Date: | View: | Photographer: |
|---|---|---|
| 5/17/2023 | South | J. Martone (Tetra Tech; contractor for NASA) |

Standing along dirt access back towards Runway 17-35 and Hot Pad area. The former asphalt/cement plant which used to be located on the north side of the runway was removed.

## WOD - FIVE-YEAR REVIEW PHOTOGRAPHIC LOG

| Date: | View: | Photographer: |
|---|---|---|
| 5/17/2023 | North | J. Martone (Tetra Tech; contractor for NASA) |

Standing along dirt access road that leads to perimeter gate (Gate 11).

| Date: | View: | Photographer: |
|---|---|---|
| 5/17/2023 | East | J. Martone (Tetra Tech; contractor for NASA) |

Standing along dirt access road looking at WOD-MW002S and WOD-MW002D and perimeter fence.

## WOD - FIVE-YEAR REVIEW PHOTOGRAPHIC LOG

| Date: | View: | Photographer: |
|---|---|---|
| 5/17/23 | Northwest | J. Martone (Tetra Tech; contractor for NASA) |

View of WOD-MW008. Other than some rust the well appeared to be in good condition. Picture depicts typical rusty conditions of most of the wells in the area.

| Date: | View: | Photographer: |
|---|---|---|
| 5/17/2023 | North | J. Martone (Tetra Tech; contractor for NASA) |

View of the dirt access road and facility perimeter gate (Gate 11).

## WOD - FIVE-YEAR REVIEW PHOTOGRAPHIC LOG

| Date: | View: | Photographer: |
|---|---|---|
| 5/17/2023 | North | J. Martone (Tetra Tech; contractor for NASA) |

Standing in woods near 15-MW002 looking at the drop off towards the creek. No unusual erosion was noted.

| Date: | View: | Photographer: |
|---|---|---|
| 5/17/2023 | NA | J. Martone (Tetra Tech; contractor for NASA) |

View of 15-MW002. Well Identification has faded/worn off and there is no protective casing due to the location of the well.

## WOD - FIVE-YEAR REVIEW PHOTOGRAPHIC LOG

| Date: | View: | Photographer: |
|---|---|---|
| 5/17/2023 | East | J. Martone (Tetra Tech; contractor for NASA) |

Standing next to Gate 11 looking down the facility perimeter fence from inside the facility.

| Date: | View: | Photographer: |
|---|---|---|
| 5/17/23 | West | J. Martone (Tetra Tech; contractor for NASA) |

Looking down the facility perimeter fence towards Gate 11 from outside the facility.

## WOD - FIVE-YEAR REVIEW PHOTOGRAPHIC LOG

| Date: | View: | Photographer: |
|---|---|---|
| 5/17/23 | North | J. Martone (Tetra Tech; contractor for NASA) |

View of WOD-MW006. The brush has encroached on WOD-MW006 and needs to be cleared/cut back.

# APPENDIX D

# SITE INSPECTIONS AND INTERVIEWS

This page intentionally left blank

# Site Inspection Checklist

| I. SITE INFORMATION | |
|---|---|
| **Site name:** NASA Wallops Flight Facility (WFF) Former Fire Training Area (FFTA) | **Date of inspection:** May 17, 2023 |
| **Location and Region:** Wallops Island, Virginia EPA Region 3 | **EPA ID:** VA8800010763 |
| **Agency, office, or company leading the five-year review:** NASA | **Weather/temperature:** Partly Cloudy / 74°F |

**Remedy Includes**: (Check all that apply):

- ☐ Landfill cover/containment
- ☐ Access controls
- ☒ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☒ Other - In-Situ Biological Treatment
- ☒ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

**Attachments:** ☒ Photo Log ☐ Site map attached

**II. INTERVIEWS** (Check all that apply):

1. **O&M site manager**: David Liu (Name) NASA Project Coordinator (Title) [Questionnaire] (Date)
   Interviewed ☐ at site ☐ at office ☒ by phone/email Phone No.: (757) 824-2141
   Email: david.liu-1@nasa.gov
   Problems, suggestions; ☒ Report attached - [See Five-Year Review Interview Questionnaire]

2. **O&M staff:** N/A (Name) (Title) (Date)
   Interviewed ☐ at site ☐ at office ☐ by phone/email Phone No.:
   Problems, suggestions; ☐ Report attached -

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply:

   Agency: U.S. Environmental Protection Agency (EPA)
   Contact: Lorie Baker (Name) Project Manager (Title) [Questionnaire] (Date) (215) 814-3355 (Phone No.:)
   Email: Baker.Lori@epa.gov
   Problems; suggestions; ☒ Report attached - [See Five-Year Review Interview Questionnaire]

   Agency: Virginia Department of Environmental Quality (VDEQ)
   Contact: Michelle Payne (Name) Project Manager (Title) [Questionnaire] (Date) (804) 698-4014 (Phone No.:)
   Email: Michelle.Payne@deq.virginia.gov
   Problems; suggestions; ☒ Report attached - [See Five-Year Review Interview Questionnaire]

4. **Other interviews** (optional) ☐ Report attached.

| III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply): | | | | |
|---|---|---|---|---|
| 1. | **O&M Documents** | | | |
| | ☐ O&M manual | ☐ Readily available | ☒ Up to date | ☐ N/A |
| | ☐ As-built drawings | ☐ Readily available | ☐ Up to date | ☒ N/A |
| | ☐ Maintenance logs | ☐ Readily available | ☐ Up to date | ☒ N/A |
| | Remarks: Long-Term Monitoring Plan for groundwater and LUC Remedial Design available. | | | |
| 2. | **Site-Specific Health and Safety Plan** | ☐ Readily available | ☒ Up to date | ☐ N/A |
| | ☐ Contingency plan/emergency response plan | ☐ Readily available | ☐ Up to date | ☒ N/A |
| | Remarks: | | | |
| 3. | **O&M and OSHA Training Records** | ☐ Readily available | ☐ Up to date | ☒ N/A |
| | Remarks: | | | |
| 4. | **Permits and Service Agreements** | | | |
| | ☐ Air discharge permit | ☐ Readily available | ☐ Up to date | ☒ N/A |
| | ☐ Effluent discharge | ☐ Readily available | ☐ Up to date | ☒ N/A |
| | ☐ Waste disposal, POTW | ☒ Readily available | ☐ Up to date | ☒ N/A |
| | ☐ Other permits - | ☐ Readily available | ☐ Up to date | ☒ N/A |
| | Remarks: | | | |
| 5. | **Gas Generation Records** | ☐ Readily available | ☐ Up to date | ☒ N/A |
| | Remarks: | | | |
| 6. | **Settlement Monument Records** | ☐ Readily available | ☐ Up to date | ☒ N/A |
| | Remarks: | | | |
| 7. | **Groundwater Monitoring Records** | ☒ Readily available | ☒ Up to date | ☐ N/A |
| | Remarks: Provided to regulators upon issue and maintained by NASA. | | | |
| 8. | **Leachate Extraction Records** | ☐ Readily available | ☐ Up to date | ☒ N/A |
| | Remarks: | | | |
| 9. | **Discharge Compliance Records** | | | |
| | ☐ Air | ☐ Readily available | ☐ Up to date | ☒ N/A |
| | ☐ Water (effluent) | ☐ Readily available | ☐ Up to date | ☒ N/A |
| | Remarks: | | | |
| 10. | **Daily Access/Security Logs** | ☐ Readily available | ☐ Up to date | ☒ N/A |
| | Remarks: | | | |

## IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☒ Federal Facility in-house ☒ Contractor for Federal Facility
☐ Other –

2. **O&M Cost Records**

☐ Readily available ☐ Up to date ☒ N/A
☐ Funding mechanism/agreement in place
Original O&M cost estimate: ☐ Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**
Describe costs and reasons: None. Typical monitoring well maintenance and vegetation clearing for access to wells.

## V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

### A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured ☒ N/A
Remarks: No fencing specific to site. Overall facility boundary is fenced.

### B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☒ N/A
Remarks: Site is located within the controlled federal property of NASA WFF; facility and site access are restricted and controlled.

**C. Institutional Controls (ICs)**

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs not being fully enforced ☐ Yes ☒ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by): Drive by / Site walk with self-reporting.
Annual inspections: Inspected during each groundwater monitoring event
Responsible party/agency: NASW WFF prime [on-site] contractor. Bluestone Environmental.
Contact: Susan Dunn Environmental Scientist 05/17/2023 (757) 824-1832
Name Title Date Phone No.:

Reporting is up-to-date ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency ☒ Yes ☐ No ☐ N/A

Specific requirements indeed or decision documents have been met ☐ Yes ☐ No ☒ N/A

Violations have been reported ☐ Yes ☐ No ☒ N/A

Other problems or suggestions: ☐ Report attached -

2. **Adequacy** ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks: Site is located within the controlled federal property of NASA WFF; facility and site access are restricted. Groundwater at the site is not used or accessed, other than for environmental monitoring.

**D. General**

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident

Remarks:

2. **Land use changes on site** ☐ N/A

Remarks: Land use has not changed since the last FYR event on July 10, 2018.

3. **Land use changes off site** ☐ N/A

Remarks: None observed or reported

## VI. GENERAL SITE CONDITIONS

**A. Roads** ☐ Applicable ☒ N/A

1. **Roads damaged** ☐ Location shown on site map ☐ Roads adequate ☒ N/A

Remarks: No roads present at FFTA. An abandoned taxiway runs adjacent to the FFTA area but is maintained by the facility.

**B. Other Site Conditions**

Remarks: The stairway down to 14-MW004 and 14-MW005 is in fair condition. Vegetation observed encroaching FFTA area wells 14-MW001, 14-MW002, and FFTA-MW105D. Vegetation should be cleared/trimmed back prior to future inspection and/or sampling events.

## VII. LANDFILL COVERS ☐ Applicable ☒ N/A

### A. Landfill Surface

1. **Settlement - (Low spots)** ☐ Location shown on site map ☐ Settlement not evident
   Areal extent: Depth:
   Remarks: N/A

2. **Cracks** ☐ Location shown on site map ☐ Cracking not evident
   Lengths: Widths: Depths:
   Remarks: N/A

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent: Depth:
   Remarks: N/A

4. **Holes** ☐ Location shown on site map ☐ Holes not evident
   Areal extent: Depth:
   Remarks: N/A

5. **Vegetative Cover** ☐ Grass ☐ Cover properly established ☐ No signs of stress
   ☐ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks: N/A

6. **Alternative Cover (armored rock, concrete, etc.)** ☐ N/A
   Remarks: N/A

7. **Bulges** ☐ Location shown on site map ☐ Bulges not evident
   Areal extent: Height:
   Remarks: N/A

8. **Wet Areas/Water Damage** ☐ Wet areas/water damage not evident
   ☐ Wet areas ☐ Location shown on site map Areal extent:
   ☐ Ponding ☐ Location shown on site map Areal extent:
   ☐ Seeps ☐ Location shown on site map Areal extent:
   ☐ Soft subgrade ☐ Location shown on site map Areal extent:
   Remarks: N/A

9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability
   Areal extent:
   Remarks: N/A

### B. Benches ☐ Applicable ☒ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☒ N/A or okay
   Remarks:

2. **Bench Breached** ☐ Location shown on site map ☒ N/A or okay
Remarks:

3. **Bench Overtopped** ☐ Location shown on site map ☒ N/A or okay
Remarks:

**C. Letdown Channels** ☐ Applicable ☒ N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement
Areal extent: Depth:
Remarks: N/A

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
Material type: Areal extent:
Remarks: N/A

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion
Areal extent: Depth:
Remarks: N/A

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent: Depth:
Remarks: N/A

5. **Obstructions** Type: ☐ No obstructions
☐ Location shown on site map Areal extent: Size:
Remarks: N/A

6. **Excessive Vegetative Growth** Type:
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent:
Remarks: N/A

**D. Cover Penetrations** ☐ Applicable ☒ N/A

1. **Gas Vents** ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☒ N/A
Remarks:

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☒ N/A
Remarks:

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☒ N/A
Remarks:

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☒ N/A
Remarks:

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☒ N/A
Remarks:

**E. Gas Collection and Treatment** ☐ Applicable ☒ N/A

1. **Gas Treatment Facilities**
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs Maintenance
Remarks: N/A

2. **Gas Collection Wells, Manifolds and Piping**
☐ Good condition ☐ Needs Maintenance
Remarks: N/A

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
☐ Good condition ☐ Needs Maintenance ☒ N/A
Remarks:

**F. Cover Drainage Layer** ☐ Applicable ☒ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☒ N/A
Remarks:

2. **Outlet Rock Inspected** ☐ Functioning ☒ N/A
Remarks:

**G. Detention/Sedimentation Ponds** ☐ Applicable ☒ N/A

1. **Siltation** Areal extent: Depth: ☒ N/A
☐ Siltation not evident
Remark

2. **Erosion** Areal extent: Depth:
☒ Erosion not evident
Remarks:

3. **Outlet Works** ☐ Functioning ☒ N/A
Remarks:

4. **Dam** ☐ Functioning ☒ N/A
Remarks:

**H. Retaining Walls** ☐ Applicable ☒ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement: Vertical displacement:
Rotational displacement:
Remarks: N/A

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
Remarks: N/A

**I. Perimeter Ditches/Off-Site Discharge** ☐ Applicable ☒ N/A

1. **Siltation** ☐ Location shown on site map ☐ Siltation not evident
Areal extent: Depth:
Remarks: N/A

2. **Vegetative Growth** ☐ Location shown on site map ☒ N/A
☐ Vegetation does not impede flow
Areal extent: Type:
Remarks: N/A

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
Areal extent: Depth:
Remarks: N/A

4. **Discharge Structure** ☐ Functioning ☒ N/A
Remarks:

**VIII. VERTICAL BARRIER WALLS** ☐ Applicable ☒ N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
Areal extent: Depth:
Remarks: N/A

2. **Performance Monitoring**
Type of monitoring: ☐ Performance not monitored
Frequency: ☐ Evidence of breaching
Head differential:
Remarks: N/A

**IX. GROUNDWATER/SURFACE WATER REMEDIES** ☒ Applicable ☐ N/A

**A. Groundwater Extraction Wells, Pumps, and Pipelines** ☐ Applicable ☒ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
☐ Good condition ☐ All required wells properly operating ☐ Needs Maintenance ☒ N/A
Remarks:

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition ☐ Needs Maintenance
Remarks: N/A

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks: N/A

**B. Surface Water Collection Structures, Pumps, and Pipelines** ☐ Applicable ☒ N/A

1. **Collection Structures, Pumps, and Electrical**
☐ Good condition ☐ Needs Maintenance
Remarks: N/A

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition ☐ Needs Maintenance
Remarks: N/A

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks: N/A

**C. Treatment System** ☐ Applicable ☒ N/A

1. **Treatment Train** (Check components that apply)
☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters -
☐ Additive (*e.g.*, chelation agent, flocculent) -
☐ Others -
☐ Good condition ☐ Needs Maintenance
☐ Sampling ports properly marked and functional
☐ Sampling/maintenance log displayed and up to date
☐ Equipment properly identified
☐ Quantity of groundwater treated annually -
☐ Quantity of surface water treated annually -
Remarks: N/A

2. **Electrical Enclosures and Panels** (properly rated and functional)
☒ N/A ☐ Good condition ☐ Needs Maintenance
Remarks:

3. **Tanks, Vaults, Storage Vessels**
☒ N/A ☐ Good condition ☐ Proper secondary containment ☐ Needs Maintenance
Remarks:

4. **Discharge Structure and Appurtenances**
☒ N/A ☐ Good condition ☐ Needs Maintenance
Remarks:

5. **Treatment Building(s)**

☒ N/A ☐ Good condition (esp. roof and doorways) ☐ Needs repair

☐ Chemicals and equipment properly stored

Remarks:

6. **Monitoring Wells** (pump and treatment remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ All required wells located ☐ Needs Maintenance ☒ N/A

Remarks:

**D. Monitoring Data**

1. Monitoring Data

☒ Is routinely submitted on time ☒ Is of acceptable quality

2. Monitoring data suggests:

☒ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

Arsenic, manganese, and naphthalene COCs are not declining in all wells.

**E. Monitored Natural Attenuation**

1. **Monitoring Wells** (natural attenuation remedy)

☒ Properly secured/locked ☐ Functioning ☒ Routinely sampled ☒ Good condition

☒ All required wells located ☒ Needs Maintenance ☐ N/A

Remarks: All required FFTA area wells found and accessed. Wells are in good condition with exception of having rusty well casings. Well casing maintenance (i.e., painting) will be required in the future. FFTA-MW101S and 14-MW001 casing lids deteriorated, rusty, and should be replaced. 14-MW002 casing lid is missing and well is missing a well plug. FFTA-MW060I well casing has been taken over by ant colony they should be removed.

**X. OTHER REMEDIES**

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

N/A

## XI. OVERALL OBSERVATIONS

### A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

The selected remedy at FFTA is in situ biological treatment (biostimulation), institutional controls, and monitoring. The remedy is intended to reduce COC concentrations in the contaminant plume, and to prevent exposure until cleanup levels are met. The in situ biological treatment component was accomplished with a pilot study. The biostimulation substrate successfully reduced the concentration of most organics in the plume area sufficiently such that EPA and VDEQ concurred full in situ implementation of the biostimulation component of the remedy was not necessary. Groundwater monitoring and institutional controls will continue until cleanup levels are met for all COCs.

Compared to the site conditions prior to the biostimulation injection in 2009, the maximum concentrations of benzene, 4-methyphenol, naphthalene, and manganese have decreased and the contaminant plumes have decreased in size. Only arsenic, manganese, and naphthalene exceed cleanup goals. Arsenic and manganese seem to be stable both in concentration and areal extent.

### B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

No issues. LTM Program is evaluated and updated regularly by NASA and the regulators based on LTM data.

### C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

No issues or observations suggest the remedy protectiveness will be compromised.

### D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

As discussed in LTM evaluation reports and determined by NASA with regulator concurrence, some monitoring wells and/or analytes were removed from the LTM program since cleanup levels were reached. No further optimization opportunities identified.

# Site Inspection Checklist

## I. SITE INFORMATION

| | |
|---|---|
| **Site name:** NASA Wallops Flight Facility (WFF) Waste Oil Dump (WOD) | **Date of inspection:** May 17, 2023 |
| **Location and Region:** Wallops Island, Virginia EPA Region 3 | **EPA ID:** VA8800010763 |
| **Agency, office, or company leading the five-year review:** NASA | **Weather/temperature:** Partly Cloudy / 74°F |

**Remedy Includes**: (Check all that apply):

- ☐ Landfill cover/containment
- ☐ Access controls
- ☒ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☒ Other - In-Situ Biological Treatment
- ☒ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

**Attachments:** ☒ Photo Log ☐ Site map attached

## II. INTERVIEWS (Check all that apply):

1. **O&M site manager**: David Liu (Name) NASA Project Coordinator (Title) [Questionnaire] (Date)
   Interviewed ☐ at site ☐ at office ☒ by phone/email Phone No.: (757) 824-2141
   Email: david.liu-1@nasa.gov
   Problems, suggestions; ☒ Report attached - [See Five-Year Review Interview Questionnaire]

2. **O&M staff**: N/A (Name) (Title) (Date)
   Interviewed ☐ at site ☐ at office ☐ by phone/email Phone No.:
   Problems, suggestions; ☐ Report attached -

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.). Fill in all that apply:

   Agency: U.S. Environmental Protection Agency (EPA)
   Contact: Lorie Baker (Name) Project Manager (Title) [Questionnaire] (Date) (215) 814-3355 (Phone No.:)
   Email: Baker.Lori@epa.gov
   Problems; suggestions; ☒ Report attached - [See Five-Year Review Interview Questionnaire]

   Agency: Virginia Department of Environmental Quality (VDEQ)
   Contact: Kyle Newman (Name) Project Manager (Title) [Questionnaire] (Date) (804) 659-1322 (Phone No.:)
   Email: kyle.newman@deq.virginia.gov
   Problems; suggestions; ☒ Report attached - [See Five-Year Review Interview Questionnaire]

4. **Other interviews** (optional) ☐ Report attached -

| III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply): | | | | |
|---|---|---|---|---|
| 1. | **O&M Documents** | | | |
| | ☒ O&M manual | ☐ Readily available | ☒ Up to date | ☐ N/A |
| | ☐ As-built drawings | ☐ Readily available | ☐ Up to date | ☒ N/A |
| | ☐ Maintenance logs | ☐ Readily available | ☐ Up to date | ☒ N/A |
| | Remarks: Long-Term Monitoring Plan for groundwater and LUC Remedial Design available. | | | |
| 2. | **Site-Specific Health and Safety Plan** | ☐ Readily available | ☒ Up to date | ☐ N/A |
| | ☐ Contingency plan/emergency response plan | ☐ Readily available | ☐ Up to date | ☒ N/A |
| | Remarks: | | | |
| 3. | **O&M and OSHA Training Records** | ☐ Readily available | ☐ Up to date | ☒ N/A |
| | Remarks: | | | |
| 4. | **Permits and Service Agreements** | | | |
| | ☐ Air discharge permit | ☐ Readily available | ☐ Up to date | ☒ N/A |
| | ☐ Effluent discharge | ☐ Readily available | ☐ Up to date | ☒ N/A |
| | ☐ Waste disposal, POTW | ☒ Readily available | ☐ Up to date | ☒ N/A |
| | ☐ Other permits - | ☐ Readily available | ☐ Up to date | ☒ N/A |
| | Remarks: | | | |
| 5. | **Gas Generation Records** | ☐ Readily available | ☐ Up to date | ☒ N/A |
| | Remarks: | | | |
| 6. | **Settlement Monument Records** | ☐ Readily available | ☐ Up to date | ☒ N/A |
| | Remarks: | | | |
| 7. | **Groundwater Monitoring Records** | ☒ Readily available | ☒ Up to date | ☐ N/A |
| | Remarks: Provided to regulators upon issue and maintained by NASA. | | | |
| 8. | **Leachate Extraction Records** | ☐ Readily available | ☐ Up to date | ☒ N/A |
| | Remarks: | | | |
| 9. | **Discharge Compliance Records** | | | |
| | ☐ Air | ☐ Readily available | ☐ Up to date | ☒ N/A |
| | ☐ Water (effluent) | ☐ Readily available | ☐ Up to date | ☒ N/A |
| | Remarks: | | | |
| 10. | **Daily Access/Security Logs** | ☐ Readily available | ☐ Up to date | ☒ N/A |
| | Remarks: | | | |

## IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☒ Federal Facility in-house ☒ Contractor for Federal Facility
☐ Other -

2. **O&M Cost Records**

☐ Readily available ☐ Up to date ☒ N/A
☐ Funding mechanism/agreement in place
Original O&M cost estimate - ☐ Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**
Describe costs and reasons: None. Typical monitoring well maintenance and vegetation clearing for access to wells.

## V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

### A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured ☒ N/A
Remarks: No fencing specific to site. Facility boundary is fenced.

### B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☒ N/A
Remarks: Site is located within the controlled federal property of NASA WFF; facility and site access are restricted and controlled.

**C. Institutional Controls (ICs)**

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs not being fully enforced ☐ Yes ☒ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by): Drive by / Site walk with self-reporting.
Annual inspections: Inspected during each groundwater monitoring event
Responsible party/agency: NASW WFF prime [on-site] contractor, Bluestone Environmental Group.
Contact: Susan Dunn Environmental Scientist 05/17/2023 (757) 824-1832
Name Title Date Phone No.:

Reporting is up-to-date ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency ☒ Yes ☐ No ☐ N/A

Specific requirements indeed or decision documents have been met ☐ Yes ☐ No ☒ N/A

Violations have been reported ☐ Yes ☐ No ☒ N/A

Other problems or suggestions: ☐ Report attached -

2. **Adequacy** ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks: Site is located within the controlled federal property of NASA WFF; facility and site access are restricted. Groundwater at the site is not used or accessed, other than for environmental monitoring.

**D. General**

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident

Remarks:

2. **Land use changes on site** ☐ N/A

Remarks: Land use has not changed since the last FYR event on July 10, 2018.

3. **Land use changes off site** ☐ N/A

Remarks: None observed or reported

## VI. GENERAL SITE CONDITIONS

**A. Roads** ☐ Applicable ☒ N/A

1. **Roads damaged** ☐ Location shown on site map ☐ Roads adequate ☒ N/A

Remarks: No paved roads present at WOD. Runway 17-35 is adjacent but is maintained by the facility. A dirt road is present at WOD that leads to a facility perimeter gate (Gate 11). The road was observed to be in good condition.

**B. Other Site Conditions**

Remarks: Vegetation observed encroaching WOD area wells 15-MW007, WOD-MW003, and WOD-MW006. Vegetation should be cleared/trimmed back prior to future inspection and/or sampling events.

## VII. LANDFILL COVERS ☐ Applicable ☒ N/A

### A. Landfill Surface

1. **Settlement - (Low spots)** ☐ Location shown on site map ☐ Settlement not evident
   Areal extent: Depth:
   Remarks: N/A

2. **Cracks** ☐ Location shown on site map ☐ Cracking not evident
   Lengths: Widths: Depths:
   Remarks: N/A

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent: Depth:
   Remarks: N/A

4. **Holes** ☐ Location shown on site map ☐ Holes not evident
   Areal extent: Depth:
   Remarks: N/A

5. **Vegetative Cover** ☐ Grass ☐ Cover properly established ☐ No signs of stress
   ☐ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks: N/A

6. **Alternative Cover (armored rock, concrete, etc.)** ☒ N/A
   Remarks: N/A

7. **Bulges** ☐ Location shown on site map ☐ Bulges not evident
   Areal extent: Height:
   Remarks: N/A

8. **Wet Areas/Water Damage** ☐ Wet areas/water damage not evident
   ☐ Wet areas ☐ Location shown on site map Areal extent:
   ☐ Ponding ☐ Location shown on site map Areal extent:
   ☐ Seeps ☐ Location shown on site map Areal extent:
   ☐ Soft subgrade ☐ Location shown on site map Areal extent:
   Remarks: N/A

9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability
   Areal extent:
   Remarks: N/A

### B. Benches ☐ Applicable ☒ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☒ N/A or okay
   Remarks:

2. **Bench Breached** ☐ Location shown on site map ☒ N/A or okay
Remarks:

3. **Bench Overtopped** ☐ Location shown on site map ☒ N/A or okay
Remarks:

**C. Letdown Channels** ☐ Applicable ☒ N/A
(Channel lined with erosion control mats, riprap, grout bags, and/or gabions that descend down the steep side slope of the cover and allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement
Areal extent: Depth:
Remarks: N/A

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
Material type: Areal extent:
Remarks: N/A

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion
Areal extent: Depth:
Remarks: N/A

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent: Depth:
Remarks: N/A

5. **Obstructions** Type: ☐ No obstructions
☐ Location shown on site map Areal extent: Size:
Remarks: N/A

6. **Excessive Vegetative Growth** Type:
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent:
Remarks: N/A

**D. Cover Penetrations** ☐ Applicable ☒ N/A

1. **Gas Vents** ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☒ N/A
Remarks:

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☒ N/A
Remarks:

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☒ N/A
Remarks:

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☒ N/A
Remarks:

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☒ N/A
Remarks:

**E. Gas Collection and Treatment** ☐ Applicable ☒ N/A

1. **Gas Treatment Facilities**
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs Maintenance
Remarks: N/A

2. **Gas Collection Wells, Manifolds and Piping**
☐ Good condition ☐ Needs Maintenance
Remarks: N/A

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
☐ Good condition ☐ Needs Maintenance ☒ N/A
Remarks:

**F. Cover Drainage Layer** ☐ Applicable ☒ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☒ N/A
Remarks:

2. **Outlet Rock Inspected** ☐ Functioning ☒ N/A
Remarks:

**G. Detention/Sedimentation Ponds** ☐ Applicable ☒ N/A

1. **Siltation** Areal extent: Depth: ☒ N/A
☐ Siltation not evident
Remarks:

2. **Erosion** Areal extent: Depth:
☒ Erosion not evident
Remarks:

3. **Outlet Works** ☐ Functioning ☒ N/A
Remarks:

4. **Dam** ☐ Functioning ☒ N/A
Remarks:

**H. Retaining Walls** ☐ Applicable ☒ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement: Vertical displacement:
Rotational displacement:
Remarks: N/A

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
Remarks: N/A

**I. Perimeter Ditches/Off-Site Discharge** ☐ Applicable ☒ N/A

1. **Siltation** ☐ Location shown on site map ☐ Siltation not evident
Areal extent: Depth:
Remarks: N/A

2. **Vegetative Growth** ☐ Location shown on site map ☒ N/A
☐ Vegetation does not impede flow
Areal extent: Type:
Remarks: N/A

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
Areal extent: Depth:
Remarks: N/A

4. **Discharge Structure** ☐ Functioning ☒ N/A
Remarks:

## VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
Areal extent: Depth:
Remarks: N/A

2. **Performance Monitoring**
Type of monitoring: ☐ Performance not monitored
Frequency: ☐ Evidence of breaching
Head differential:
Remarks: N/A

## IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A

**A. Groundwater Extraction Wells, Pumps, and Pipelines** ☐ Applicable ☒ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
☐ Good condition ☐ All required wells properly operating ☐ Needs Maintenance ☒ N/A
Remarks:

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition ☐ Needs Maintenance
Remarks: N/A

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks: N/A

**B. Surface Water Collection Structures, Pumps, and Pipelines** ☐ Applicable ☒ N/A

1. **Collection Structures, Pumps, and Electrical**
☐ Good condition ☐ Needs Maintenance
Remarks: N/A

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition ☐ Needs Maintenance
Remarks: N/A

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks: N/A

**C. Treatment System** ☐ Applicable ☒ N/A

1. **Treatment Train** (Check components that apply):
☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters -
☐ Additive (*e.g.*, chelation agent, flocculent) -
☐ Others -
☐ Good condition ☐ Needs Maintenance
☐ Sampling ports properly marked and functional
☐ Sampling/maintenance log displayed and up to date
☐ Equipment properly identified
☐ Quantity of groundwater treated annually -
☐ Quantity of surface water treated annually -
Remarks: N/A

2. **Electrical Enclosures and Panels** (properly rated and functional)
☒ N/A ☐ Good condition ☐ Needs Maintenance
Remarks:

3. **Tanks, Vaults, Storage Vessels**
☒ N/A ☐ Good condition ☐ Proper secondary containment ☐ Needs Maintenance
Remarks:

4. **Discharge Structure and Appurtenances**
☒ N/A ☐ Good condition ☐ Needs Maintenance
Remarks:

5. **Treatment Building(s)**
☒ N/A ☐ Good condition (esp. roof and doorways) ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:

6. **Monitoring Wells** (pump and treatment remedy)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☒ N/A
Remarks:

**D. Monitoring Data**

1. Monitoring Data
☒ Is routinely submitted on time ☒ Is of acceptable quality

2. Monitoring data suggests:
☒ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining
Arsenic COC is not declining in all wells.

**E. Monitored Natural Attenuation**

1. **Monitoring Wells** (natural attenuation remedy)
☒ Properly secured/locked ☐ Functioning ☒ Routinely sampled ☒ Good condition
☒ All required wells located ☒ Needs Maintenance ☐ N/A
Remarks: All required WOD area wells found. Wells are in good condition with exception of having rusty well casings. Well casing maintenance (i.e., painting) will be required in the future. WOD-MW003R casing lid deteriorated, rusty, and should be replaced. Some well identification markings have either faded and or disappeared. Wells identification marking should be updated/redone.

## X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

## XI. OVERALL OBSERVATIONS

**A. Implementation of the Remedy**

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

The selected remedy at WOD includes in situ biological treatment (biostimulation), institutional controls, and monitoring of COCs. The remedy is intended to reduce COC concentrations in the contaminant plume, and to prevent exposure until cleanup levels are met. The in situ biological treatment component was accomplished with a pilot study and full-scale injection. Groundwater monitoring and institutional controls will continue until cleanup levels are met.

Benzene was removed from the LTM program in 2014 after concentrations were below the cleanup level during several consecutive LTM events. Only arsenic exceeds the cleanup goal; however, this is isolated to an area on the western boundary of the site. LTM continues.

| B. | Adequacy of O&M |
|---|---|
| | Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.<br><br>No issues. LTM Program is evaluated and updated regularly by NASA and the regulators based on LTM data. |
| **C.** | **Early Indicators of Potential Remedy Problems** |
| | Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.<br><br>No issues or observations suggest the remedy protectiveness will be compromised. |
| **D.** | **Opportunities for Optimization** |
| | Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.<br><br>As discussed in LTM evaluation reports and determined by NASA with regulator concurrence, some monitoring wells and/or analytes were removed from the LTM program since cleanup levels were reached. No further optimization opportunities identified. |

# FIVE-YEAR REVIEW QUESTIONNAIRE

| | |
|---|---|
| **Facility:** | NASA Wallops Flight Facility, Wallops Island, Virginia |
| **EPA ID:** | VA8800010763 |
| **Five-Year Review No.:** | Five-Year Review No. 3 (Third); Year 2023 |
| **Site(s):** | 1. Former Fire Training Area (FFTA)<br>2. Waste Oil Dump (WOD) |
| **Format:** | Questionnaire / Email |
| **Interviewee:** | Kyle Newman |
| **Agency/Title/etc:** | VDEQ, Remedial Project Manager |
| **Date:** | 6/13/23 |

## Background

1. Are you aware of any efforts by NASA to solicit or engage input and concerns from the Public? If so, please describe these efforts.

Yes. NASA conducts regular community outreach events both for facility employees and the community. NASA also engages with local officials and follows statutory requirements for soliciting public comment on CERCLA documents, including this review.

2. What effects have site operations had on the surrounding community or area?

PFAS contamination from the facility (not this site) has previously impacted drinking water supplies to the town of Chincoteague, resulting in the installation of a pump and treat system and changes to the production well configuration. However, activities related to the sites in question have not had an impact on the community.

3. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.

There are some limited concerns about PFAS and other contamination within the community, but overall there appears to be confidence in NASA's efforts to remedy the issue. There do not appear concerns regarding the specific site in question.

4. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, give details.

A Navy jet had an incident on the runway last year that required the use of AAAF foam and resulted in another release of PFAS. Investigations are ongoing, but do not appear

to have involved emergency responses from authorities since treatment systems have been put in place to protect local water supplies.

5. Are you aware of any intrusive activities being conducted at the site or uses of the site other than monitoring or maintenance?

No.

6. Are you aware of any uses of the groundwater at or downgradient of the site?

Yes, it is used as a drinking water source by the town of Chincoteague.

## State and Local Considerations (Regulatory)

1. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.

The facility regularly coordinates with DEQ in the form of biweekly update calls, quarterly in-person meetings, and regular direct contact between NASA, DEQ, and EPA staff. These are not specifically related to the site, but provide the opportunity for updates as needed. A site visit has been conducted as part of a larger tour of CERCLA sites on the facility.

2. Have there been any complaints, violations, or other compliance issues related to the site requiring a response by your office? If so, please give details of the events and results of the responses.

None from the DEQ Office of Remediation Programs

3. Have there been any changes in regulations or cleanup levels since implementation that may impact the site?

PFAS remains an evolving challenge as the science, laws, and regulations shift over time, and may impact the site remedy.

## Performance, Operation, and Maintenance Problems

1. Is the remedy functioning as intended by the decision documents? How well is the remedy performing?

Yes, all remedies in place appear to be functioning well and as intended. However, in the future it may need to be revised to address PFAS contamination.

2. Describe the Long-Term Monitoring (LTM) staff and activities. If there is not a continuous on-site presence, describe the staff and frequency of site inspections and activities.

Site groundwater is regularly monitored and reported to DEQ and EPA.

*3.* Have there been any significant changes in the LTM requirements, operational adjustments, maintenance schedules, or sampling routines since start up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe the changes and impacts.

There have been minor changes to LTM frequency, but future changes will likely be dependent on the results of the PFAS RI.

4. Do you have any comments or feedback on the adequacy of the implemented remedy? Are all the right constituents included? Is the monitoring frequency adequate?

The results of the PFAS investigation will determine the adequacy of the remedy for the site moving forward.

5. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

No further comments.

# FIVE-YEAR REVIEW QUESTIONNAIRE

| | |
|---|---|
| **Facility:** | NASA Wallops Flight Facility, Wallops Island, Virginia |
| **EPA ID:** | VA8800010763 |
| **Five-Year Review No.:** | Five-Year Review No. 3 (Third); Year 2023 |
| **Site(s):** | 1. Former Fire Training Area (FFTA)<br>2. Waste Oil Dump (WOD) |
| **Format:** | Questionnaire / Email |
| **Interviewee:** | **Lorie Baker** |
| **Agency/Title/etc:** | **US EPA Region 3/Project Manager** |
| **Date:** | **6/6/2023** |

## Background

1. Are you aware of any efforts by NASA to solicit or engage input and concerns from the Public? If so, please describe these efforts. **Yes. NASA published a public notice to alert the surrounding communities of the beginning of the Five-Year Review (FYR) process. If this wasn't done, it is also recommended that the tribes that have shown interest in the environmental work at WFF also be notified.**

2. What effects have site operations had on the surrounding community or area? **Generally, for the two OUs that are the subject of this FYR, cleanup actions and investigations that had occurred based on the RODs have not had an effect on the surrounding community.**

3. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details. **The main community concerns would be associated with PFAS contamination on WFF. Since the discovery of PFAS in public wells, there have been more community and employee concerns and more involvement with local stakeholders such as the Town of Chincoteague (TOC) and the local health department. NASA reacted quickly by constructing the treatment system for the TOC water wells that were contaminated with PFAS and the GAC system is operating well. It does not appear that the FFTA is a main source contributing to the TOC well contamination, but further investigation is ongoing.**

4. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, give details. **While not on the two sites, there was an incident nearby. On March 28, 2022, there was an intentional emergency release of approximately 200 gallons of AFFF concentrate applied to the runway at WFF as requested by the Navy Landing Safety Officer due to an unsafe nose gear condition on an incoming plane. The**

**release covered a large area (700 ft x 40 ft) and occurred in proximity to the TOC drinking water wells. NASA is performing an investigation of soils and groundwater in the area using Navy funding.**

5. Are you aware of any intrusive activities being conducted at the site or uses of the site other than monitoring or maintenance? **There have been and may be additional monitoring wells constructed in the FFTA and WOD area as part of the PFAS investigations. I am not aware of any other intrusive activities in this area.**

6. Are you aware of any uses of the groundwater at or downgradient of the site? **Both NASA and TOC have public drinking water wells on WFF. The NASA wells are not in close proximity to these two sites, and although the FFTA does not appear to be the source of the PFAS contamination in the TOC wells, the upcoming PFAS RI should help to determine the extent of the FFTA PFAS plume.**

## State and Local Considerations (Regulatory)

1. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results. **This question is directed to the State. EPA has conducted no site visits/inspections/reporting activities to the best of my knowledge. As part of the CERCLA post-ROD long-term monitoring program, NASA provides EPA periodic monitoring reports.**

2. Have there been any complaints, violations, or other compliance issues related to the site requiring a response by your office? If so, please give details of the events and results of the responses. **Not to my knowledge.**

3. Have there been any changes in regulations or cleanup levels since implementation that may impact the site? **PFAS should continue to be noted in the FYR as an emerging contaminant for the FFTA and will need to be addressed prior to closeout. If it's been detected at the WOD monitoring wells, this should also be noted. Since the last FYR, EPA has developed Regional Screening Levels for PFOS and PFOA, along with a handful of other PFAS compounds. EPA has also proposed identifying PFOA and PFOS as CERCLA hazardous substances, in addition to proposing MCLs for these compounds.**

## Performance, Operation, and Maintenance Problems

1. Is the remedy functioning as intended by the decision documents? How well is the remedy performing? **Yes, the remedy is functioning as intended by the decision**

**documents for the FFTA and WOD; however for the FFTA, the remedy will most likely need to be amended to include remediation of PFAS once the RI/FS is completed.**

2. Describe the Long-Term Monitoring (LTM) staff and activities. If there is not a continuous on-site presence, describe the staff and frequency of site inspections and activities.
**EPA is not involved with the LTM activities at these sites but receives and reviews LTM reports on a routine basis.**

*3.* Have there been any significant changes in the LTM requirements, operational adjustments, maintenance schedules, or sampling routines since start up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe the changes and impacts.
**Monitoring frequency and constituents continue to be under review as monitoring reports are received, and changes have been requested and approved. Additional changes will be made in the future based on monitoring results. The protectiveness/effectiveness of the remedy for the FFTA may need to continue to be deferred until the PFAS RI/FS is completed for this OU.**

4. Do you have any comments or feedback on the adequacy of the implemented remedy? Are all the right constituents included? Is the monitoring frequency adequate?
**At the FFTA, further action may be necessary once the PFAS investigation is completed and/or cleanup levels or MCLs are established for PFAS compounds***.*

5. Do you have any comments, suggestions, or recommendations regarding the site's management or operation? **The sites are well-managed by NASA. No further comments at this time.**

# FIVE-YEAR REVIEW QUESTIONNAIRE

| | |
|---|---|
| **Facility:** | NASA Wallops Flight Facility, Wallops Island, Virginia |
| **EPA ID:** | VA8800010763 |
| **Five-Year Review No.:** | Five-Year Review No. 3 (Third); Year 2023 |
| **Site(s):** | 1. Former Fire Training Area (FFTA)<br>2. Waste Oil Dump (WOD) |
| **Format:** | Questionnaire / Email |
| **Interviewee:** | **David Liu** |
| **Agency/Title/etc:** | **NASA/Restoration Program Manager** |
| **Date:** | **6/13/2023** |

## Background

1. Are you aware of any efforts by NASA to solicit or engage input and concerns from the Public? If so, please describe these efforts.

*NASA published a public notice announcing the start of this Five-Year Review. In the past five years, NASA has routinely hosted public information sessions at the WFF Visitor Center and employee outreach sessions at the cafeteria to provide updates on our PFAS activities and answer questions from the community and employees. NASA has also published public notices to solicit public comments on two Proposed Cleanup Plans and an Engineering Evaluation and Cost Analysis for three FUDS projects and was present at the public information sessions.*

2. What effects have site operations had on the surrounding community or area?

*LTM operations at the FFTA and WOD have not affected the surrounding community or area.*

3. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.

*I am not aware of any community concerns regarding these sites. As indicated above, NASA has been engaging our employees and the public on our activities related to PFAS.*

4. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, give details.

*I am not aware of anything of this nature at the FFTA and WOD.*

5. Are you aware of any intrusive activities being conducted at the site or uses of the site other than monitoring or maintenance?

*No intrusive activities have been conducted at the two sites other than monitoring and maintenance.*

6. Are you aware of any uses of the groundwater at or downgradient of the site?

*Land use controls are in place to prevent groundwater use at the FFTA and WOD. The Town of Chincoteague and Trails End have drinking water wells in the surficial aquifer. None of the wells are downgradient of the FFTA or WOD.*

## State and Local Considerations (Regulatory)

1. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.

*NASA conducts routine long term monitoring activities and provides reports to EPA and VDEQ.*

2. Have there been any complaints, violations, or other compliance issues related to the site requiring a response by your office? If so, please give details of the events and results of the responses.

*None that I am aware of.*

3. Have there been any changes in regulations or cleanup levels since implementation that may impact the site?

*Yes. EPA has developed Regional Screening Levels (RSLs) for 8 PFAS compounds, is proposing to develop Maximum Contaminant Levels for 6 compounds, and list PFOA and PFOS as hazardous substances. PFAS is present at both the FFTA and WOD above RSLs.*

## Performance, Operation, and Maintenance Problems

1. Is the remedy functioning as intended by the decision documents? How well is the remedy performing?

*Yes, the remedy is function as intended. The remedy would have to be amended to include PFAS in the future.*

2. Describe the Long-Term Monitoring (LTM) staff and activities. If there is not a continuous on-site presence, describe the staff and frequency of site inspections and activities.

*LTM activities at the FFTA are conducted at a frequency of once every 15 months by an off-site contractor. LTM activities at the WOD are conducted at a frequency of once every 30 months by an on-site contractor.*

*3.* Have there been any significant changes in the LTM requirements, operational adjustments, maintenance schedules, or sampling routines since start up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe the changes and impacts.

*The FFTA LTM Plan Revision 4 was completed in September 2022. The sampling frequency is once every 15 months at seven monitoring wells for three contaminants of concern – naphthalene, arsenic, and manganese. Benzene and 4-methylphenol met the cleanup criteria set forth in the ROD since the last Five-Year Review.*

*The WOD LTM Plan Revision 4 was completed in August 2022. The sampling frequency is once every 30 months at three monitoring wells for one contaminant of concern – arsenic.*

4. Do you have any comments or feedback on the adequacy of the implemented remedy? Are all the right constituents included? Is the monitoring frequency adequate?

*The monitoring frequency is adequate for the LTM constituents. PFAS is being investigated separately.*

5. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

*No.*

This page intentionally left blank