Naval Facilities Engineering Systems Command Northwest
Silverdale, Washington

Final

Site Inspection Report for Per- and Polyfluoroalkyl Substances

Naval Base Kitsap-Keyport
Keyport, Washington

December 2023

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Prepared for NAVFAC Northwest
by CH2M HILL, Inc.
Seattle, Washington
Contract N62470-16-D-9000
CTO N4425518F4117

Executive Summary

This Site Inspection (SI) Report was prepared by CH2M HILL, Inc., a wholly owned subsidiary of Jacobs, for the Department of the Navy (Navy), Naval Facilities Engineering Systems Command (NAVFAC) Atlantic, under the Comprehensive Long-term Environmental Action—Navy Contract N62470-16-D-9000, Contract Task Order N4425518F4117 for submittal to NAVFAC Northwest. This SI Report presents the data and findings obtained from a per- and polyfluoroalkyl substances (PFAS) investigation conducted at Naval Base Kitsap (NBK) Keyport in Keyport, Washington.

A Preliminary Assessment (PA) for PFAS was conducted at NBK-Keyport to identify potential PFAS release areas[1] (CH2M, 2020). Of the 21 areas identified for evaluation, 9 were identified as potential PFAS release areas and 12 were recommended for no further action. Additionally, four special areas associated with NBK-Keyport, but not part of the installation, were recommended for no further action in a technical memo published prior to the PA (CH2M, 2018). Of the nine potential PFAS release areas, two areas, the Former Metal Plating Shop/Waste Oil Spill Area (Operable Unit [OU] 2/Area 8) and the Keyport Landfill (OU 1) were recommended for Remedial Investigation (RI) and were not investigated in the SI, since PFAS were known to be present at these areas from previous sampling results. PFAS were present at concentrations greater than the May 2023 screening levels (SLs) (USEPA, 2023). Seven areas were recommended for further investigation as part of an SI.

The seven sites recommended for SI are as follows:

- Building 76
- 2008 Car Fire site
- Keyport Sludge Disposal Area (Operable Unit [OU] 2/Area 5)
- Building 1006
- Van Meter Road Spill/Former Drum Storage Area (OU 2/Area 2)
- Keyport Peninsula Fill (Site 7)
- Landfill Extension (Northeast Portion of Area 22)

The objectives of the SI were identified in the *Sampling and Analysis Plan, Site Inspection for Per- and Polyfluoroalkyl Substances for Naval Base Kitsap-Keyport, Keyport, Washington* (CH2M, 2022a):

- Determine whether PFAS are present in groundwater and soil at concentrations warranting further investigation.
- Refine the understanding of the hydrogeologic characteristics at potential PFAS release areas and evaluate the potential for on- and off-Base migration of PFAS, if present.

PFAS are water-soluble and relatively mobile through soils to groundwater. Therefore, if a historical release occurred at a potential PFAS release area, it is likely to be detected within groundwater at the release area and/or downgradient. Based on this rationale, the SI activities included collection of groundwater and soil samples at or near the seven potential PFAS release areas identified in the PA. Groundwater and soil samples were analyzed for the 18 PFAS compounds listed in Method 537.1 via liquid chromatography tandem mass spectrometry compliant with the Department of Defense (DoD) and Department of Energy Consolidated Quality Systems Manual for Environmental Laboratories, Version 5.3, in accordance with the laboratory's Environmental Laboratory Accreditation Program accreditation letters.

Soil and sediment data were initially screened against residential scenario soil screening levels (SLs) for perfluorooctanoic acid (PFOA), perfluorooctane sulfonate (PFOS), perfluorobutanesulfonic acid (PFBS), perfluorononanoic acid (PFNA), perfluorohexanesulfonic acid (PFHxS), and hexafluoropropylene oxide dimer acid (HFPO-DA) presented in the November 2022 Regional Screening Level (RSL) Table (USEPA, 2022). Groundwater

[1] Potential PFAS release areas were referred to as potential PFAS source areas in the PA (CH2M, 2020).

analytical results were initially screened against residential scenario tap water SLs for PFOA, PFOS, PFBS, PFNA, PFHxS, and HFPO-DA presented in the November 2022 RSL Table (USEPA, 2022). These SLs are as follows:

- PFOA – Soil SL: 19 micrograms per kilogram (µg/kg), groundwater SL: 6.0 nanograms per liter (ng/L)
- PFOS – Soil SL: 13 µg/kg, groundwater SL: 4.0 ng/L
- PFBS – Soil SL: 1,900 µg/kg, groundwater SL: 600 ng/L
- PFNA – Soil SL: 19 µg/kg, groundwater SL: 5.9 ng/L
- PFHxS – Soil SL: 130 µg/kg, groundwater SL: 39 ng/L
- HFPO-DA – Soil SL: 23 µg/kg, groundwater SL: 6.0 ng/L

Following completion of the initial data screening and human health risk screening (HHRS), the USEPA published RSLs for two additional PFAS: perfluorobutanoic acid (PFBA) and perfluorohexanoic acid (PFHxA) (USEPA, 2023). Consistent with DoD Instruction 4715.18, and in consideration of the timing of this report, the PFHxA SL was used for screening soil and groundwater data at potential PFAS release areas only where inclusion of these values had the potential to impact site management decisions (that is, the potential PFAS release areas not already recommended for RIs). PFBA was not included in the analyte list for the SI but will be included during further investigations. The SL for PFHxA is as follows:

- PFHxA – Soil SL: 3,200 µg/kg, groundwater SL: 990 ng/L

PFHxA did not exceed SLs; therefore, it does not impact site management decisions. Because an RI is recommended for some of the SI areas, an evaluation of PFBA and PFHxA would not change the recommendation. PFBA and PFHxA will be considered in the RI planning.

Subsurface soil samples were collected from two depth intervals during installation of new groundwater monitoring wells at the potential PFAS release areas during the SI. Standalone surface soil samples were also collected at Building 76, the 2008 Car Fire site, and Building 1006. Soil borings were advanced (with no monitoring wells installed) at Building 76 and the Keyport Sludge Disposal Area (OU 2/Area 5). PFAS were detected in soil at each of the potential PFAS release areas; however, detections only exceeded the SLs at Building 76, Building 1006, and the Van Meter Road Spill/Former Drum Storage Area (OU 2/Area 2).

Groundwater samples were collected from the newly installed monitoring wells following well development at the potential PFAS release areas, and from one existing well at the Van Meter Road Spill/ Former Drum Storage Area (OU 2/Area 2). PFAS were detected in groundwater samples at the potential PFAS release areas except the Landfill Extension (Northwest Portion of Area 22), and concentrations exceeded the SLs at five potential PFAS release areas.

Sediment samples were collected at one SI area, the Van Meter Road Spill/Former Drum Storage Area (OU 2/Area 2). Two PFAS (PFOS and PFOA) were detected in sediment, but at concentrations below the SLs.

At this time, no further investigation is recommended for the following two areas:

- Keyport Peninsula Fill (Site 7)
- Landfill Extension (Northeast Portion of Area 22)

RIs are recommended for the following five areas:

- Building 76
- Keyport Sludge Disposal Area (OU 2/Area 5)
- 2008 Car Fire (adjacent to Building 198)
- Building 1006
- Van Meter Road Spill/Former Drum Storage Area (OU 2/Area 2)

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Acronyms and Abbreviations

µg/kg	microgram(s) per kilogram
11Cl-pF3OudS	11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid
9Cl-PF3ONS	9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid
ADONA	4,8-dioxa-3H-perfluorononanoic acid
AFFF	aqueous film-forming foam
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CH2M	CH2M HILL, Inc.
CLEAN	Comprehensive Long-term Environmental Action—Navy
COPC	chemical of potential concern
CSM	conceptual site model
DO	dissolved oxygen
DoD	Department of Defense
DOH	Washington State Department of Health
Ecology	Washington State Department of Ecology
EPP	Environmental Protection Plan
FD	field duplicate
FS	Feasibility Study
G-RAM	general radioactive materials
HDPE	high-density polyethylene
HFPO-DA	hexafluoropropylene oxide dimer acid
HHRS	Human Health Risk Screening
IAS	Initial Assessment Study
IDW	investigation-derived waste
KPUD	Kitsap Public Utilities District
MS	matrix spike
MSD	matrix spike duplicate
NAVFAC	Naval Facilities Engineering Systems Command
Navy	Department of the Navy
NBK	Naval Base Kitsap
ND	not detected
NEtFOSAA	N-ethyl perfluorooctanesulfonamidoacetic acid
ng/L	nanogram(s) per liter
NMeFOSAA	N-methyl perfluorooctanesulfonamidoacetic acid
NTU	nephelometric turbidity unit

NUWC	Naval Undersea Warfare Center
ORP	oxidation-reduction potential
OU	operable unit
PA	Preliminary Assessment
PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutanesulfonic acid
PFDA	perfluorodecanoic acid
PFDoA	perfluorododecanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexoanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
PFTA	perfluorotetradecanoic acid
PFTrDA	perfluorotridecanoic acid
PFUnA	perfluoroundecanoic acid
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
RPM	Remedial Project Manager
RSL	Regional Screening Level
SAP	Sampling and Analysis Plan
SI	Site Inspection
SL	Screening Level
SOP	standard operating procedure
STP	sewage treatment plant
TSDF	Transport, Storage, and Disposal Facility
USEPA	United States Environmental Protection Agency
WMP	Waste Management Plan
WQP	water quality parameter

SECTION 1

Introduction

This Site Inspection (SI) Report was prepared by CH2M HILL, Inc., a wholly owned subsidiary of Jacobs, for the Department of the Navy (Navy), Naval Facilities Engineering Systems Command (NAVFAC) Atlantic, under the Comprehensive Long-term Environmental Action—Navy (CLEAN) 9000, Contract N62470-16-D-9000, Contract Task Order N4425518F4117 for submittal to NAVFAC Northwest. This SI Report presents the data and findings obtained from a per- and polyfluoroalkyl substances (PFAS) investigation conducted at Naval Base Kitsap (NBK) Keyport in Keyport, Washington (**Figure 1-1**).

The objectives of the SI were defined in the *Sampling and Analysis Plan, Site Inspection for Per- and Polyfluoroalkyl Substances for Naval Base Kitsap-Keyport, Keyport, Washington* (SAP) (CH2M, 2022a). The objectives were as follows:

- Determine whether PFAS are present in groundwater and soil at concentrations warranting further investigation.
- Refine the understanding of the hydrogeologic characteristics at potential PFAS source areas and evaluate the potential for on- and off-Base migration of PFAS, if present.

This SI Report outlines the approach taken to achieve the listed objectives, results, conclusions regarding data collected, and recommendations. The conclusions and recommendations provided reflect the status of evolving PFAS regulatory guidelines at the time of reporting.

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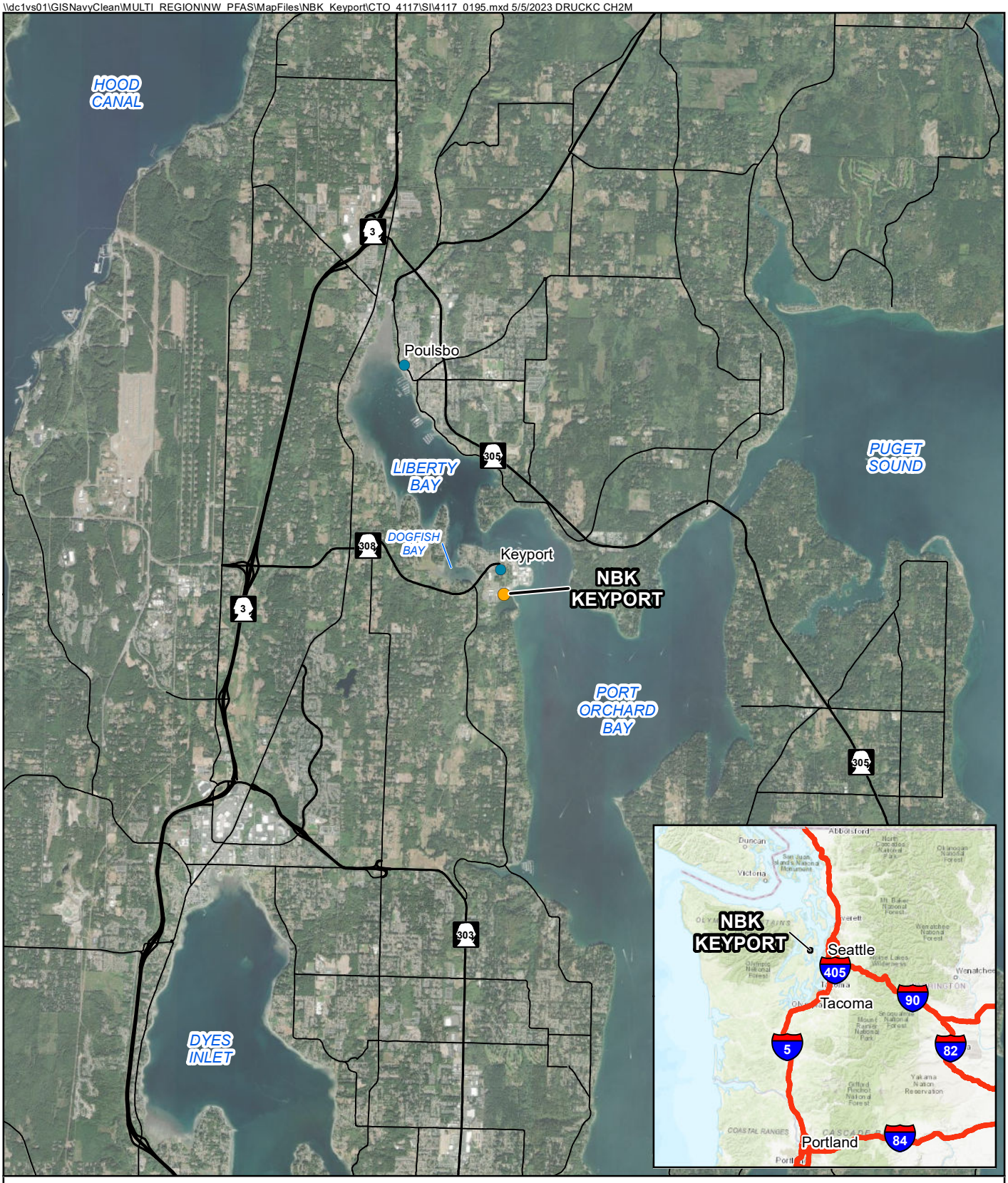


LEGEND

- NBK Keyport
- City
- State Route
- Local Connecting Road

NOTES:
NBK = Naval Base Kitsap
PFAS = Per- and Polyfluoroalkyl Substances

IMAGERY SOURCE:
ESRI ArcGIS Online Web Service,
World Imagery, 2022

Figure 1-1
Location Map
Site Inspection for PFAS
NBK Keyport, Keyport, Washington

0 0.8 1.6
Miles
1 inch = 1.6 mile
N

SECTION 2

Site Background and Physical Setting

This section presents background information on NBK-Keyport, including site history, potential sources of PFAS, and relevant information on the physical and hydrogeologic setting at the site.

2.1 Facility Background

2.1.1 Description and History

NBK-Keyport occupies 340 acres (including tidelands) adjacent to the town of Keyport in Kitsap County, Washington, on a small peninsula in the central portion of Puget Sound (**Figure 2-1**). The peninsula is bordered by Dogfish Bay and Liberty Bay to the west and northwest and Port Orchard Bay to the north, northeast, and southeast. NBK-Keyport, formerly known as Naval Undersea Warfare Center (NUWC) Keyport Division and Naval Sea Systems Command Keyport, is one of two active NUWCs for the Navy's Pacific Fleet.

NBK-Keyport was established in 1914 as the primary torpedo manufacturing station for the Navy's Pacific Fleet, and NBK-Keyport continues to provide technical support to the Pacific Fleet. The installation is comprised of both residential and industrial areas. The northwestern portion of the installation, closest to the town of Keyport, is primarily residential. The industrial area, located in the eastern portion of the installation, is bordered by Port Orchard Bay to the east and the Shallow Lagoon to the south. The southern portion of the installation is primarily housing and forested land, although several storage buildings, including Building 1006, exist southwest of the Shallow Lagoon (**Figure 2-1**).

2.1.2 Previous Environmental Investigations

An Initial Assessment Study (IAS) was performed at NBK-Keyport in 1983 and identified several areas that were potentially impacted by chemicals other than PFAS (VOCs, pesticides, metals, paint residues, strippers, lacquers, thinners, deflocculant and enamels, detergents, cleaners, and waste sludge containing metals (NEESA, 1984). As a result of the IAS and subsequent studies, four areas that are part of this SI were the subject of additional investigation: Area 2 (now referred to as OU2/ Area 2), Area 5 (now referred to as OU 2/ Area 5), Area 7 (now referred to as Site 7), and Area 22, shown on **Figure 2-1**. This subsection provides brief background for each area. PFAS were not chemicals of concern at the time of the IAS or subsequent investigations and were thus not investigated.

In 1989, NBK-Keyport was officially listed on the National Priorities List and became a Superfund site. Two of the PFAS SI sites were recommended for further investigation in the Remedial Investigation (RI) and Feasibility Study (FS) process at that time: Area 2 and Area 5, with the RI/FS process starting in 1988 and the final RI/FS report completed in 1993 (Navy, 1993a).

- Van Meter Road Spill/Drum Storage Area (Operable Unit [OU] 2/Area 2): This area was referred to as Area 2 in the IAS and is composed of three distinct sites – the Van Meter Road plating shop wastes spill area, where a spill of plating shop wastes occurred in 1976, and two unpaved drum storage areas, which were operational from the 1940s to the 1960s. The Van Meter Road Spill is a site on which a spill of plating shop wastes from the former metal plating shop occurred in 1976 from a tank truck parked on Van Meter Road. The drum storage areas currently operate as a construction material laydown yard with four existing structures (Buildings 957, 1017, 1018, and 1077). In this area, unused product (any chemicals, solvents, fuels, and/or oils used at NKB Keyport that came in 55-gallon drums) was reportedly released directly onto the ground surface from partially filled drums. Chemicals, solvents, fuels, and oils used at NBK-Keyport that came in 55-gallon drums could have contributed to PFAS impacts in this area. In total, an estimated 4,000 to 8,000 gallons of waste was discharged to the environment between 1940 and the 1960s (NEESA, 1984). Following the RI/FS process, the Record of Decision (ROD) for OU2, including OU 2/Area 2, was signed in 1994 (Navy, 1993a, 2005). Currently, OU 2/Area 2 is one of three active Superfund sites at NBK-Keyport, with ongoing post-ROD

activities being conducted, including long-term monitoring of several media and site operations and maintenance to determine if remedial action objectives have been met.

- Keyport Sludge Disposal Area (OU 2/Area 5): This area is referred to as Area 5 in the IAS. Up to 5,000 gallons of sludge from the former sewage treatment plant (STP), located near the current location of Building 180, was disposed of from the 1940s through the mid-1970s at Area 5 (NEESA, 1984). Based on health risk assessments conducted during the RI/FS process and before signing of the OU 2 ROD, Area 5 was documented as requiring no further action in the ROD (Navy, 1993a, 2005).

Site 7 (referred to as Area 7 in the IAS) and Area 22 were not recommended for further investigation in the IAS; however, subsequent geotechnical studies and excavations indicated the presence of contamination in the subsurface fill and soil (URS, 1993). An SI was conducted for these areas in 1991 and 1992 to evaluate the presence of contamination related to the fill and debris placed in these areas.

- Keyport Peninsula Fill (Site 7): This area was referred to as Area 7 in the IAS and borders Port Orchard Bay in the northeast portion of NBK-Keyport. The area was originally shallow tidal flats until it was filled in stages from the 1930s until 1972 with dredged spoils, excavation material, and gravels. Area 7 was recommended for no further action because it was capped by pavement and buildings and was not considered to pose a threat to human health or the environment (URS, 1993). During the SI, several metals and volatile or semivolatile organic compounds were detected at concentrations above potential regulatory criteria; however, due to the limited exceedances and the paved surface cover across the majority of the site, no further removal actions or investigations were recommended in the SI.
- Area 22: Area 22 was the primary industrial and domestic waste disposal facility for NBK-Keyport from the 1930s until the landfill closed in 1973. Area 22 is predominantly paved and comprised of parking lots and light industrial buildings. During the 1993 SI, several metals were detected at concentrations above potential regulatory criteria; however, due to the limited exceedances and the paved surface cover in the majority of the site, no further removal actions or investigations were recommended in the 1993 SI.

Two additional areas described in the IAS, OU 1 (Site 1) and OU 2/Area 8, were sampled for the presence of PFAS. The sampling was not conducted as part of an ongoing investigation of PFAS sources or intended to define nature and extent of PFAS impacts in these areas. OU 1, known as the Keyport Landfill, was operational from the 1930s to 1973 and was the primary industrial waste disposal site at NBK Keyport during that time span (NEESA, 1984). At OU 1/Site 1, new and existing monitoring wells were sampled for PFAS between 2019 and 2022. OU2/ Area 8 is the former metal plating shop and waste oil spill area. At OU 2/ Area 8, existing monitoring wells were sampled for PFAS in 2018 and 2019 as part of long-term monitoring efforts and in support of a future ecological risk assessment under the existing ROD.

In 2020, a Preliminary Assessment (PA) for PFAS was conducted at NBK-Keyport to identify potential PFAS release areas (CH2M, 2020). Of the 21 areas identified for evaluation, 9 were identified as potential PFAS release areas and 12 were recommended for no further action (in addition to the special areas located outside the NBK-Keyport footprint that were recommended for no further action in a technical memo published prior to the PA [CH2M, 2018]). Of the 9 potential PFAS release areas, seven were recommended for further investigation as part of an SI: Building 76, 2008 Car Fire, Keyport Sludge Disposal Area (OU 2/Area 5), Building 1006, Van Meter Road Spill/Former Drum Storage Area (OU 2/Area 2), Keyport Peninsula Fill (Site 7), and Landfill Extension (Northeast Portion of Area 22). The PA recommended additional investigation at these seven areas based on the potential for a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-type release of PFAS-containing materials during historical Navy operations. The PA also recommended two sites, OU 1 and OU 2/Area 8, move directly from PA to RI, since PFAS were known to be present in previous sampling results. PFAS were present at concentrations greater than the May 2023 SLs (USEPA, 2023).

2.2 Environmental Setting

This section provides the environmental setting of NBK-Keyport.

2.2.1 Climate

The climate on the Keyport peninsula is characterized by cool, dry summers and wet, cool winters (NEESA, 1984). Average high temperatures during the summer months range from 65 to 80 degrees Fahrenheit, while winter highs are typically in the 40 degrees Fahrenheit range (Weatherbase, 2023). Average annual precipitation is approximately 36 inches, approximately three-fourths of which falls between October and April (NEESA, 1984). The Keyport area receives approximately 6 inches of snowfall annually (Weatherbase, 2023).

2.2.2 Topography and Hydrologic Setting

NBK-Keyport and the town of Keyport are situated on a low-lying peninsula. Elevations within the vicinity of the installation range from approximately 10 to 60 feet above mean sea level (NEESA, 1984). The developed area of the peninsula lies on a broad flat knoll that slopes gently to the north and east into Port Orchard Bay, to the south toward the Shallow Lagoon, and to the west to the tidal flat adjoining Dogfish Bay (**Figure 2-1**). A ridge is present at the southeast corner of the installation, and topography at the south edge and southwest of the installation also rises steeply. Portions of NBK-Keyport have been historically cut and filled to accommodate infrastructure and housing on the installation, which has altered the topography slightly on a localized scale.

Marine or brackish water bodies on and near the installation consist of Liberty Bay, Port Orchard Bay, Dogfish Bay, the Tide Flats, Marsh Pond, and the Shallow Lagoon. Freshwater bodies include two creeks draining into the Marsh Pond and two streams that discharge into the Shallow Lagoon (**Figure 2-1**). The Shallow Lagoon also receives overland flow from the highlands south of the installation and from the southwestern portion of the industrial area. Liberty Bay receives runoff and overland flow from the northwestern portions of the installation and Port Orchard Bay receives runoff and overland flow from the northern, eastern, and southeastern portions of the installation. Overland flow drains in a radial pattern from the small knoll northeast of the main gate. Areas southwest of the knoll and west of a groundwater divide across the center of the installation drain toward Dogfish Bay via the Tide Flats and Marsh Pond to the east (URS, 1992).

Much of NBK-Keyport is covered in low-permeability surfaces (extensive paved areas and low-permeability soil) with stormwater infrastructure to capture and control surface water. Stormwater catchments collect and divert water to several outfalls within the surrounding surface water bodies.

2.2.3 Geologic Setting

The Keyport peninsula area lies within the Puget Sound Lowland, consisting of glacial and nonglacial deposits overlying volcanic bedrock. The nine stratigraphic units in the area, which may or may not be beneath the installation, are (from youngest to oldest): Holocene Alluvium, Vashon Recessional Outwash, Vashon Till, Vashon Advance Outwash, Colvos Sand, Clover Park Formation, Glacial Drift Unit, Early Pleistocene deposits, and Tertiary volcanic bedrock. Surface conditions above these nine stratigraphic units generally consist of fill material, riprap, and dredged material from the surrounding coastal areas.

Details about each stratigraphic unit are listed from the youngest to oldest units below (URS, 1992):

- Holocene Alluvium: localized, thin layers of sand, gravel, silt, and peat
- Vashon Recessional Outwash: discontinuous, unconsolidated units of sand, gravel, and silt; up to 100 feet thick
- Vashon Till: a dense unit of gravel and cobble in silt, fine sand, and clay forming an aquiclude up to 80 feet thick
- Vashon Advance Outwash: coarse sand and gravel with some silt lenses up to 50 feet thick

- Colvos Sand: well-stratified sand with some lenses of fine gravel and clay; typically less than 150 feet thick
- Clover Park Formation: laminated silt and clay with lenses of sand, gravel, and peat forming a laterally extensive aquiclude between 70 and 150 feet thick
- Glacial Drift Unit: gravel and coarse sand with localized till and clay; between 100 and 200 feet thick
- Early Pleistocene deposits: clay and silt with lenses of sand, gravel, and some till; over 400 feet thick

2.2.4 Hydrogeologic Setting

Two primary groundwater aquifers (generally referred to as "upper" and "lower") occur at NBK-Keyport. Most of NBK-Keyport is underlain by the Clover Park Formation, an aquitard separating the variably unconfined, semiconfined, and confined upper aquifer above and the confined lower aquifer beneath it (Navy, 2005).

Groundwater within the upper aquifer at the site occurs within three poorly defined water-bearing zones that are assumed to be hydraulically connected. The zones consist of locally perched groundwater in permeable sands overlying Vashon Till deposits, groundwater in continuous water-bearing zones that exist within recent alluvial or Vashon Recessional Outwash deposits, and groundwater that is confined or semiconfined below or within the Vashon Till. A combination of these water-bearing zones may occur in any one area. Static water levels within the upper aquifer are typically between 3 and 20 feet below ground surface (bgs) and show tidally influenced water level fluctuations of between 0 and 6 feet, depending on well location and screened interval.

Groundwater flow within the upper aquifer at the site typically follows topography and parallels surface water drainage patterns (**Figure 2-1**). Shallow groundwater flows in a radial pattern from a small knoll in the residential area northeast of the main gate, toward marine and brackish surface water bodies surrounding the Keyport peninsula. Near the southern end of NBK-Keyport, groundwater flows north and east, toward the Shallow Lagoon, the marsh, and Port Orchard Bay. A groundwater divide trends north-south through the central portion of NBK-Keyport. Groundwater flows west of the divide toward the Marsh Pond and Tide Flats, and east of the divide toward the Shallow Lagoon and Port Orchard Bay (**Figure 2-1**) (URS, 1992).

The lower aquifer is generally present below depths of 120 feet bgs, extending to depths greater than 1,000 feet, with flowing artesian conditions common between the depths of 674 and 805 feet (URS, 1992), the (general) depth at which the local supply wells are screened. Due to a limited number of wells screened within the lower aquifer, and the relatively large distance between them, groundwater flow direction in the lower aquifer is not known. Hydraulic communication between the upper and lower aquifers is not likely because of the thickness of the silt and clay aquitard (Clover Park Formation). Furthermore, while on-Base monitoring wells within the upper aquifer sampled during previous investigations have shown PFAS impacts, PFAS (specifically perfluorooctanoic acid [PFOA] and perfluorooctane sulfonate [PFOS]) have not been detected in samples collected from lower aquifer wells, including on-Base supply Well 5 (Navy, 2016).

2.3 On-Base and Off-Base Drinking Water Source Evaluation

This section discusses the sources of drinking water at the Base and in the adjacent off-Base areas and whether on-Base or off-Base drinking water could have been impacted by the potential PFAS source areas investigated as part of the SI.

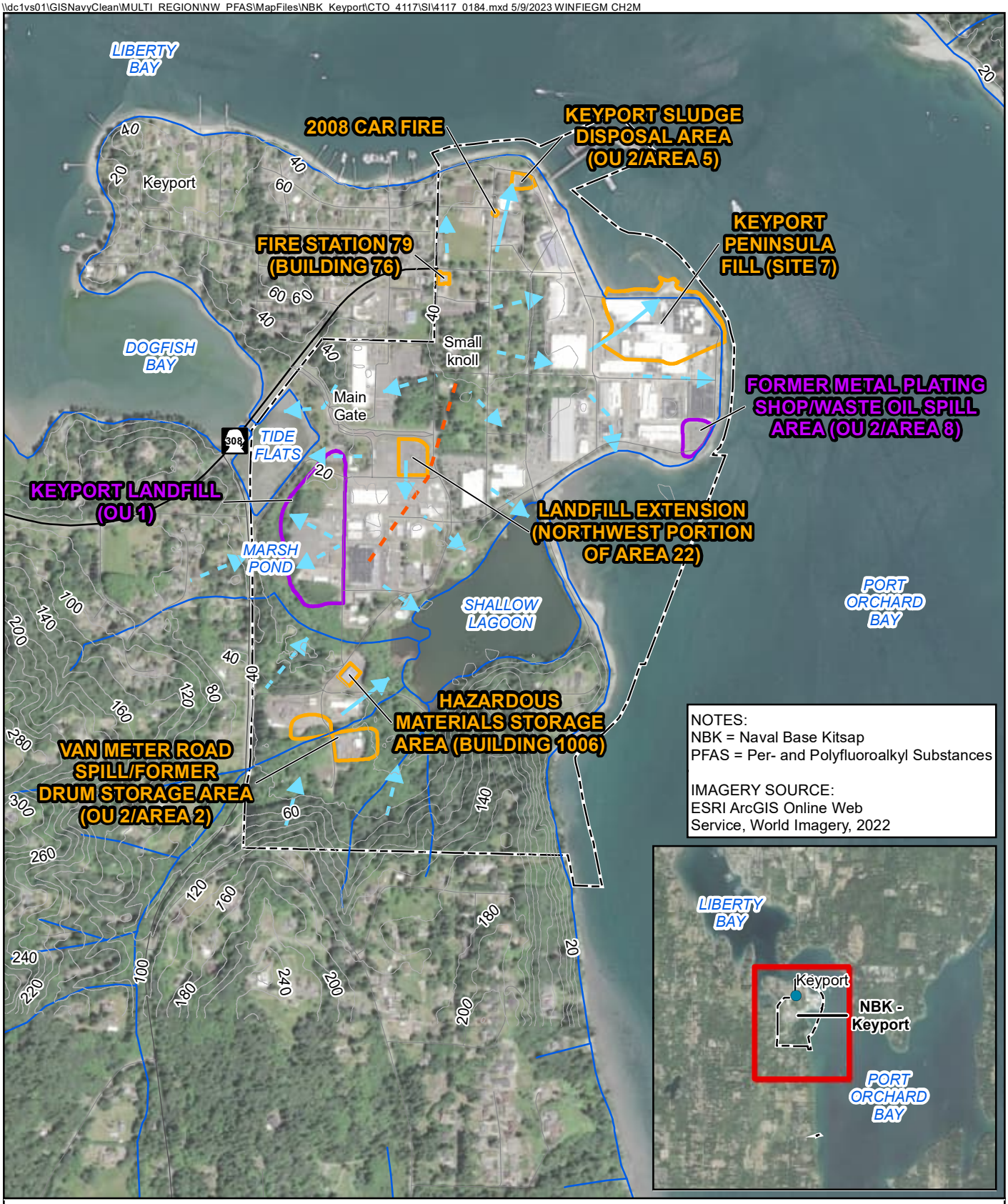
On-Base drinking water at NBK-Keyport is obtained from Well 5 in Building 64, in the central portion of NBK-Keyport on the northern shore of the Shallow Lagoon (**Figure 2-1**), with a backup supply provided by the Kitsap Public Utilities District (KPUD). Well 5 and the two KPUD wells adjacent to NBK-Keyport are screened within the lower confined aquifer at depths ranging from 745 to 1,030 feet bgs (Navy, 2018); PFOA and PFOS were not detected during previous sampling of Well 5 (Navy, 2016). Off-Base drinking water for the town of Keyport is provided by two drinking water supply wells (one primary and one emergency), approximately 0.5 mile upgradient of NBK-Keyport and approximately 80 feet cross-gradient of the base boundary, respectively, that are screened within the lower aquifer. The primary drinking water supply well was sampled for PFAS in 2017 and

PFOA and PFOS were not detected (Keyport Public Utility District Water Resources Director, pers. comm. 2022). Hydraulic communication between the upper and lower aquifers is not likely because of the thickness of the silt and clay aquitard (the Clover Park Formation) separating these two aquifer units; thus, no known exposure pathway exists from potentially impacted upper aquifer groundwater to residents that rely on the municipal water supply from KPUD primary and emergency supply wells or the on-Base drinking water well.

Based on data obtained from Washington State Department of Ecology (Ecology) and Washington State Department of Health (DOH), private drinking water wells may serve some of the parcels within 1 mile to the northwest of NBK-Keyport, including suspected private wells on developed and undeveloped parcels in the town of Keyport. The wells may be downgradient or cross-gradient of shallow groundwater flow from the northeastern portion of NBK-Keyport. However, the exact number of private wells and their locations, current operational status (active or abandoned), depth, and usage are not well documented. Based upon limited records available, some of these wells are suspected to be monitoring wells because of depth, location, and Navy contractor affiliation or abandoned, as one public well record confirmed.

Private drinking water wells may exist in the town of Keyport, which is within 1-mile in a cross-gradient direction of the Building 76. PFOA and PFOS either individually or combined were not detected in groundwater above 70 ng/L[2]. There were no detected concentrations of PFOS and/or PFOA above 70 ng/L in the monitoring wells and, the groundwater flow direction at Building 76 is to the north/northwest and not toward potential off-base drinking water wells. Based on the current data, a complete exposure pathway from Building 76 to off-Base drinking water wells has not been identified. However, there is uncertainty regarding the direction of groundwater flow along the Base boundary adjacent to the town of Keyport.

2 EPA issued lifetime drinking water health advisories for PFOA and PFOS in May 2016 of 70 ng/L, individually or combined. On March 14, 2023, EPA proposed a draft regulatory drinking water standard for certain PFAS, including PFOA and PFOS. In response, DoD has issued the following statement: "DoD respects and values the public comment process on this proposed nationwide drinking water rule and looks forward to the clarity that a final regulatory drinking water standard for PFAS will provide. In anticipation of the final standard that EPA expects to publish by the end of 2023, the DoD is assessing what actions DoD can take to be prepared to incorporate EPA's final regulatory standard into our current cleanup process, such as reviewing our existing data and conducting additional sampling where necessary. In addition, DoD will incorporate nationwide PFAS cleanup guidance, issued by EPA and applicable to all owners and operators under the federal cleanup law, as to when to provide alternate water when PFAS are present."



LEGEND

- Upper Aquifer Groundwater Flow Direction (dashed where inferred)
- Surface Water Body
- Highway
- Major Road
- Local Road
- Groundwater Divide
- 20' Topographic Contour
- Potential PFAS Source Area
- Recommended for RI prior to SI Investigation
- Installation Boundary

0 440 880 Feet

1 inch = 1,000 feet

N

Figure 2-1
Base Layout Map
Site Inspection for PFAS
NBK Keyport, Keyport, Washington

SECTION 3

Field Investigation Methodology

This section describes the field activities, which were performed in accordance with the SAP (CH2M, 2022a) except where noted. Field activities were conducted from August 2022 through August 2023; field notes are provided in **Appendix A**.

3.1 Site Preparation and Utility Clearance

Prior to intrusive investigation activities, a site walk was conducted on August 12, 2022, with the drilling subcontractor, the CH2M field team lead, and the NBK-Keyport Remedial Project Manager (RPM) to assess the proposed drilling locations for drill rig accessibility, vegetation reduction needs (if any), presence of utility infrastructure (aboveground powerlines, indications of subsurface utilities, etc.), and other potential hazards. Two utility locate tickets were submitted to Washington 811 to notify private and public entities of the intended ground-disturbing work. Responses from public utilities indicated that no public utilities are present on NBK-Keyport. Subsequent 811 tickets were submitted as work progressed to renew the permit.

Prior to intrusive investigation activities, a third-party utility clearance subcontractor marked subsurface utilities within the white line areas of proposed boring locations. Utility locates were remarked periodically over the course of the field event as drilling progressed to ensure compliance with the permit time requirements. Subsurface utilities were marked within 5 feet of the proposed boring locations. Ground-penetrating radar, conductive, and nonconductive utility locate techniques were applied to mark all utilities present within drilling areas. Excavation and outage requests were submitted to and approved by NBK-Keyport for each investigation area prior to ground disturbance.

Subsurface utilities forced the relocation of several proposed monitoring wells or soil borings. Additional details are provided in **Section 3.17**.

3.2 Archaeological Monitoring

Consultation with the NBK-Keyport cultural resources manager prior to mobilization required that archaeological monitoring be conducted during intrusive environmental sampling activities to identify and protect cultural resources in areas identified as having high potential based on either their location in relation to known archaeological sites or their high probability for archaeological resources. Upon review of the Section 106 Consultation provided for review by the Navy, the Suquamish Tribal Historic Preservation Officer concurred with the Navy determination of No Historic Properties Affected, with the requirement for monitoring of boring activities by a professional archaeologist.

Archaeological monitoring was performed by a CH2M professional archaeologist who was onsite during intrusive activities at these areas. The archaeological monitor examined excavated soils for archaeological artifacts and/or evidence of past human use. No artifacts or other cultural resources were observed during the SI activities.

3.3 Radiological Monitoring

A Radiation Protection Plan was prepared to identify potential general radioactive materials (G-RAM) that could be encountered and to provide monitoring protocols during field investigation activities. Radiation monitoring was performed during intrusive work at Keyport Peninsula Fill (Site 7) and Landfill Extension (Northeast Portion of Area 22) sites. Monitoring was conducted in accordance with the Radiation Protection Plan. No G-RAM was identified during monitoring.

3.4 Monitoring Well Installation

Soil borings and monitoring well installations were conducted from August 29, 2022, to January 29, 2023, and August 7 to 18, 2023. A total of 29 monitoring wells were planned for construction at NBK-Keyport; however, due to the presence of equipment and ongoing pipeline projects at Site 7 that prevented access, one well was not installed there, and only 28 monitoring wells were constructed during the initial drilling mobilization. This deviation from the SAP (CH2M, 2022a) is further detailed in **Section 3.17** and was recorded in Field Change Request (FCR) #1, included herein as **Appendix B**. Soil boring logs are provided in **Appendix C**. Further, based on initial evaluation of data from Building 76 and continued uncertainty as to the direction of groundwater flow, four additional monitoring wells were installed at Building 76, for a total of 32 monitoring wells. The rationale and description of this scope is provided in FCR #2, included in **Appendix B**.

New monitoring wells were installed in accordance with the State of Washington well construction standards by a Washington-licensed driller. Well construction reports were submitted to Washington State Department of Ecology following construction. Borehole advancement was conducted using a rotosonic drill rig. During drilling, continuous soil cores were extruded and collected in plastic sleeves and logged for lithology. Borehole advancement and soil logging were conducted in accordance with the SAP (CH2M, 2022a). The locations of the monitoring wells installed are shown on **Figures 3-1** through **3-6**.

The new monitoring wells were constructed with 2-inch-inside-diameter Schedule 40 polyvinyl chloride (PVC) risers connected to 2-inch inside diameter factory slotted 0.020-inch Schedule 40 PVC screen with a bottom cap. The depth of the screened intervals varied at each well to screen across the groundwater table, as described in the SAP (CH2M, 2022a). Twenty-two of the monitoring wells were installed with 10-foot screens; however, six wells were constructed with a 20-foot screen to either obtain water production from multiple potentially productive zones interspersed with less productive zones or due to potential fluctuations in groundwater elevations due to tidal fluctuations. These installations were constructed in accordance with the SAP, which allowed for use of screens shorter or longer than 10-feet to meet SI objectives. The annular space between the borehole wall and well screen was backfilled with a 12/20 sand filter pack, placed around the annular space of the well screen from the bottom of the boring and extending to a minimum height of 2 feet above the top of the well screen. A bentonite seal of at least 5 feet thick was placed above the top of the sand pack. After the bentonite had been hydrated, either a cement-bentonite grout or neat cement was placed in the remaining annular space. Well heads were completed as flush-mount manholes, except for two wells at the Van Meter Road Spill/Former Drum Storage Area (OU 2/Area 2) in a wooded area, which required stickup casing and protective bollards. Monitoring well construction details are provided in **Appendix C**.

To avoid introducing PFAS during the well installation process, drill tooling and well development equipment used PFAS-free components (such as parts or O-rings without Teflon, Viton, polytetrafluoroethylene, and all other fluorinated compounds). Additionally, thread lubricant used on the drilling tools and well materials (such as riser, screen, sand, and grout) did not contain polytetrafluoroethylene or any other fluorine-containing substance. Coated bentonite pellets were not used to avoid possible introduction of PFAS.

3.5 Monitoring Well Development

After completing each well installation, monitoring wells were developed following a minimum of 24 hours to allow for grout curing. Monitoring wells were developed by the drilling subcontractor and/or CH2M field staff using a combination of surging, bailing, and pumping. During monitoring well development, the CH2M field crew measured water quality parameters (WQPs), including potential of hydrogen (pH), temperature, specific conductivity, oxidation-reduction potential (ORP), dissolved oxygen (DO) and turbidity with a water quality meter. Development continued until turbidity was below 10 nephelometric turbidity units (NTUs) or at least three well volumes of groundwater were removed.

Development information, including turbidity, pH, specific conductivity, temperature, and gallons of water removed, were recorded as field notes. In addition, the water quality meter was calibrated daily (at a minimum). Well development logs are provided in **Appendix D**. Surge blocks, bailers, and pumps used during development did not contain PFAS.

During well development of monitoring well NBKK-OU2A2-MW01, the well was found to have pulled in significant amounts of filter pack sand during development, indicative of broken PVC or a compromised screen. Upon inspection by the drilling subcontractor, it was determined that the likely break in the well screen was near the bottom of the screen interval. On March 29, 2023, the well was repaired by inserting a small PVC plug at the bottom of the screen interval, resulting in minimal loss to screen length. On the same date, the well was developed as described above; the well development log is included in **Appendix D.**

3.6 Groundwater Sampling

Groundwater samples were collected from 28 newly installed monitoring wells and one existing monitoring well. Two existing wells located at the Van Meter Road Spill/Former Drum Storage Area (OU 2/Area 2), 2MW-1 and MW2-2, could not be located and were not sampled. These SAP deviations are further detailed in **Section 3.17**. Monitoring well NBKK-OU2A2-MW01, which required repair prior to development, as described in **Section 3.5**, was sampled on June 1, 2023. Additional samples were collected from the four newly installed monitoring wells at Building 76 on August 14 and 15, 2023.

Samples were collected under low flow/low stress conditions with a PFAS-free bladder pump or a peristaltic pump. The pump intake was placed at the middle of the saturated well screen interval. Prior to collecting the sample, depth-to-water readings and WQPs were measured and recorded (approximately every 5 minutes) using a depth-to-water meter and water quality meter, which were calibrated daily (at a minimum). Sampling began when three well volumes had been purged or when minimal water level drawdown requirements were met and WQPs had stabilized for three consecutive readings, as follows:

- Temperature within 3%
- pH within 0.1 pH units
- Conductivity within 3 percent
- Dissolved oxygen within 10 percent
- ORP within 10 millivolts
- Turbidity measurements less than 10 NTUs or within 10 percent

Once drawdown requirements were met, depth-to-water, WQPs, and total well depth measurements were recorded. Groundwater sampling data sheets and WQP measured during sampling are provided in **Appendix E**.

Groundwater was collected in laboratory-supplied high-density polyethylene (HDPE) bottles and placed into coolers containing enough ice to keep the samples 0 to 10 degrees Celsius (but not frozen) until they were received by the laboratory. Field quality assurance (QA) and quality control (QC) samples and frequencies are discussed in **Section 3.10**.

To avoid introducing PFAS during groundwater sampling, PFAS-containing equipment and components were not used. The use of PFAS-containing clothing and sunscreen, insect repellant, and other personal hygiene products that may contain PFAS were avoided. Sample tubing was HDPE.

3.7 Groundwater Level Measurements

A synoptic groundwater elevation survey was conducted at accessible newly installed monitoring wells using a water level indicator. Three wells within the Van Meter Road Spill/Former Drum Storage Area (OU 2/Area 2) – two new and one existing – were inaccessible inside a fenced area during the survey and several subsequent attempts. The survey was conducted on January 27, 2023, more than 24 hours after well installation and development had been completed. Depth-to-water was measured from the top of the PVC riser and recorded to the nearest 0.01 foot. Potentiometric surface maps for each of the SI sites are presented on **Figures 3-1** through **3-6,** with

potentiometric surfaces of Building 1006 and the Van Meter Road Spill/Former Drum Storage Area (OU 2/Area 2) presented on one figure**.** An additional synoptic groundwater elevation survey was conducted at Building 76 on August 16, 2023, to include the existing and newly installed wells. Synoptic groundwater elevations are provided in **Appendix F**.

3.8 Soil Sampling

At each of the seven SI sites, surface soil samples were collected from unpaved areas at each monitoring well location. In addition, a total of ten standalone surface soil samples were collected from unpaved areas: five at Building 76 (NBKK-B76-SS05, NBKK-B76-SS10, NBKK-B76-SS11, NBKK-B76-SS12, and NBKK-B76-SS13), two at the 2008 Car Fire site (NBKK-CF1-SS04 and NBKK-CF1-SS05), and three at Building 1006 (NBKK-B1006-SS05, NBKK-B1006-SS06, and NBKK-B1006-SS07). Surface soil samples were collected from a depth interval of 0 to 1 or 0.5 to 1 foot bgs using a stainless-steel hand trowel. Surface soil samples were biased towards topographically low areas where surface water pooling or accumulation would be most likely to occur.

Subsurface soil samples were collected from each soil boring at which a monitoring well was installed, at either one or two depth intervals determined by the geologists in the field according to the following guidelines as prescribed by the SAP (CH2M, 2022a):

- One sample from 1 to 2 or 2 to 3 feet bgs below asphalt, concrete, or obvious fill material where unpaved surfaces were not present.
- During additional field activities at Building 76, one additional shallow subsurface soil sample was collected at standalone soil borings to verify whether potential PFAS impacts extended below the surface, per investigation activities scoped in FCR #2 (**Appendix B**). Samples were collected from 1 to 3 feet bgs at these locations (NBKK-B76-SB10 through NBKK-B76-SB13).
- One sample at the capillary fringe in the unsaturated soil (where lithologic conditions allowed). During additional well installation in August 2023 at Building 76, two subsurface soil samples were collected during each well installation (at wells NBKK-B76-MW06, NBKK-B76-MW07, NBKK-B76-MW08, and NBKK-B76-MW09). These soil samples represent potential PFAS accumulation and migration zones at the air-water interface of water-bearing material encountered and were collected directly above the selected well screen interval, taking semi-confining lenses in the heterogeneous lithology into consideration, also between the capillary fringe and the surface soil sample depths. This SAP deviation is described in **Section 3.17**.

Additionally, subsurface samples were collected from three standalone soil borings at which a monitoring well was not installed: one location at Building 76 (NBKK-B76-SB05) and two boring locations at Keyport Sludge Disposal Area (OU 2/Area 5) (NBKK-OU2A5-SB04 and NBKK-OU2A5-SB05).

Soil sample locations are presented on **Figures 3-1** through **3-6.** Subsurface soil samples were collected during sonic drilling from the extruded soil core recovered from the sonic tooling in PFAS-free 4-inch core bags. Soil was homogenized and collected into laboratory-supplied HDPE jars using reusable and decontaminated single-use dedicated equipment. Soil samples were placed into coolers on ice for overnight shipment to the laboratory. Field QA/QC samples and frequencies are discussed in **Section 3.10**.

To avoid introducing PFAS during soil sampling, PFAS-containing equipment and components were not used. The use of PFAS-containing clothing and sunscreen, insect repellant, and other personal hygiene products that may contain PFAS were avoided.

3.9 Sediment Sampling

Three sediment samples were collected from three locations at the Van Meter Road Spill/Former Drum Storage Area (OU 2/Area 2), two adjacent to A Street at the location of the 1976 spill site, and one downgradient location to the southwest of the Shallow Lagoon. No surface water samples were collected. Sediment samples were collected from 0 to 5 inches below sediment surface at each sediment sampling location using a stainless-steel hand trowel.

Sediment samples were homogenized before filling laboratory-provided sample jars for analysis of PFAS. The sediment samples were placed into coolers on ice for overnight shipment to the laboratory. Field QA/QC samples and frequencies are discussed in **Section 3.10**. Sediment sampling locations are presented on **Figure 3-4**.

To avoid introducing PFAS during sediment sampling, PFAS-containing equipment and components were not used. The use of PFAS-containing clothing and sunscreen, insect repellant, and other personal hygiene products that may contain PFAS were avoided.

3.10 Quality Assurance and Quality Control

Field QA/QC samples were collected during sampling, in accordance with the SAP (CH2M, 2022a). These samples were obtained to:

- Confirm that disposable and reusable sampling equipment were free of PFAS
- Evaluate field methodology
- Establish ambient field background conditions
- Evaluate whether cross contamination occurred during sampling and/or shipping

Field QA/QC samples were collected as follows:

- Equipment rinsate blank samples were collected from decontaminated sampling equipment once per day during soil (only when reusable sampling equipment [stainless-steel trowel, hand auger] was used) and groundwater sampling. A total of seventeen equipment blanks were collected during sampling.
- Field blank samples were collected at each potential PFAS source area. A total of eleven field blanks were collected during sampling.
- Field duplicate samples were collected at the frequency of one per 10 normal field samples of similar matrix. Five soil field duplicate samples and five groundwater field duplicate samples were collected during sampling. Sediment field duplicate samples were inadvertently not collected; this SAP deviation is described in **Section 3.17**.
- Matrix spike (MS) and matrix spike duplicate (MSD) samples were collected for every 20 environmental samples collected (or greater than or equal to 5 percent of the samples collected) per medium, including field duplicates. Seven MS/MSD samples were collected during sampling.

3.11 Sample Packaging and Shipping

After collection, soil, groundwater, and sediment samples were placed in coolers on ice with a corresponding chain-of-custody. Samples were stored with sufficient ice to maintain temperatures of 0 to 10 degrees Celsius (but not frozen). Coolers were then managed, secured, and shipped on ice via FedEx to Battelle Norwell Operations, Norwell, Massachusetts for analysis. During shipment, precautions were taken to monitor and track the shipments and coordinate arrival with the lab.

3.12 Tidal Influence Study

Following well development, pressure transducers were deployed within the 10 new monitoring wells at the 2008 Car Fire, Keyport Sludge Disposal Area (OU 2/Area 5), and the Keyport Peninsula Fill (Site 7) site to monitor groundwater level fluctuations with respect to tidal cycles. The pressure transducers were submerged approximately 1 to 3 feet below the top of the water column within the well casing. Groundwater elevation data were collected in 1-minute increments for 1 week (January 1 through January 7, 2023). Pressure transducer data are provided on **Figures 3-7** through **3-9** for the 2008 Car Fire, the Keyport Sludge Disposal Area (OU 2/Area 5), and the Keyport Peninsula Fill (Site 7), respectively and in **Appendix F**. Results of the tidal influence study are presented in Sections 4.1.2, 4.1.3, and 4.1.6.

3.13 Decontamination Procedures

Decontamination activities including decontaminating nondisposable equipment were conducted in accordance with the standard operating procedures (SOPs) provided in the SAP (CH2M, 2022a). Decontamination water was sourced from on-Base water supply (Well 5), which was previously tested for PFAS, as described in **Section 2.3**.

Water generated while decontaminating sampling equipment was collected and disposed as investigation-derived waste (IDW) as described in **Section 3.15**. Disposable sampling equipment and personal protective equipment, such as HDPE tubing and nitrile gloves, were also disposed of as IDW.

Reusable heavy equipment, such as drilling rods and augers, were decontaminated before and after the collection of each sample. The fluid generated was disposed as IDW. Heavy equipment decontamination procedures were conducted in accordance with the Decontamination of Drilling Rigs and Equipment SOP provided in the SAP (CH2M, 2022a).

3.14 Surveying

Newly installed permanent monitoring wells were horizontally and vertically located by a Washington-licensed surveyor from January 23 through 24, 2023 and on August 24, 2023. The surveyor provided coordinates of all horizontal points X, Y, to the nearest 0.5 foot and vertical point Z to the nearest 0.01 foot (0.1 foot for unpaved ground surface elevations). The survey report is provided as **Appendix G**.

3.15 Investigation-derived Waste Management

IDW generated during the SI included drill cuttings generated during monitoring well installations, purge water from well development and groundwater sampling, decontamination fluids, disposable sampling equipment, and personal protective equipment. Solid IDW was contained in 76 55-gallon stainless-steel drums, and aqueous IDW was containerized into 20 55-gallon stainless-steel drums and 10 new 275-gallon United States Department of Transportation-approved intermediate bulk container totes. Containers were properly sealed, labeled, and staged within a Navy-approved covered staging area.

Upon completion of sampling activities and prior to disposal, CH2M field staff members collected waste characterization samples from the IDW containers. Solid and aqueous IDW samples were analyzed for volatile organic compounds, semivolatile organic compounds, pH, Resource Conservation and Recovery Act (RCRA) metals, total petroleum hydrocarbons, and ignitability as well as the 18 PFAS compounds listed in United States Environmental Protection Agency (USEPA) Method 537.1 in accordance with the Environmental Protection Plan (EPP)/Waste Management Plan (WMP) (CH2M, 2022b). IDW was characterized as nonhazardous. On March 27, 2023, analytical data was provided to the NAVFAC Northwest RPM and waste coordinator for waste profiling and transport and disposal coordination for field work conducted through January 2023. Weekly inspections to monitor the staging area and container integrities were conducted from date of generation until receipt and evaluation of IDW sample analytical data and confirmation that waste was nonhazardous, upon which waste inspection frequency was updated to monthly inspections, which were continued by CH2M personnel until August 2023, when the waste was removed from site as coordinated by the NBK-Keyport Transport, Storage, and Disposal Facility (TSDF) and Waste Coordination staff. Additional solid and aqueous waste generated during August 2023 field activities was sampled and inspected as described above; analytical data was provided to the NAVFAC Northwest RPM and waste coordinator for waste profiling and transport and disposal coordination on October 18, 2023.

IDW management activities were conducted in accordance with the EPP/WMP (CH2M, 2022b). IDW analytical data are provided in **Appendix H**.

3.16 Laboratory Analysis and Data Usability Assessment

Groundwater and soil samples were submitted to Battelle Norwell Operations, Norwell, Massachusetts, a DoD Environmental Laboratory Accreditation Program accredited laboratory, in accordance with chain-of-custody procedures. Raw analytical data are provided in **Appendix I**. Samples were analyzed for the 18 PFAS compounds listed in Method 537.1 via liquid chromatography tandem mass spectrometry compliant with Quality Systems Manual 5.1 Table B-15, in accordance with the SAP (CH2M, 2022a):

- PFBS
- PFOS
- PFOA
- Perfluorodecanoic acid (PFDA)
- Perfluorododecanoic acid (PFDoA)
- Perfluoroheptanoic acid (PFHpA)
- PFHxS
- PFHxA
- PFNA
- Perfluorotetradecanoic acid (PFTA)
- Perfluorotridecanoic acid (PFTrDA)
- Perfluoroundecanoic acid (PFUnA)
- 4,8-dioxa-3H-perfluorononanoic acid (ADONA)
- 9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid (9Cl-PF3ONS)
- 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)
- N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)
- N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)
- HFPO-DA

After laboratory analysis of samples was complete, data usability was assessed. Data validation was conducted by an independent third-party data validator. Complete validation findings are presented in the data validation reports included in **Appendix J**. Data were then verified and prepared for upload to the Naval Installation Restoration Information Solution database and a Data Quality Assessment was completed (**Appendix K**). The data validation review demonstrated that the analytical systems were generally in control and data results can be used in the project decision making process.

3.17 Deviations from the Sampling and Analysis Plan

Table 3-1 summarizes deviations from the SAP (CH2M, 2022a) that were necessary due to unexpected field conditions, information gathered during the pre-drilling site walk and utility clearance activities, and inadvertent deviations in field data collection determined after demobilization. These deviations do not impact the SI data quality or usability.

Table 3-1. Summary of SAP Deviations

Investigation Area	Sampling Station(s)	SAP Deviation	Rationale
Building 76	NBKK-B76-MW03	Monitoring well location was moved approximately 15 feet to the northeast during utility location activities.	Well moved due to utilities present.
	NBKK-B76-MW04	The location of well NBKK-B76-MW04 was moved 19 feet northeast from the scoped location as presented in the SAP.	A specific reason for this deviation was not noted in field notes from set up on this well on September 2, 2023. The altered location of the well does not negatively impact the data or objective for this location.
	NBKK-B76-MW06	Monitoring well location was moved approximately 15 feet to the east during utility location activities.	Well moved due to utilities present.
	NBKK-B76-SB06	Two subsurface soil samples were collected rather than one sample as scoped.	Melted ice compromised the samples and they were discarded. An additional step-out soil boring advanced 5 feet to the east for re-sample, and two subsurface soil samples were collected: one from the first observed wetted soil in the soil boring likely representative of localized perched water, and one from the capillary zone based on observed water level measured in the casing during drilling. Both soil samples contribute to understanding potential PFAS accumulation and migration.
	NBKK-B76-MW07	Monitoring well location was moved approximately 16 feet during utility location activities to account for surface features (trees and landscaping limiting rig access and clearance).	Well moved due to surface features preventing adequate drill rig access.
	NBKK-B76-SB07	Two subsurface soil samples were collected rather than one sample as scoped.	Two subsurface soil samples were collected: one from the first observed wetted soil in the soil boring likely representative of localized perched water, and one from the capillary zone based on observed water level measured in the casing during drilling. Both soil samples contribute to understanding potential PFAS accumulation and migration.
	NBKK-B76-MW08	Monitoring well location was moved approximately 25 feet during utility location activities to account for surface topography and a tree limiting rig access and clearance.	Well moved due to surface features preventing adequate drill rig access.
	NBKK-B76-SB08	Two subsurface soil samples were collected rather than one sample as scoped.	Two subsurface soil samples were collected: one from the first observed wetted soil in the soil boring, likely representative of localized perched water, and one from the capillary zone based on observed water level measured in the casing during drilling. Both soil samples contribute to understanding potential PFAS accumulation and migration.

Table 3-1. Summary of SAP Deviations

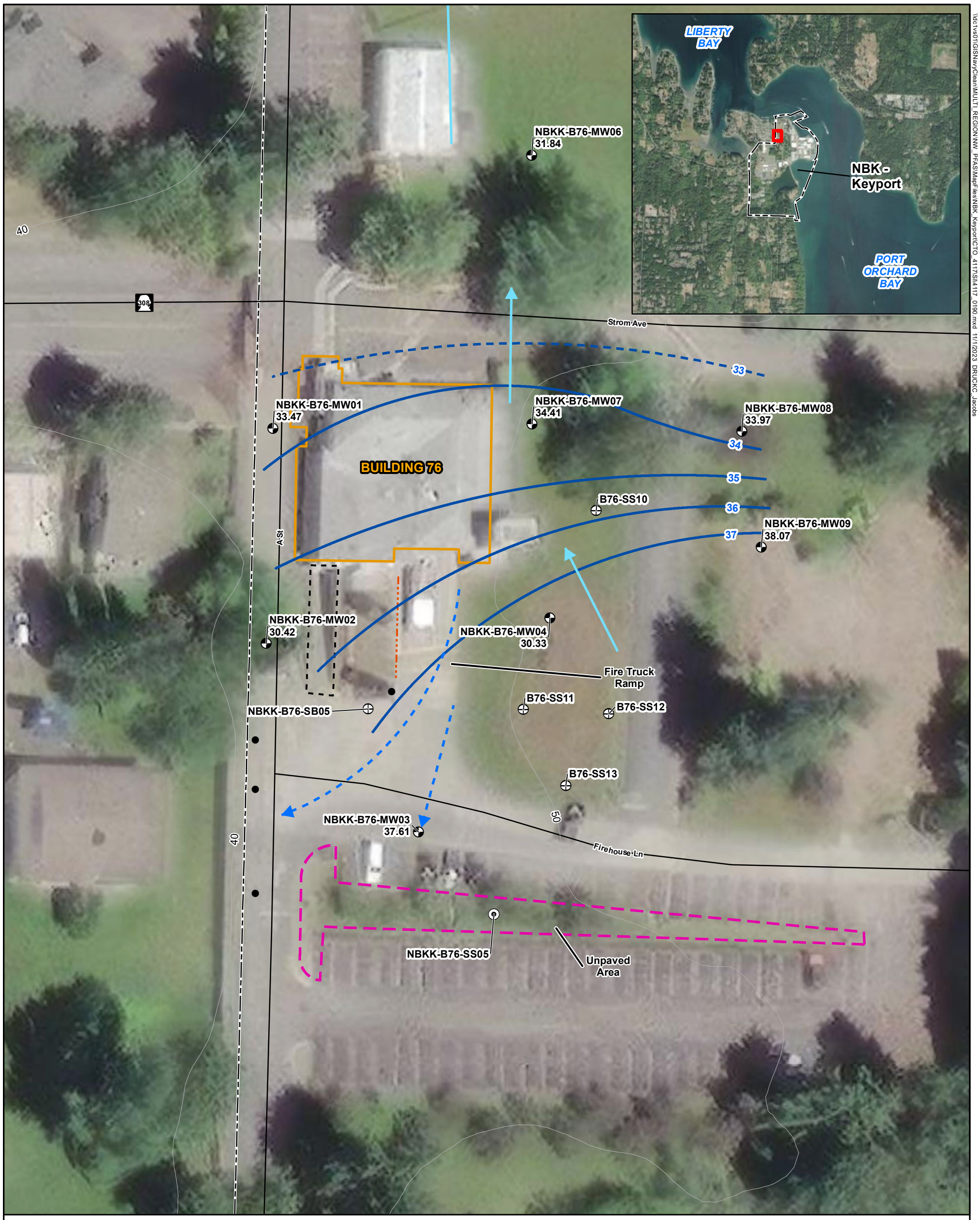
Investigation Area	Sampling Station(s)	SAP Deviation	Rationale
Building 76 (continued)	NBKK-B76-SB09	Two subsurface soil samples were collected rather than one sample as scoped.	Two subsurface soil samples were collected: one from the first observed wetted soil in the soil boring likely representative of localized perched water, and one from the capillary zone based on observed water level measured in the casing during drilling. Both soil samples contribute to understanding potential PFAS accumulation and migration.
2008 Car Fire site	NBKK-CF1-MW01	The location of well NBKK-CF1-MW01 is located approximately 16 feet northwest of the scoped location as presented in the SAP.	A specific reason for this deviation was not noted in field notes from set up on this well on October 13, 2022. The altered location of the well does not negatively impact the data or objective for this location.
	NBKK-CF1-MW02	Monitoring well location was moved approximately 25 feet to the north-northeast during drill rig setup and reconnaissance.	Well moved due to utilities present.
	NBKK-CF1-MW03	Monitoring well location was moved approximately 25 feet to the north-northeast during drill rig setup and reconnaissance.	Well moved to avoid blocking access to the Building 198 entrance.
Keyport Sludge Disposal Area (OU 2/ Area 5)	NBKK-OU2A5-MW01	Monitoring well location was moved approximately 30 feet to the north-northwest during utility location activities.	Well moved due to utilities present and to avoid parking disruption.
Building 1006	NBKK-B1006-MW03	Monitoring well location was moved approximately 20 feet to the northeast during utility location activities.	Well moved due to utilities present.
	NBKK-B1006-MW04	Monitoring well location was deemed unsafe for drilling during site reconnaissance by drilling crew; monitoring well location was moved approximately 15 feet to the north.	Well moved due to the overhead utility lines present.
	NBKK-B1006-SB01 (planned as NBKK-B1006-SS01) and NBKK-B1006-SB02 (planned as NBKK-B1006-SS02)	Soil samples were collected from 1 to 2 feet bgs and were redefined as subsurface soil samples (NBKK-B1006-SB01 and NBKK-B1006-SB02).	Fill material and roots prevented collecting soil samples above 1 foot bgs.
	NBKK-B1006-SB01 through NBKK-B1006-SB04	Capillary fringe soil samples were not collected as scoped at each of the four monitoring well locations.	Groundwater was encountered during air knifing and/or hand augering at shallow depths.

Table 3-1. Summary of SAP Deviations

Investigation Area	Sampling Station(s)	SAP Deviation	Rationale
Van Meter Road Spill/Former Drum Storage Area (OU 2/ Area 2)	NBKK-OU2A2-MW03	Monitoring well location was moved approximately 15 feet to the northwest during utility location activities.	Well moved due to utilities and vegetation present.
	NBKK-OU2A2-MW04	Monitoring well location was moved approximately 10 feet to the south inside the gated area during utility location activities.	Well moved due to utilities present and to facilitate drilling rig access.
	NBKK-OU2A2-SB01, NBKK-OU2A2-SB02, NBKK-OU2A2-SB03, and NBKK-OU2A2-SB04	Capillary fringe soil samples were not collected as scoped at each of the four monitoring well locations.	Groundwater was encountered during air knifing and/or hand augering at shallow depths.
	2MW-1 and MW2-2	Existing wells 2MW-1 and MW2-2 were not sampled as proposed in the SAP.	Wells were not found during site reconnaissance or prior to groundwater sampling or gauging.
	NBKK-OU2A2-MW04 and NBKK-OU2-MW05	Wells NBKK-OU2A2-MW04 and NBKK-OU2-MW05 were not included in the data set for potentiometric mapping.	Monitoring wells were inaccessible (in a locked gated area) during the synoptic groundwater level survey and several subsequent attempts to gain access.
Keyport Peninsula Fill (Site 7)	NBKK-S7-MW01	Monitoring well location was moved approximately 20 feet to the west during utility location activities.	Well moved due to utilities present.
	NBKK-S7-MW02	Monitoring well location was moved approximately 20 feet to the west during utility location activities.	Well moved due to utilities present.
	NBKK-S7-MW03	Monitoring well NBKK-S7-MW03 was not installed during the SI.	Access issues and other construction work was occurring for the duration of the SI. Removal of this well from the SI scope is described in Field Change Request 1 (**Appendix A**).
Landfill Extension (Northeast Portion of Area 22)	NBKK-LFEX-MW01	Monitoring well location was moved approximately 15 feet to the north during utility location activities.	Well location moved due to the presence of utilities and to avoid disruption to parking areas.
	NBKK-LFEX-MW03	Monitoring well location was moved approximately 15 feet to the west during drilling activities.	Well location moved to avoid disruption to parking and high areas within the Landfill Extension parking log.
	NBKK-LFEX-MW04	Monitoring well location was moved approximately 15 feet to the north during drilling activities.	Well location moved to provide for better rig placement away from Torpedo Road.

Table 3-1. Summary of SAP Deviations

Investigation Area	Sampling Station(s)	SAP Deviation	Rationale
All	Field Duplicate (FD) counts	Eighty-one soil samples were collected, requiring a total of nine FD samples at required frequency of 1 per 10 (10%). Five FD samples were collected. Thirty-three groundwater samples were collected, requiring a total of four FD samples at a required frequency of 1 per 10 (10%). Five FD samples were collected. Three sediment samples were collected, requiring a total of one FD sample at a required frequency of 1 per 10 (10%). No FD samples were collected.	An incorrect number of FD samples was collected during the SI for soil, groundwater, and sediment.
All	MS/MSD counts	Eighty-one soil samples were collected, requiring a total of five MS/MSD samples at required frequency of 1 per 20 (5%). Four MS/MSDs were collected. Thirty-three groundwater samples were collected, requiring a total of two MS/MSD samples at a required frequency of 1 per 20 (5%). Three MS/MSD samples were collected. Three sediment samples were collected, requiring a total of one MS/MSD sample at a required frequency of 1 per 20 (5%). No MS/MSD samples were collected.	An incorrect number of MS/MSD samples was collected during the SI for soil and sediment.
All	HHRS	The SAP indicated that an HHRS would only be prepared if warranted based on PFAS data; however, an HHRS was conducted for all SI investigation areas.	Due to the quick turnaround time required for the reports, it was determined to be most straightforward with this CTO's SI Reports to proceed with completing the HHRS for each of the SI sites to quickly determine sites that may require further discussion on the path forward.



LEGEND

- Monitoring Well Installation/Groundwater Sampling/Soil Sampling Location
- Shallow Subsurface Soil Sampling Location
- Surface Soil Sampling Location
- Stormwater Catch Basin
- Groundwater Contour Elevation (dashed where inferred)
- Surface Water Drainage Direction (Estimated)
- Upper Aquifer Groundwater Flow Direction
- Unpaved Area
- Trench Drain
- 10' Topographic Contour
- Road
- Potential PFAS Release Area
- Sump
- Installation Boundary

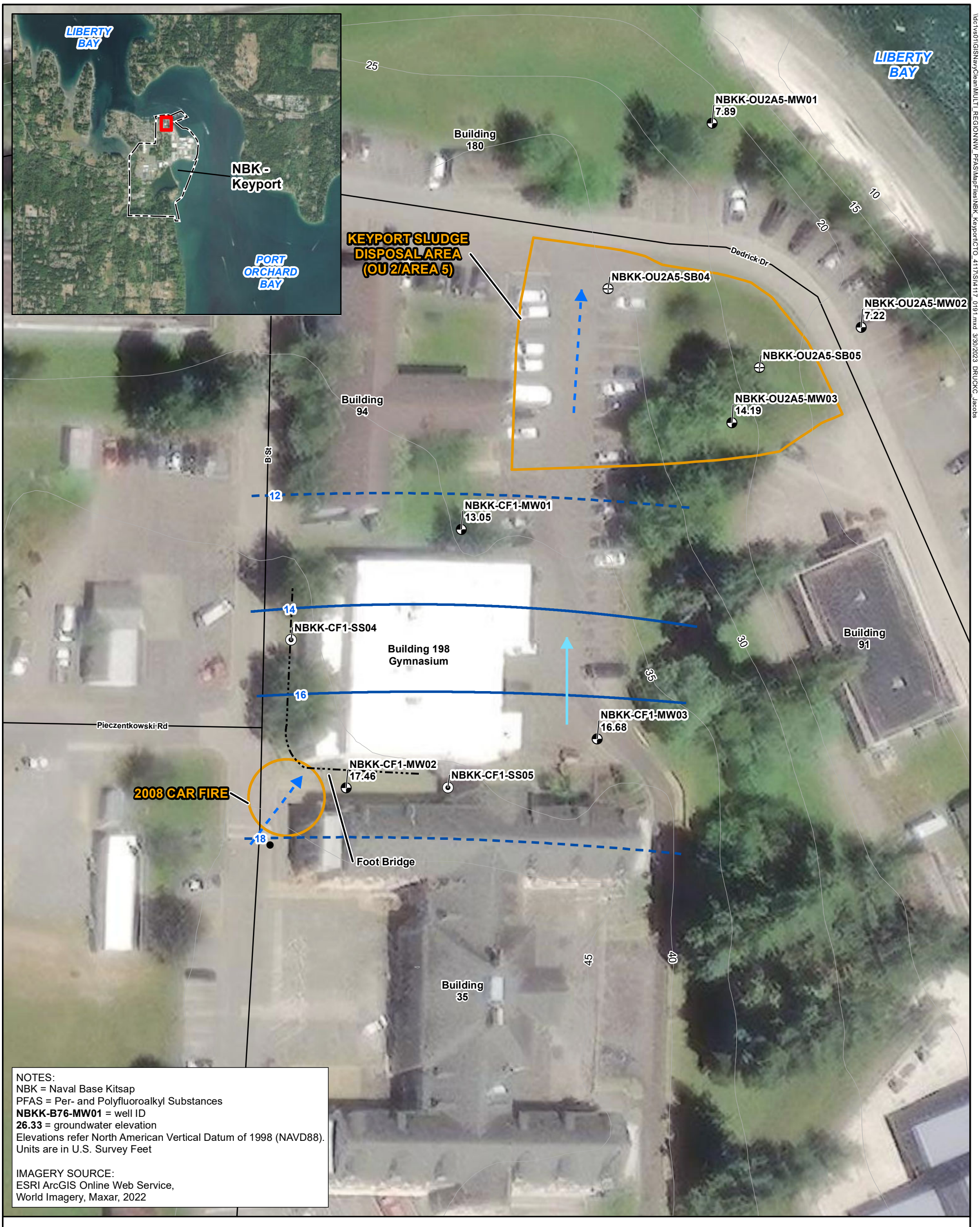
IMAGERY SOURCE:
ESRI ArcGIS Online Web Service, World Imagery, Maxar, 2022

NOTES:
NBK = Naval Base Kitsap
PFAS = Per- and Polyfluoroalkyl Substances
NBKK-B76-MW01 = well ID
26.33 = groundwater elevation
Elevations refer North American Vertical Datum of 1998 (NAVD88).
Units are in U.S. Survey Feet

Groundwater elevations measured in wells NBKK-B76-MW02 and NBKK-B76-MW04, screened at approximately -5 to -15 feet NAVD88, reflect hydraulic conditions in a deeper portion of the aquifer than those measured in the remaining site wells, which are screened at approximately 1 to 35 NAVD88 feet. Therefore, these water levels were not included in development of the potentiometric surface map.

0 20 40
1 inch = 40 feet
N

Figure 3-1
Potentiometric Surface Map: Building 76
Site Inspection for PFAS
NBK Keyport, Keyport, Washington



NOTES:
NBK = Naval Base Kitsap
PFAS = Per- and Polyfluoroalkyl Substances
NBKK-B76-MW01 = well ID
26.33 = groundwater elevation
Elevations refer North American Vertical Datum of 1998 (NAVD88).
Units are in U.S. Survey Feet

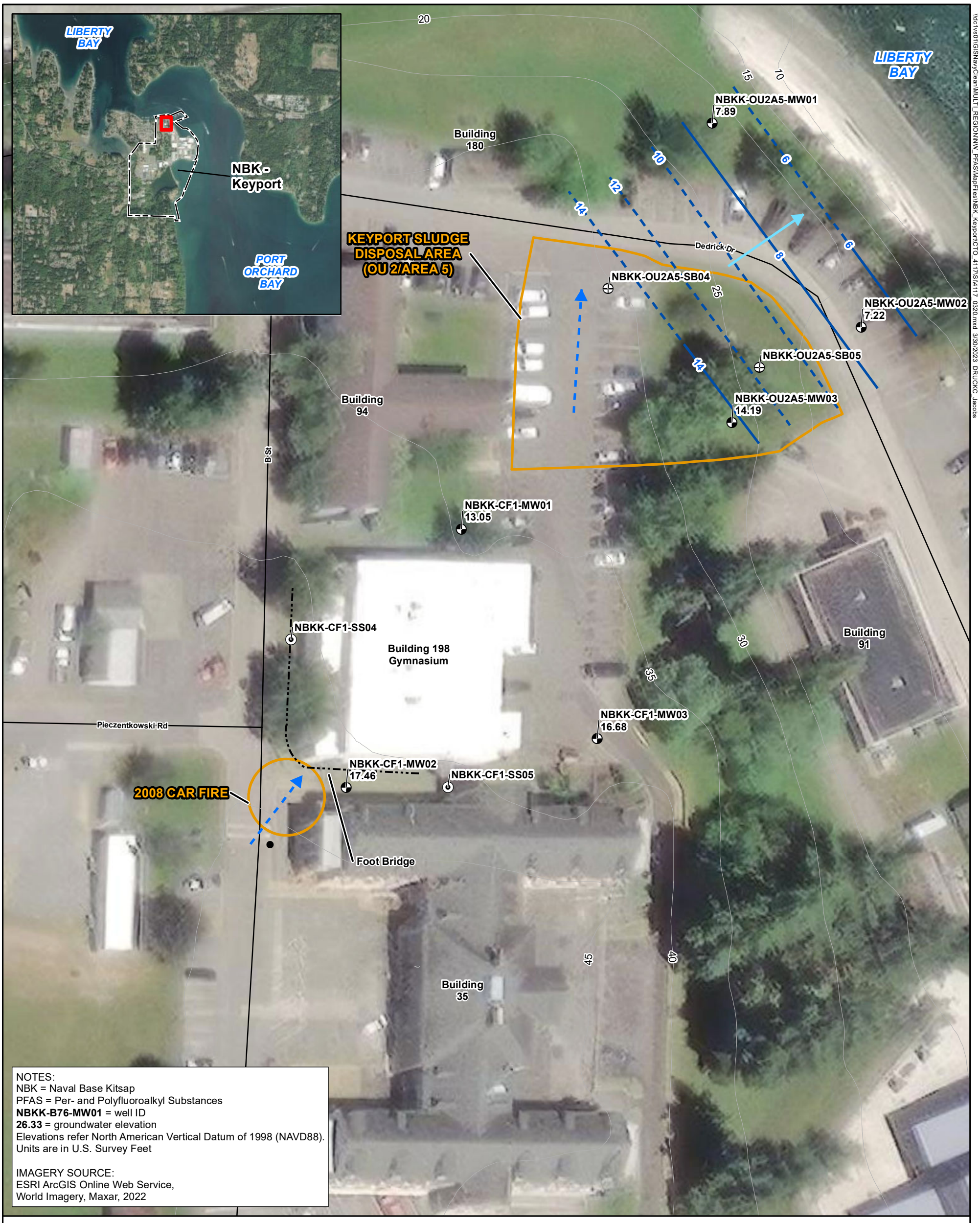
IMAGERY SOURCE:
ESRI ArcGIS Online Web Service,
World Imagery, Maxar, 2022

LEGEND

- Monitoring Well Installation/Groundwater Sampling/Soil Sampling Location
- Shallow Subsurface Soil Sampling Location
- Surface Soil Sampling Location
- Stormwater Catch Basin
- Groundwater Contour Elevation (dashed where inferred)
- Surface Water Drainage Direction (Estimated)
- Upper Aquifer Groundwater Flow Direction
- Unpaved Area
- Drainage Ditch
- 5' Topographic Contour
- Road
- Potential PFAS Release Area
- Installation Boundary

Figure 3-2
Potentiometric Surface Map: 2008 Car Fire
Site Inspection for PFAS
NBK Keyport, Keyport, Washington

0 25 50
1 inch = 50 feet
N



NOTES:
NBK = Naval Base Kitsap
PFAS = Per- and Polyfluoroalkyl Substances
NBKK-B76-MW01 = well ID
26.33 = groundwater elevation
Elevations refer North American Vertical Datum of 1998 (NAVD88).
Units are in U.S. Survey Feet

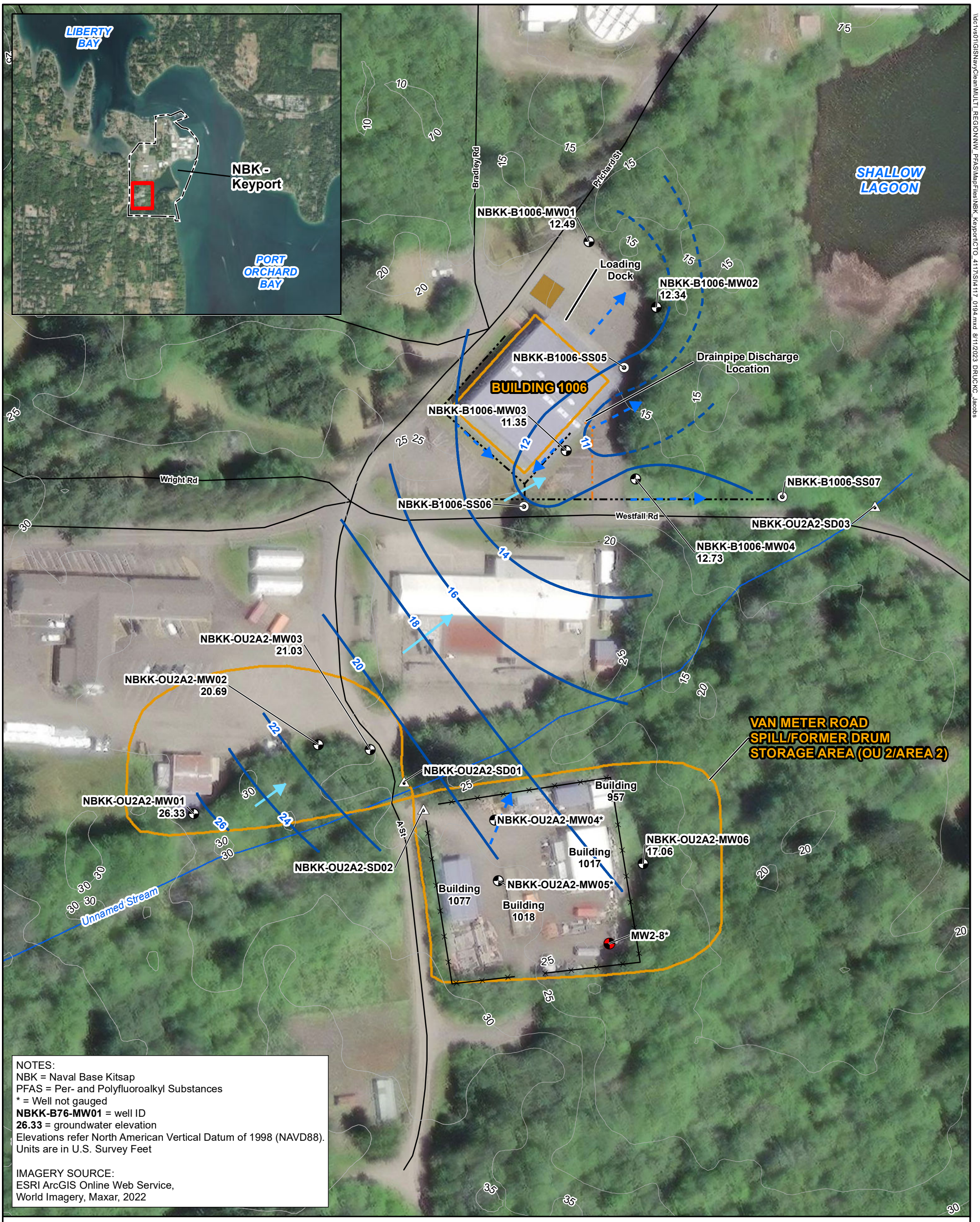
IMAGERY SOURCE:
ESRI ArcGIS Online Web Service,
World Imagery, Maxar, 2022

LEGEND

- Monitoring Well Installation/Groundwater Sampling/Soil Sampling Location
- Shallow Subsurface Soil Sampling Location
- Surface Soil Sampling Location
- Stormwater Catch Basin
- Groundwater Contour Elevation (dashed where inferred)
- Surface Water Drainage Direction (Estimated)
- Upper Aquifer Groundwater Flow Direction
- Unpaved Area
- Drainage Ditch
- 5' Topographic Contour
- Road
- Potential PFAS Release Area
- Installation Boundary

Figure 3-3
Potentiometric Surface Map:
Keyport Sludge Disposal Area (OU 2/Area 5)
Site Inspection for PFAS
NBK Keyport, Keyport, Washington

0 25 50
1 inch = 50 feet
N



NOTES:
NBK = Naval Base Kitsap
PFAS = Per- and Polyfluoroalkyl Substances
* = Well not gauged
NBKK-B76-MW01 = well ID
26.33 = groundwater elevation
Elevations refer North American Vertical Datum of 1998 (NAVD88).
Units are in U.S. Survey Feet

IMAGERY SOURCE:
ESRI ArcGIS Online Web Service,
World Imagery, Maxar, 2022

LEGEND

- Monitoring Well Installation/Groundwater Sampling/Soil Sampling Location
- Existing Monitoring Well Groundwater Sampling Location
- Surface Soil Sampling Location
- Sediment Sampling Location
- Groundwater Contour Elevation (dashed where inferred)
- Surface Water Drainage Direction (Estimated)
- Upper Aquifer Groundwater Flow Direction
- Fence
- Drainage Ditch
- Open Utility Ditch (at time of release)
- 5' Topographic Contour
- Stream
- Road
- StorageTank
- Potential PFAS Release Area
- Installation Boundary

0 50 100
1 inch = 100 feet
N

Figure 3-4
Potentiometric Surface Map: Building 1006 and Van Meter Road Spill/Former Drum Storage Area (OU 2/Area 2)
Site Inspection for PFAS
NBK Keyport, Keyport, Washington

LEGEND

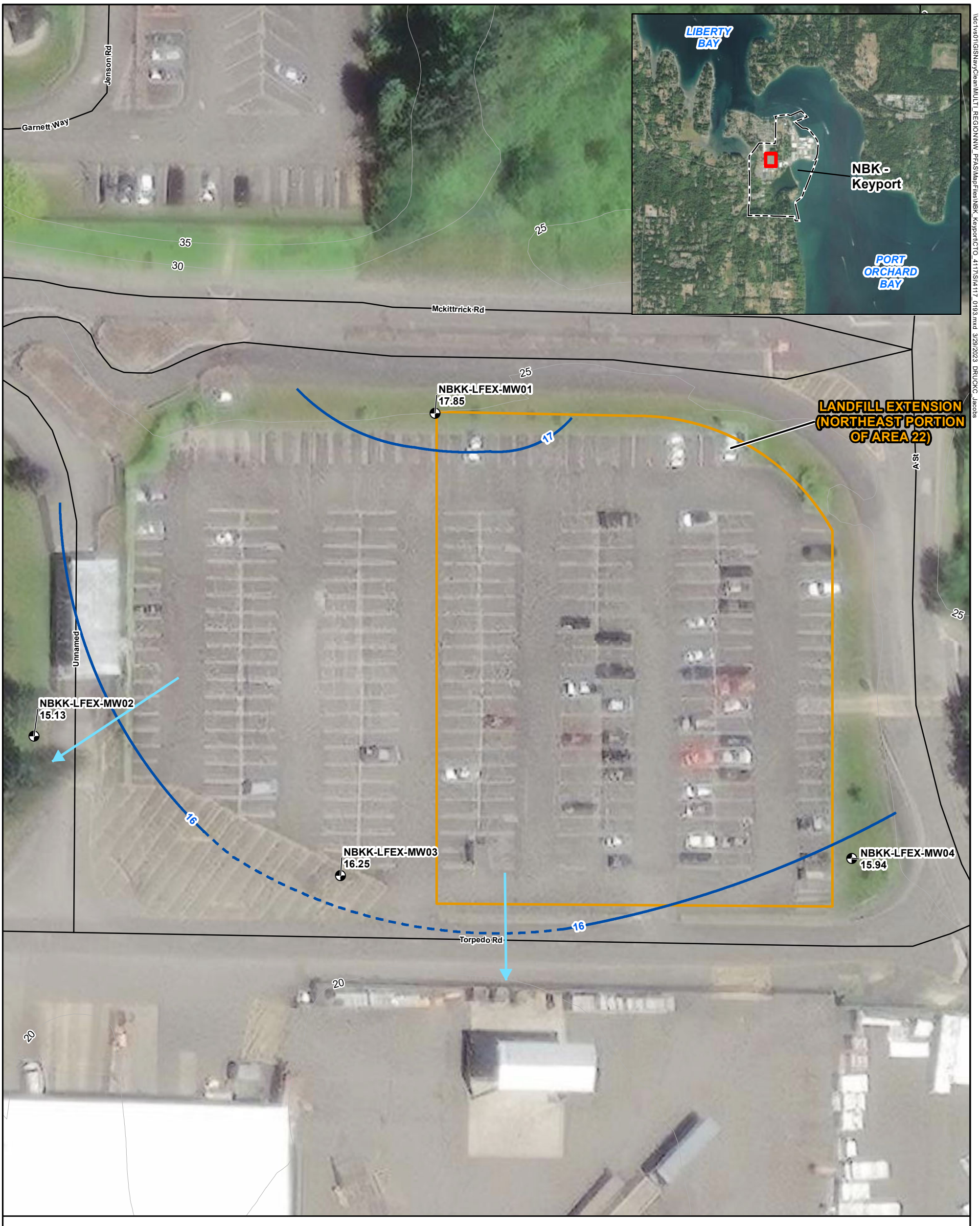
- Monitoring Well Installation/Groundwater Sampling/Soil Sampling Location
- Groundwater Contour Elevation (dashed where inferred)
- Surface Water Drainage Direction (Estimated)
- Upper Aquifer Groundwater Flow Direction
- 5' Topographic Contour
- Road
- Potential PFAS Release Area
- Installation Boundary

Figure 3-5
Potentiometric Surface Map: Keyport Peninsula Fill (Site 7)
Site Inspection for PFAS
NBK Keyport, Keyport, Washington

NOTES:
NBK = Naval Base Kitsap
PFAS = Per- and Polyfluoroalkyl Substances
NBKK-B76-MW01 = well ID
26.33 = groundwater elevation
Elevations refer North American Vertical Datum of 1998 (NAVD88).
Units are in U.S. Survey Feet

IMAGERY SOURCE:
ESRI ArcGIS Online Web Service,
World Imagery, Maxar, 2022

0 45 90
1 inch = 90 feet
N



LEGEND

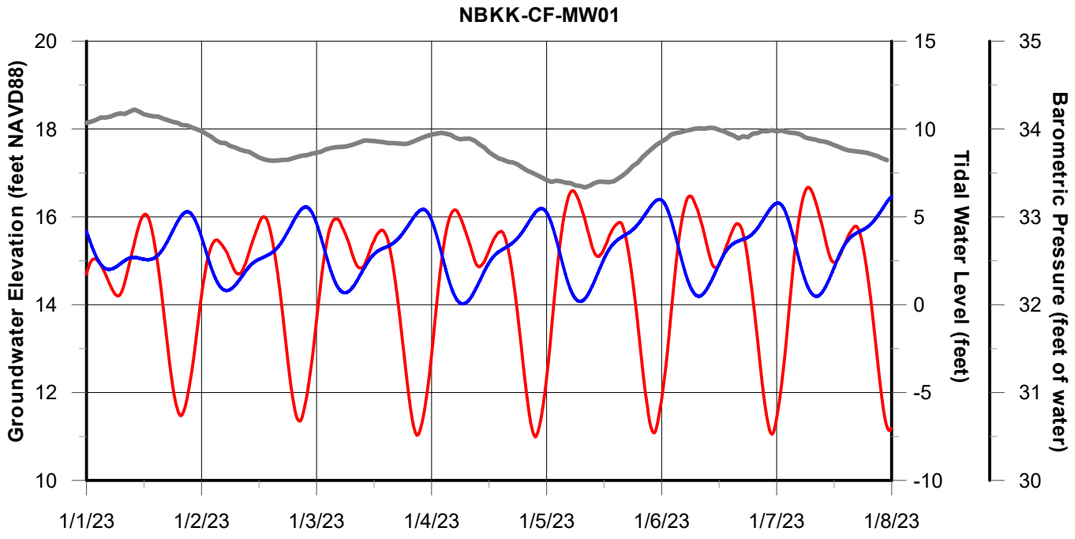
- Monitoring Well Installation/Groundwater Sampling/Soil Sampling Location
- Groundwater Contour Elevation (dashed where inferred)
- Upper Aquifer Groundwater Flow Direction
- 5' Topographic Contour
- Road
- Potential PFAS Release Area
- Installation Boundary

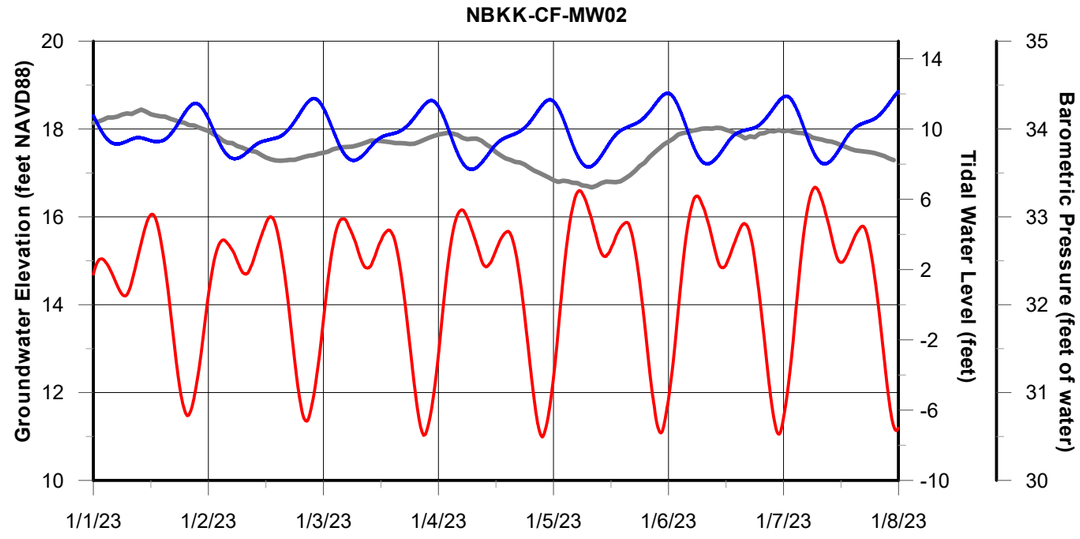
Figure 3-6
Potentiometric Surface Map: Landfill Extension (Northeast Portion of Area 22)
Site Inspection for PFAS
NBK Keyport, Keyport, Washington

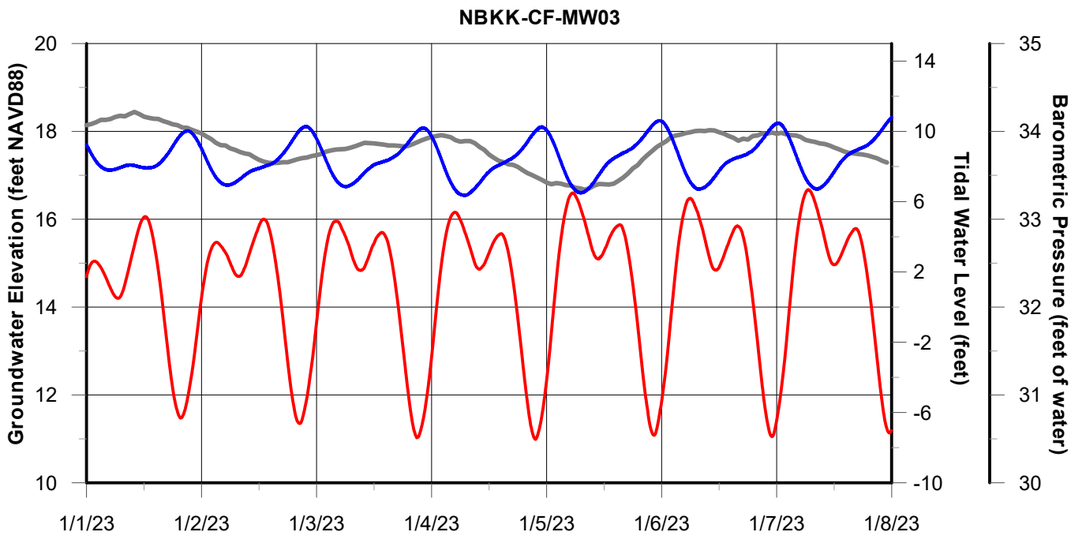
NOTES:
NBK = Naval Base Kitsap
PFAS = Per- and Polyfluoroalkyl Substances
NBKK-B76-MW01 = well ID
26.33 = groundwater elevation
Elevations refer North American Vertical Datum of 1998 (NAVD88).
Units are in U.S. Survey Feet

IMAGERY SOURCE:
ESRI ArcGIS Online Web Service,
World Imagery, Maxar, 2022

0 25 50
1 inch = 50 feet
N



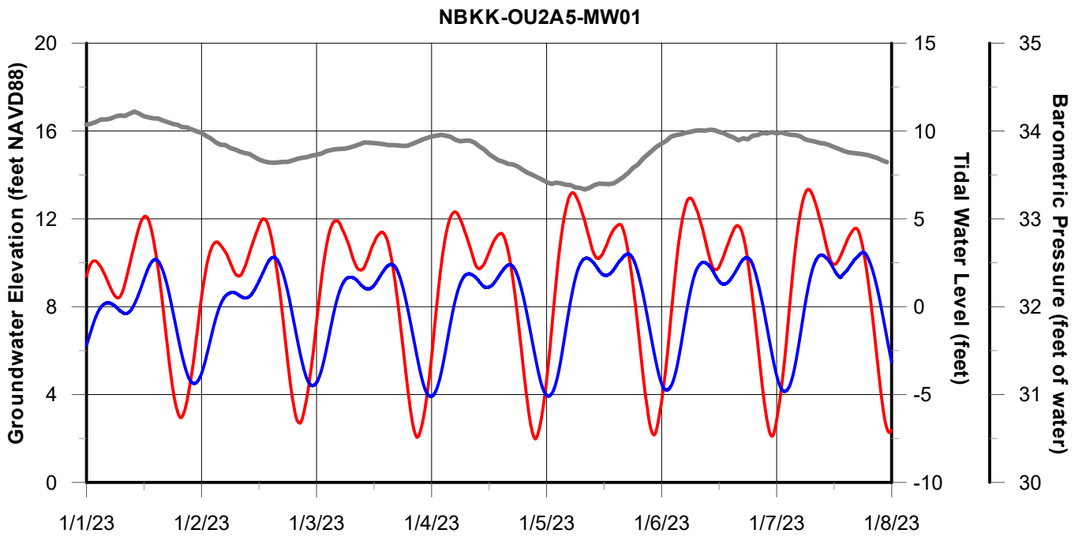


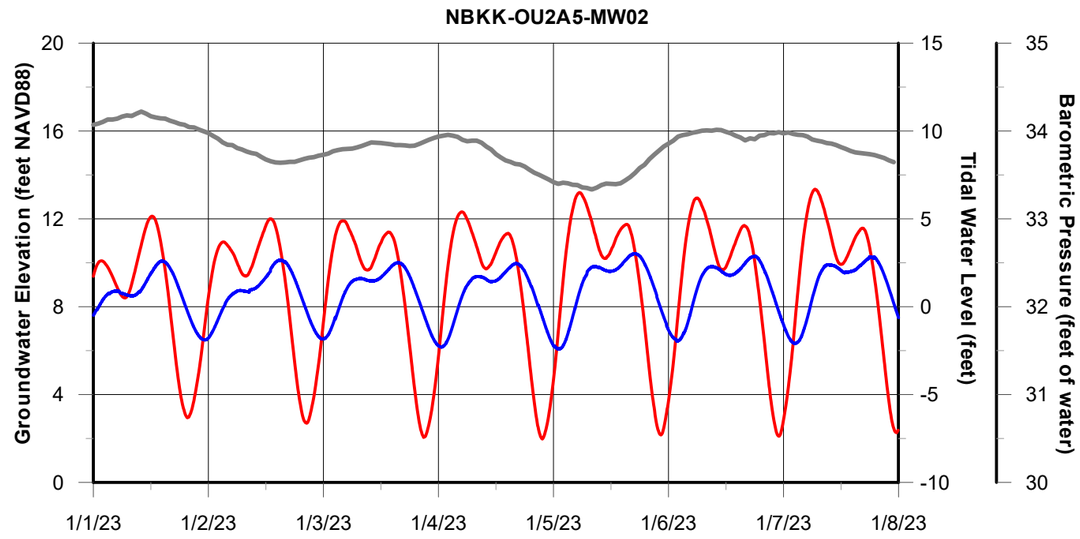


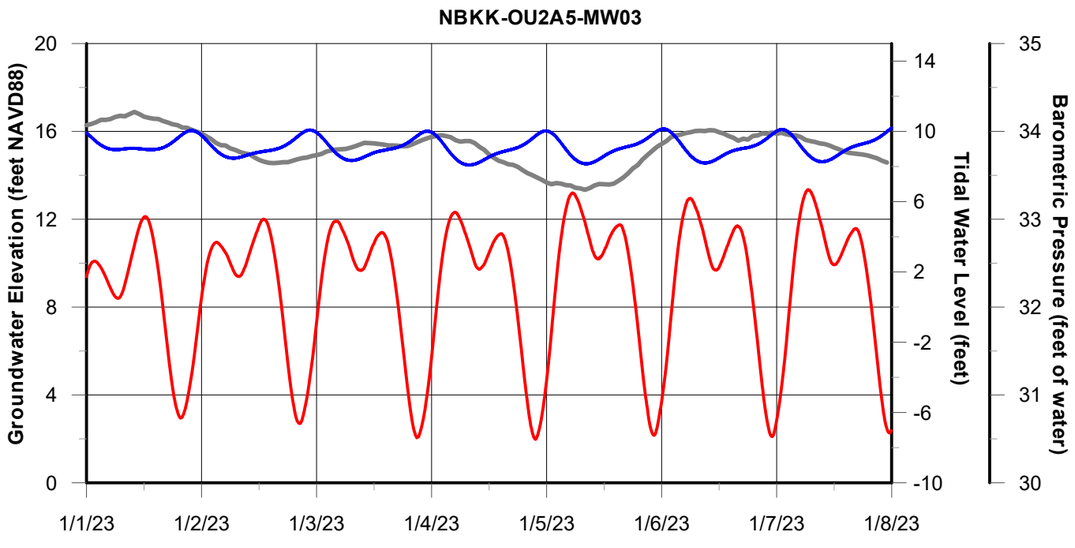
LEGEND
- Groundwater Elevation
- Tidal Water Level
- Barometric Pressure

Notes:
1. NAVD88 = North American Vertical Datum of 1988
2. Barometric pressure and verified tidal water level data was downloaded for the Bremerton, WA Buoy (9.5 miles): 9445958 https://tidesandcurrents.noaa.gov/stationhome.html?id=9445958

Figure 3-7.
Water Levels and Barometric Pressure versus Time: 2008 Car Fire
Site Inspection for PFAS
Naval Base Kitsap Keyport
Keyport, Washington



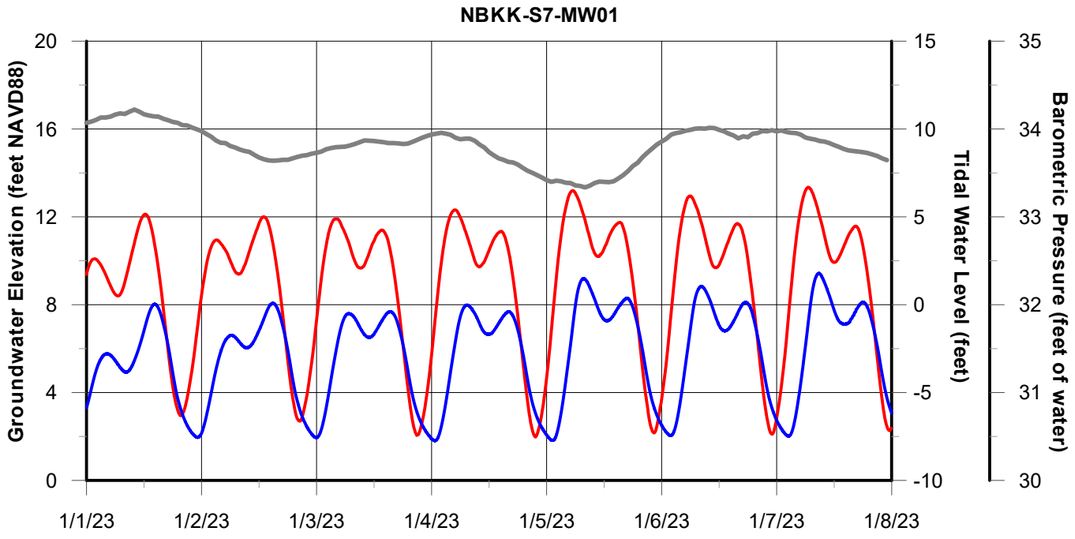


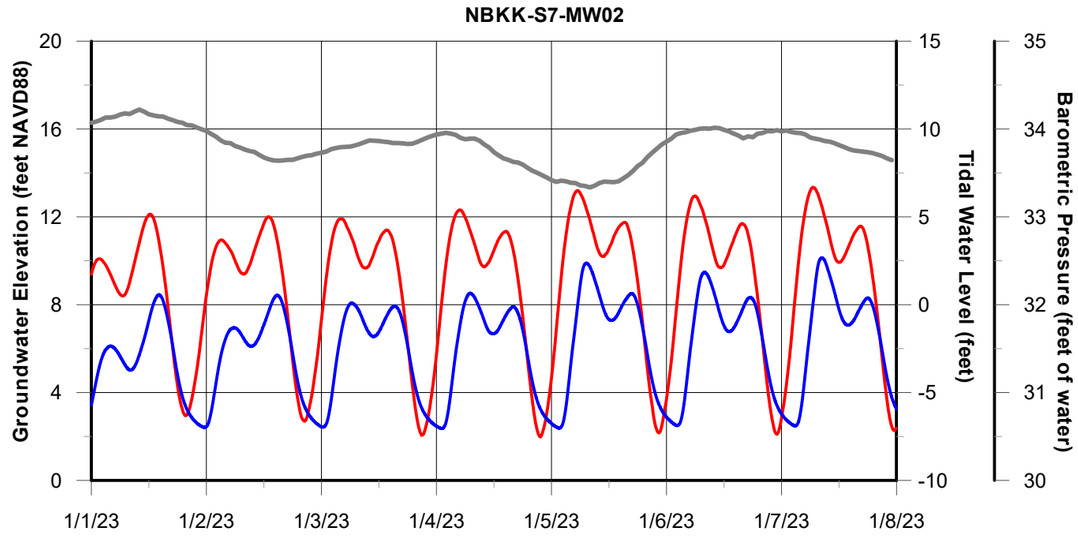


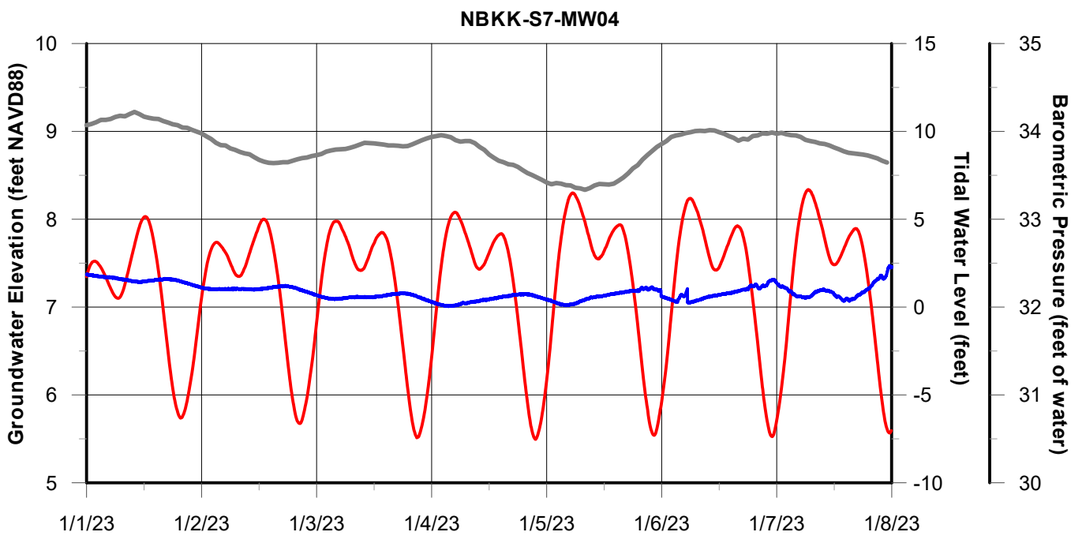
LEGEND
- Groundwater Elevation
- Tidal Water Level
- Barometric Pressure

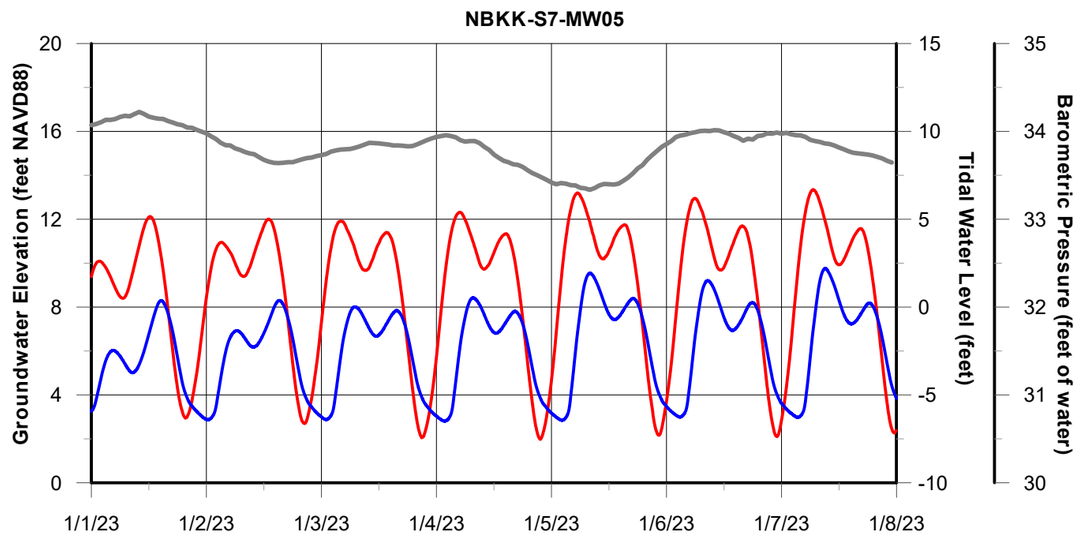
Notes:
1. NAVD88 = North American Vertical Datum of 1988
2. Barometric pressure and verified tidal water level data was downloaded for the Bremerton, WA Buoy (9.5 miles): 9445958 https://tidesandcurrents.noaa.gov/stationhome.html?id=9445958

Figure 3-8.
Water Levels and Barometric Pressure versus Time: Keyport Sludge Disposal Area (OU2/Area 5)
Site Inspection for PFAS
Naval Base Kitsap Keyport
Keyport, Washington









LEGEND
- Groundwater Elevation
- Tidal Water Level
- Barometric Pressure

Notes:
1. NAVD88 = North American Vertical Datum of 1988
2. Barometric pressure and verified tidal water level data was downloaded for the Bremerton, WA Buoy (9.5 miles): 9445958 https://tidesandcurrents.noaa.gov/stationhome.html?id=9445958

Figure 3-9.
Water Levels and Barometric Pressure versus Time: Keyport Peninsula Fill (Site 7)
Site Inspection for PFAS
Naval Base Kitsap Keyport
Keyport, Washington

SECTION 4

Field Investigation Results

The details of the data evaluation, human Health Risk Screening (HHRS) process, basis for recommendations, and Base boundary proximity and drinking water exposure assessment presented in the conceptual site models (CSMs) are described in this section. The CSMs for each of the seven investigation areas are presented in **Tables 4-1** through **4-7.** The CSMs were updated with information obtained during this SI and include description and operational history, the SI approach, site-specific lithology, upper aquifer groundwater flow directions, data evaluation, off-Base drinking water exposure assessment, the HHRS findings, conclusions, and recommendations.

4.1 Data Evaluation and Human Health Risk Screening

Soil and sediment analytical results were initially screened against residential scenario soil SLs for PFOA, PFOS, PFBS, PFNA, PFHxS, and HFPO-DA presented in the November 2022 Regional Screening Level (RSL) Table (USEPA, 2022). Groundwater analytical results were screened against residential scenario tap water SLs for PFOA, PFOS, PFBS, PFNA, PFHxS, and HFPO-DA presented in the November 2022 RSL Table (USEPA, 2022). The SLs are as follows:

- PFOA – Soil SL: 19 micrograms per kilogram (µg/kg), groundwater SL: 6.0 nanograms per liter (ng/L)
- PFOS – Soil SL: 13 µg/kg, groundwater SL: 4.0 ng/L
- PFBS – Soil SL: 1,900 µg/kg, groundwater SL: 600 ng/L
- PFNA – Soil SL: 19 µg/kg, groundwater SL: 5.9 ng/L
- PFHxS – Soil SL: 130 µg/kg, groundwater SL: 39 ng/L
- HFPO-DA – Soil SL: 23 µg/kg, groundwater SL: 6.0 ng/L

Following completion of the initial data screening and human health risk screening (HHRS), the USEPA published RSLs for two additional PFAS: perfluorobutanoic acid (PFBA) and perfluorohexanoic acid (PFHxA) (USEPA, 2023). Department of Defense (DoD) Instruction 4715.18 provides a framework to recognize new or changing toxicity values to ensure DoD uses the best available toxicity data to support CERCLA HHRAs (DoD, 2019). Using this framework, the preferred, or Tier I, source for toxicity values is the EPA's Integrated Risk Information System (IRIS) program. As reflected in the USEPA RSLs, IRIS released a new toxicity profile for PFBA in December 2022 and one for PFHxA and related salts in April 2023. DoD technical guidance on investigating PFAS was updated in August 2023 to reflect these values (DoD, 2023). Consistent with DoD Instruction 4715.18, and in consideration of the timing of this report, the PFHxA SL was used for screening soil and groundwater data (**Appendix I**) at potential release PFAS areas only where inclusion of these values had the potential to impact site management decisions (that is, the potential PFAS release areas not already recommended for remedial investigations [RIs]). PFBA was not included in the analyte list for the SI but will be included during further investigations. The SL for PFHxA is as follows:

- PFHxA – Soil SL: 3,200 µg/kg, groundwater SL: 990 ng/L

A comparison of analytical results for PFOA, PFOS, PFBS, PFHxS, PFNA, HFPO-DA, and PFHxA to SLs is summarized in **Tables 4-8** through **4-10**. Data for PFAS other than PFOA, PFOS, PFBS, PFHxS, PFNA, HFPO-DA, and PFHxA are provided in **Appendix I**. The data may be evaluated in the future if criteria are established.

Consistent with Navy and EPA SI guidance (Pioneer Technologies Corporation, 2008), the HHRS evaluation is a preliminary risk screening tool used as a line of evidence to support site management decisions, path forward, and prioritization of future phases. The HHRS was conducted based on future residential exposure and potable use of groundwater for each of the investigation areas[3] and is presented in detail in **Appendix L**. The analytical results used in the HHRS were limited to those PFAS identified in the SAP (PFOA, PFOS, PFBS, PFNA, PFHxS, and

[3] Although the SAP indicated an HHRS would only be prepared for an area if warranted, an HHRS was conducted for all investigation areas.

HFPO-DA). Following completion of the initial data screening and HHRS, the USEPA published RSLs for two additional PFAS: PFBA and PFHxA (USEPA, 2023). PFBA was not included in the analyte list for the SI but will be included during future investigations. There were no soil, groundwater, or sediment exceedances of the PFHxA RSL; therefore, PFHxA does not impact site management decisions and is not included in the **Figures 4-1 through 4-7**, the Conceptual Site Model tables (**Tables 4-1 through 4-7)** or the HHRS (**Appendix L)**. The HHRS is not intended for eliminating individual chemicals of potential concern (COPCs) from evaluation in the RI phase. For sites moving forward to an RI, at a minimum all eight PFAS compounds included in the DoD technical guidance (DoD, 2023) will be investigated for each RI site, and a site-specific risk assessment will be conducted.

4.1.1 Building 76

Table 4-1. Building 76 Conceptual Site Model

<table>
<tr><td>Description and Operational History and Potential for PFAS Release</td><td colspan="6">Building 76 is located in the northwestern portion of the installation, southeast of the intersection of Strom Avenue and A Street and bordered by Strom Avenue to the north, A Street to the west, the fire truck access ramp and parking area to the south, and a grass-covered area to the east (Figure 3-1). The western Base perimeter fence lies just west of A Street, with several offsite residential parcels beyond.

Building 76 was constructed in 1937 and operated as a chapel until 1972 before being converted into the sole fire station for NBK-Keyport. As such, the NBK-Keyport Fire Department responds to fire or other on-Base emergency incidents. Transfer and storage of aqueous film-forming foam (AFFF) has occurred at Building 76 prior to 2010. Transfer of 5-gallon buckets of AFFF into the fire trucks was conducted on the truck ramp south of Building 76. During transfer of AFFF, minor spills and splashes have reportedly occurred. Building 76 houses two fire trucks equipped with tanks carrying approximately 30 gallons of AFFF concentrate each.

No AFFF has been knowingly used or released at Building 76, with the exceptions of the transfers described above dating back to 2010.

During SI data review, it was identified that what appears to be a stockpile of unknown material was previously present east of Building 76. This was identified during review of historical aerial photos from 2010 through present which indicate potential staging of unknown material from August through November 2011. Following apparent removal of the stockpile after the August 2011 photo, the ground surface to the southeast of Building 76 is visibly impacted, as indicated through lack of grass/vegetation (Figure 3-1). The impact to the ground surface is diminished in 2023, but still present. It is likely that the stockpiled material was excavated from an area adjacent to the sump below the truck ramp during a stormwater infrastructure project which occurred from 2010 through 2011, based on anecdotal evidence.</td></tr>
<tr><td>SI Approach</td><td colspan="6">• Soil and groundwater samples were collected from newly installed monitoring well locations at Building 76. New monitoring wells were located downgradient of the presumed surface water flow or groundwater flow from the potential PFAS release areas (based on operational history) and were biased toward topographically low areas and surface water drainage features, as described in the PA (CH2M, 2020).
• Nine surface soil samples were collected at nine surface sample locations from 0 to 1 foot bgs (Table 4-8, Figure 4-1).
• Sixteen subsurface soil samples were collected at the new monitoring well locations and five soil boring locations. One subsurface soil boring was advanced to collect a subsurface sample adjacent to the paved sump at the approximate depth of the sump (approximately 6 feet bgs). Four additional soil borings southeast of Building 76 were advanced to approximately 3 feet bgs. Samples were collected from the shallow subsurface (1 to 15 feet bgs) and within the capillary fringe, ranging in depth from 19 to 59 feet bgs (Table 4-9, Figure 4-1).
• Eight groundwater samples were collected from eight newly installed monitoring wells with screen intervals ranging in depth from 19 to 69 feet bgs (Table 4-8, Figure 4-1).</td></tr>
<tr><td rowspan="4">Sample Stations</td><td rowspan="4">Monitoring Wells</td><td>Well ID</td><td>NBKK-B76-MW01</td><td>NBKK-B76-MW02</td><td>NBKK-B76-MW03</td><td>NBKK-B76-MW04</td></tr>
<tr><td>Screen Interval (ft bgs)</td><td>29 to 39</td><td>49 to 59</td><td>34 to 44</td><td>59 to 69</td></tr>
<tr><td>Well ID</td><td>NBKK-B76-MW06</td><td>NBKK-B76-MW07</td><td>NBKK-B76-MW08</td><td>NBKK-B76-MW09</td></tr>
<tr><td>Screen Interval (ft bgs)</td><td>22 to 32</td><td>23 to 33</td><td>24.5 to 34.5</td><td>19 to 29</td></tr>
</table>

Table 4-1. Building 76 Conceptual Site Model

Sample Stations (continued)	**Surface Soil Samples**	**Station ID**	NBKK-B76-SS05	NBKK-B76-SS06	NBKK-B76-SS07	NBKK-B76-SS08
		Sample Depth	0 to 1 foot bgs	0 to 1 foot bgs	0 to 1 foot bgs	0 to 1 foot bgs
		Station ID	NBKK-B76-SS09	NBKK-B76-SS10	NBKK-B76-SS11	NBKK-B76-SS12
		Sample Depth	0 to 1 foot bgs	0 to 1 foot bgs	0 to 1 foot bgs	0 to 1 foot bgs
		Station ID	NBKK-B76-SS13			
		Sample Depth	0 to 1 foot bgs			
	Subsurface Soil Samples	**Station ID**	NBKK-B76-SB01	NBKK-B76-SB02	NBKK-B76-SB03	NBKK-B76-SB04
		Sample Depth	2 to 3 25 to 26	2 to 3 48 to 49	2 to 3 33 to 34	1 to 2 58 to 59
		Station ID	NBKK-B76-SB05	NBKK-B76-SB06	NBKK-B76-SB07	NBKK-B76-SB08
		Sample Depth	3 to 4	9 to 10 23 to 25	15 to 16 22 to 23	15 to 16 24 to 25
		Station ID	NBKK-B76-SB09	NBKK-B76-SB10	NBKK-B76-SB11	NBKK-B76-SB12
		Sample Depth	14 to 15 19 to 20	1 to 3	1 to 3	1 to 3
		Station ID	NBKK-B76-SB13			
		Sample Depth	1 to 3			
Lithology	Fill material was observed to depths ranging from 1 to 3 feet bgs in the soil borings at Building 76. In general, the native soil was observed to be relatively homogeneous across the site and included well-graded sand with gravel. Intermittent clay and elastic silt zones were observed at various depths within the soil borings. Some asphalt was observed in boring core samples at NBKK-B76-MW03, likely as slough from the surface asphalt layer. Soil boring logs and well completion diagrams are provided in **Appendix C**.					
Hydrology	Hydrologic features were not observed near Building 76 during monitoring well installation or sampling. However, a retaining wall was observed running north-south along the Base boundary to the west of Building 76; its depth belowground and construction details are unknown, but its presence may affect surface water and/or shallow (perched) groundwater flow in the vicinity of the Base boundary. There are also uncertainties regarding stormwater infrastructure adjacent to Building 76. A stormwater replacement project to reroute stormwater runoff was completed south of Building 76, adjacent to the current sump, in 2010 - 2011, based on anecdotal and historical photographic evidence. Drainage from the Building 76 clothes washing machine/ extractor was draining to stormwater in the basement, and in 2011 it was diverted to the sanitary sewer. The influence of this project, including placement of fill and reworking of soils, on hydraulic pathways is not well understood.					
Upper Aquifer Groundwater Flow	The groundwater table was observed during drilling at depths between 13 and 29 feet bgs at Building 76 borings. Groundwater flow in the upper aquifer at Building 76 is primarily to the north. NBKK-B76-MW01, NBKK-B76-MW03, and NBKK-B76-MW06 through NBKK-B76-MW09 were screened at similar depths ranging from 19 to 44 feet bgs, while NBKK-B76-MW02 and NBKK-B76-MW04 were screened at similar depths ranging from 49 to 69 feet bgs (**Table C-1**). While developing potentiometric contours, wells NBKK-B76-MW02 and NBKK-B76-MW04 were excluded from contouring due to their representing hydraulic conditions in a deeper portion of the aquifer compared to the remaining site wells (**Figure 3-1**). The location of the site in proximity to the coastline to the north and its position on the north slope of the topographic high located to the south further suggest that the prominent groundwater flow direction at Building 76 is to the north.					

Table 4-1. Building 76 Conceptual Site Model

	Analyte	Surface Soil Samples			Subsurface Soil Samples			Groundwater Samples		
		Frequency of Detection	Frequency of Exceedance	Maximum Concentration (µg/kg)	Frequency of Detection	Frequency of Exceedance	Maximum Concentration (µg/kg)	Frequency of Detection	Frequency of Exceedance	Maximum Concentration (ng/L)
SI Results Compared to SLs	PFOA	1/9	0/9	0.369 J at SS08	3/21	0/21	0.558 J at SB12 at 1-3 feet bgs	3/8	3/8	11.6 at MW08
	PFOS	9/9	0/9	7.5 at SS08	8/21	2/21	40.3 at SB04 at 1 to 2 feet bgs	0/8	0/8	ND
	PFBS	0/9	0/9	ND	0/21	0/21	ND	5/8	0/8	2.11 J at MW08
	PFHxS	1/9	0/9	0.532 J at SS12	3/21	0/21	0.809 J at SB04 at 1 to 2 feet bgs	7/8	0/8	6.3 at MW07
	HFPO-DA	0/9	0/9	ND	0/21	0/21	ND	0/8	0/8	ND
	PFNA	0/9	0/9	ND	0/21	0/21	ND	0/8	0/8	ND
Proximity to Base Boundary and Drinking Water Exposure Assessment	Building 76 is located in the northwest portion of NBK-Keyport; the Base boundary lies directly to the west across A Street. Private drinking water wells may exist within 1 mile northwest and downgradient of Building 76, in the town of Keyport; however, the exact number and their locations, current operational status, depth, and usage have not been confirmed. Some of these wells are suspected to be abandoned or used as monitoring wells, given that residents were mandated to convert to municipal water in 1975. There were no detections of PFOS and/or PFOA in the groundwater wells above 70 ng/L and estimated groundwater flow direction is to the north/northwest and not toward potential off-base drinking water wells. Based on the current data a complete exposure pathway from Building 76 to off-Base drinking water wells has not been identified. However, there is uncertainty regarding the direction of groundwater flow along the Base boundary adjacent to the town of Keyport.									
Results Summary, HHRS Findings, Conclusions, and Recommendations	PFOA and PFHxS were detected in soil samples below the SL, and PFOS was detected in soil samples above the applicable SL. PFBS, HFPO-DA, and PFNA were not detected in soil. PFBS and PFHxS were detected in groundwater below the SLs, and PFOA was detected in groundwater samples above the SLs. PFOS, PFNA, and HFPO-DA were not detected in groundwater at Building 76. Based on the HHRS (**Appendix L**), no COPCs were identified for groundwater. There were no COPCs in soil[a] based on available results. Despite the lack of COPCs identified during the HHRS, an RI is recommended at this time, based on the following lines of evidence and the continued uncertainties regarding the CSM at Building 76: • PFOA was detected in groundwater samples above the SL at three monitoring well locations. • There are uncertainties regarding groundwater flow hydraulics south of Building 76 due to the potential influence of a retaining wall at the western Base boundary and the 2010 - 2011 stormwater replacement project. • The proximity of the site to the Base boundary and off-Base residential properties.									

[a] Subsurface soil samples at Building 76 were collected at depths of 1, 2, 3, 9, 14, 15, 19, 23, 24, 25, 33, 48, and 58 feet bgs. Subsurface soil samples collected below 15 feet bgs are deeper than a human receptor is expected to contact and therefore were not included in the HHRS for Building 76.

J = Estimated. The reported result was an estimated value with an unknown bias.

ND = Not detected

4.1.2 2008 Car Fire

Table 4-2. 2008 Car Fire Conceptual Site Model

Description and Operational History and Potential for PFAS Release	The 2008 Car Fire occurred in the north-central portion of the installation, northwest of Building 35 and southwest of Building 198 (**Figure 3-2**). The fire occurred in a parking lot between the two buildings. Approximately 0.5 gallon of AFFF concentrate, along with water, was used to extinguish the fire. During the emergency response, AFFF and water reportedly flowed toward Building 198, to the north. The AFFF and water were not contained using secondary containment materials or structures.					
SI Approach	• Soil and groundwater samples were collected from newly installed monitoring well locations at the 2008 Car Fire. New monitoring well locations were located within or downgradient of presumed surface water flow or groundwater flow from the potential PFAS release areas (based on operational history) and were biased toward topographically low areas, as described in the PA (CH2M, 2020). • Four surface soil samples were collected from two of the new monitoring well locations and two surface sample locations from 0 to 1-foot bgs (**Table 4-8**, **Figure 4-2**). • Five subsurface soil samples were collected from the three new monitoring well locations from the shallow subsurface (1 to 2.5 feet bgs) and within the capillary fringe, ranging in depth from 38 to 53 feet bgs (**Table 4-8**, **Figure 4-2**). • Three groundwater samples were collected from three newly installed monitoring wells with screen intervals ranging in depth from 53 to 65 feet bgs (**Table 4-9**; **Figure 4-2**).					
Sample Stations	**Monitoring Wells**	**Well ID**	NBKK-CF1-MW01	NBKK-CF1-MW02	NBKK-CF1-MW03	
		Screen Interval (ft bgs)	53 to 63	55 to 65	53.5 to 63.5	
	Surface Soil Samples	**Station ID**	NBKK-CF1-SS01	NBKK-CF1-SS02	NBKK-CF1-SS04	NBKK-CF1-SS05
		Sample Depth (feet bgs)	0 to 1	0.5 to 1	0 to 1	0 to 1
	Subsurface Soil Samples	**Station ID**	NBKK-CF1-SB01	NBKK-CF1-SB02	NBKK-CF1-SB03	
		Sample Depth (feet bgs)	51 to 52	1.5 to 2.5 38 to 39	1 to 2 52 to 53	
Lithology	Fill material was observed to depths ranging from 1 to 2.5 feet bgs in the soil borings at the 2008 Car Fire site. The native soil observed in soil borings consisted of mostly well-graded silty sand with gravel. Intermittent discontinuous silt and clay lenses were observed at various depths throughout the soil borings. Soil boring logs and well completion diagrams are provided in **Appendix C**.					
Hydrology	Hydrologic features were not observed near 2008 Car Fire during monitoring well installation or sampling. Water was not observed in the drainage ditches along the south and west sides of Building 198.					
Upper Aquifer Groundwater Flow and Tidal Influence	Water levels during drilling were generally observed from 22 to 39 feet bgs. Based on the synoptic groundwater level measurements collected on January 27, 2023, the upper aquifer groundwater flow at the 2008 Car Fire is to the north towards Liberty Bay and Port Orchard Bay (**Figure 3-2**). **Figure 3-7** presents plots of groundwater elevation versus time, as recorded from transducers installed in monitoring wells at the 2008 Car Fire site. In addition to groundwater elevation, the plots on **Figure 3-7** include barometric pressure (converted from millimeters of mercury to feet of water) and the tidal water level at the National Oceanic and Atmospheric Administration buoy 9445958, approximately 11 miles south of NBK-Keyport [a]. Qualitative assessment of data from wells at the 2008 Car Fire site indicate that groundwater levels in each of the 2008 Car Fire wells are tidally influenced. As shown on **Figure 3-7**, groundwater level trends mimic the tidal water level trends with a time lag of approximately 8 to 10 hours (that is, the timing of high groundwater levels occurs somewhat after the timing of the high tide). Each of the three wells show a fairly large magnitude of groundwater level fluctuations, of up to 2 feet (**Figure 3-7**) driven by a tidal fluctuation of over 12 feet. The timing of the groundwater level fluctuations coincides with both the tidal data and the barometric pressure data, though there appears to be a strong positive correlation between the groundwater levels and the tidal data. As such, the observed fluctuations in wells NBKK-CF1-MW01 through NBKK-CF1-MW03 are likely due to primarily tidal stresses.					

Table 4-2. 2008 Car Fire Conceptual Site Model

	Analyte	Surface Soil Samples			Subsurface Soil Samples			Groundwater Samples		
		Frequency of Detection	Frequency of Exceedance	Maximum Concentration (µg/kg)	Frequency of Detection	Frequency of Exceedance	Maximum Concentration (µg/kg)	Frequency of Detection	Frequency of Exceedance	Maximum Concentration (ng/L)
SI Results Compared to SLs[a]	PFOA	3/4	0/4	0.705 J at SS02	2/5	0/5	0.339 J at SB03 at 1 to 2 feet bgs	2/3	2/3	33 at MW03
	PFOS	4/4	0/4	8.93 at SS02	1/5	0/5	1.32	3/3	3/3	897 at MW02
	PFBS	0/4	0/4	ND	0/5	0/5	ND	2/3	0/3	32 at MW02
	PFHxS	0/4	0/4	ND	0/5	0/5	ND	2/3	2/3	543 at MW03
	PFNA	2/4	0/4	0.256 J at SS02	1/5	0/5	0.262 J at SB02 at 1.5 to 2.5 feet bgs	0/3	0/3	ND
	HFPO-DA	0/4	0/4	ND	0/5	0/5	ND	0/3	0/3	ND
Proximity to Base Boundary and Drinking Water Exposure Assessment	Based on the shallow aquifer groundwater flow direction to the north and the site's location in the northern portion of the installation, no private wells or public water supply wells exist within 1 mile downgradient of the 2008 Car Fire location. Further, the close proximity of the site to Liberty Bay and Port Orchard Bay to the northeast suggests that impacted groundwater from the site likely discharges to nearby surface water rather than traveling vertically downward and moving north, south, and east under Liberty Bay/Port Orchard Bay toward receptors across the Bay.									
Results Summary, HHRS Findings, Conclusions, and Recommendations	PFOA, PFOS, and PFNA were detected in surface and subsurface soil samples below the SLs. PFBS, PFHxS, and HFPO-DA were not detected in soil. PFOA, PFOS, and PFHxS were detected in groundwater above the SLs; PFBS was detected in groundwater below the SLs. PFNA and HFPO-DA were not detected in groundwater. Based on the HHRS (**Appendix L**), PFOA, PFOS, and PFHxS were identified as COPCs for groundwater, indicating potential unacceptable human health risks. There were no COPCs in soil[b] based on available results. The PFOA, PFOS, and PFHxS exceedances of the SLs in groundwater indicates a PFAS release occurred at 2008 Car Fire. Additionally, PFOA, PFOS, and PFHxS were identified as COPCs for groundwater; therefore, an RI is recommended. During RI investigations, the possible connection between the 2008 Car Fire and downgradient OU 2/Area 5 should be evaluated.									

[a] Tides and Currents, 2022.

[b] Subsurface soil samples at 2008 Car fire were collected at depths of 1, 1.5, 38, 51, and 52 feet bgs. Subsurface soil samples collected below 15 feet bgs are deeper than a human receptor is expected to contact and therefore were not included in the HHRS for 2008 Car Fire.

4.1.3 Keyport Sludge Disposal Area (OU 2/Area 5)

Table 4-3. Keyport Sludge Disposal Area (OU 2/Area 5) Conceptual Site Model

<table>
<tr><td>Description and Operational History and Potential for PFAS Release</td><td colspan="7">The Keyport Sludge Disposal Area (OU 2/Area 5) is located in the northeastern portion of the installation, south and west of Dedrick Drive. Port Orchard Bay is approximately 150 feet to the northeast beyond Dedrick Drive (Figure 3-3). A parking lot for adjacent Building 91 borders the area to the southeast.
From the 1940s through the mid-1970s up to 5,000 gallons of sludge from the former STP, near where Building 180 is currently located, was disposed of at the Keyport Sludge Disposal Area (NEESA, 1984). Both sanitary and industrial wastes were treated at the former STP until Building 825 was constructed in 1982 (Navy, 1995). Treated solid waste was placed in drying beds northeast of the STP along the shore of Liberty Bay (Navy, 1995). Once dried, the sludge was spread over OU 2/Area 5 (Navy, 1995).
The former STP, from which OU 2/Area 5 received sludge, treated industrial waste from industrial operations, including metal plating, from the 1940s to mid-1970s. No mist suppressants known to contain PFAS were reportedly used in metal plating operations; however, PFAS were detected in groundwater at the Former Metal Plating Shop/Waste Oil Spill Area (OU 2/Area 8). Therefore, it is possible that the industrial waste received by the former STP contained PFAS. PFAS would not have been removed in the treatment process; thus, it would be in the sludge deposited at OU 2/Area 5.</td></tr>
<tr><td>SI Approach</td><td colspan="7">• Soil and groundwater samples were collected from newly installed monitoring well locations at the Keyport Sludge Disposal Area (OU 2/Area 5). New monitoring well locations were located within or downgradient of presumed surface water flow or groundwater flow from the potential PFAS release areas (based on operational history), as described in the PA (CH2M, 2020).
• One surface soil sample was collected 0.5-to-1-foot bgs from one new monitoring well location (Table 4-8; Figure 4-3).
• Nine subsurface samples were collected at the new monitoring well locations from the shallow subsurface (1 to 3 feet bgs) and within the capillary fringe, ranging in depth from 5 to 11 and 29 to 37 feet bgs (Table 4-8; Figure 4-3).
• Three groundwater samples were collected from three newly installed monitoring wells with screen intervals ranging in depth from 20 to 60 feet bgs (Table 4-9; Figure 4-3).</td></tr>
<tr><td rowspan="5">Sample Stations</td><td rowspan="2">Monitoring Wells</td><td>Well ID</td><td colspan="2">NBKK-OU2A5-MW01</td><td colspan="2">NBKK- OU2A5-MW02</td><td>NBKK- OU2A5-MW03</td></tr>
<tr><td>Screen Interval (ft bgs)</td><td colspan="2">40 to 60</td><td colspan="2">40 to 60</td><td>20 to 40</td></tr>
<tr><td rowspan="2">Surface Soil Samples</td><td>Station ID</td><td colspan="6">NBKK-OU2A5-SS01</td></tr>
<tr><td>Sample Depth</td><td colspan="6">0.5 to 1 foot bgs</td></tr>
<tr><td rowspan="2">Subsurface Soil Samples</td><td>Station ID</td><td>NBKK-OU2A5-SB01</td><td>NBKK-OU2A5-SB02</td><td>NBKK-OU2A5-SB03</td><td>NBKK-OU2A5-SB04</td><td>NBKK-OU2A5-SB05</td></tr>
<tr><td>Sample Depth</td><td>36 to 37</td><td>1 to 2
29 to 30</td><td>1 to 2
33 to 34</td><td>2 to 3
5 to 6</td><td>2 to 3
10 to 11</td></tr>
<tr><td>Lithology</td><td colspan="7">Fill material was not discernable during drilling, although soil borings within the potential PFAS release area (OU2/Area 5 boundary) were intended to determine the thickness of fill. In general, the native soil was observed to be relatively heterogenous across the site and consisted of mostly well-graded silty sands and gravels with few clay beds. Intermittent discontinuous silt and clay cemented clasts with a hard consistency were observed at various depths within the soil borings. Soil boring logs and well completion diagrams are provided in Appendix C.</td></tr>
<tr><td>Hydrology</td><td colspan="7">Liberty Bay borders OU 2/Area 5 to the north and northeast (Figure 2-1).</td></tr>
<tr><td>Upper Aquifer Groundwater Flow and Tidal Influence</td><td colspan="7">Water levels during drilling were generally observed from 36 to 49 feet bgs. Based on synoptic groundwater level measurements collected on January 27, 2023, the upper aquifer groundwater flow at the Keyport Sludge Disposal Area (OU 2/Area 5) is to the northeast toward Liberty Bay and Port Orchard Bay (Figure 3-3).
Figure 3-8 present plots of groundwater elevation versus time, as recorded from transducers installed in monitoring wells at the OU2/Area 5. In addition to groundwater elevation, the plots on Figure 3-8 include barometric pressure (converted from millimeters of mercury to feet of water) and the tidal water level at the National Oceanic and Atmospheric Administration buoy 9445958, approximately 11 miles south of NBK-Keyport [a].</td></tr>
</table>

Table 4-3. Keyport Sludge Disposal Area (OU 2/Area 5) Conceptual Site Model

Upper Aquifer Groundwater Flow and Tidal Influence (continued)	Qualitative assessment of the data from the Keyport Sludge Disposal Area (OU 2/Area 5) indicates that groundwater levels in these wells are tidally influenced, as would be expected given the site's location just south of Port Orchard Bay. As shown on **Figure 3-8**, groundwater level trends at two of the three wells (NBKK-OU2A5-MW01 and NBKK-OU2A5-MW02) strongly mimic the tidal water level trends. Well NBKK-OU2A5-MW03 had groundwater fluctuations of much smaller magnitude but still appears to have a correlation with observed tidal signals. The timing of the groundwater level fluctuations does not coincide as strongly with barometric pressure data; that is, the timing of higher groundwater levels generally correlate to higher tidal levels but not with barometric pressure lows. As such, the observed fluctuations in wells NBKK-OU2A5-MW01 and NBKK-OU2A5-MW02 are likely predominantly due to tidal stresses. The smaller magnitude of groundwater level fluctuations observed in well NBKK-OU2A5-MW03 is likely due to the greater distance of this well from Liberty Bay but may also be influenced by the difference in the well screen depth at this location, where the screen was placed from 20 to 40 feet bgs, while the screens in NBKK-OU2A5-MW01 and NBKK-OU2A5-MW02 were placed at 40 to 60 feet bgs.									
SI Results Compared to SLs	**Analyte**	**Surface Soil Samples**			**Subsurface Soil Samples**			**Groundwater Samples**		
		Frequency of Detection	**Frequency of Exceedance**	**Maximum Concentration (µg/kg)**	**Frequency of Detection**	**Frequency of Exceedance**	**Maximum Concentration (µg/kg)**	**Frequency of Detection**	**Frequency of Exceedance**	**Maximum Concentration (ng/L)**
	PFOA	0/1	0/1	ND	0/9	0/9	ND	2/3	2/3	27.9 at MW01
	PFOS	1/1	0/1	0.341 J at SS01	1/9	0/9	0.236 J at SB03 at 1 to 2 feet bgs	2/3	2/3	47.7 at MW01
	PFBS	0/1	0/1	ND	0/9	0/9	ND	1/3	0/3	3.13 J at MW03
	PFHxS	0/1	0/1	ND	0/9	0/9	ND	2/3	0/3	8.99 at MW01
	HFPO-DA	0/1	0/1	ND	0/9	0/9	ND	0/3	0/3	ND
	PFNA	0/1	0/1	ND	0/9	0/9	ND	0/3	0/3	ND
Proximity to Base Boundary and Drinking Water Exposure Assessment	Based on the shallow groundwater flow direction to the northeast and the site's location in the northern portion of the installation, no private wells or public water supply wells exist within 1 mile downgradient of Keyport Sludge Disposal Area (OU 2/Area 5). Further, the close proximity of OU2/ Area 5 to Liberty Bay and Port Orchard Bay to the northeast strongly suggests that impacted groundwater from the site likely discharges to nearby surface water rather than traveling vertically downward and moving north, south, and east under Liberty Bay/Port Orchard Bay toward receptors across the Bay.									
Results Summary, HHRS Findings, Conclusions, and Recommendations	PFOS was detected in soil below the SLs. PFOA, PFBS, PFNA, PFHxS, and HFPO-DA were not detected in soil. PFOA and PFOS were detected in groundwater above the SLs; PFBS and PFHxS were detected below the SLs. PFNA and HFPO-DA were not detected in groundwater. Based on the HHRS **(Appendix L**), PFOA and PFOS were identified as COPCs for groundwater, indicating unacceptable human health risks. There were no COPCs in soil[b] based on available results. The PFOA and PFOS exceedances of the SLs in groundwater suggests that a PFAS release may have occurred at Keyport Sludge Disposal Area (OU 2/Area 5). Additionally, PFOA and PFOS were identified as COPCs for groundwater; therefore, an RI is recommended. During the RI, the possible connection between the upgradient 2008 Car Fire site and this site should be evaluated.									

[a] Tides and Currents, 2022.

[b] Subsurface soil samples at Keyport Sludge Disposal Area (OU 2/Area 5) were collected at depths of 1, 2, 5, 10, 29, 33, and 36 feet bgs. Subsurface soil samples collected below 15 feet bgs are deeper than a human receptor is expected to contact and therefore were not included in the HHRS for OU2/Area 5.

4.1.4 Building 1006

Table 4-4. Building 1006 Conceptual Site Model

<table>
<tr><td>Description and Operational History and Potential for PFAS Release</td><td colspan="7">Building 1006 operates as the Hazardous Materials Storage Building and is located in the southwestern portion of the installation, northeast of the intersection of A Street and Westfall Road (Figure 3-4). Building 1006 was constructed in 1988 to serve as a centralized storage location for hazardous materials used on Base.
Because of the high flammability of some of the materials stored at Building 1006, it was constructed with an AFFF fire suppression system, equipped with two 500-gallon steel bladder tanks that each contain 3 percent AFFF concentrate.
Two AFFF releases have occurred at Building 1006: in 2011 and in 2015. Both releases occurred due to accidental triggering of the fire suppression system.
The 2011 release activated the entire system, which released AFFF into trench drains within Building 1006. The trench drains are connected to two 4,000-gallon concrete underground secondary containment vaults located underground north of the facility. Both vaults were reportedly filled with AFFF and water mixture following the release event. The mixture was pumped into drums and transported for off-Base disposal.
The 2015 release occurred when 3 percent AFFF concentrate was released through a drainpipe east of the facility. At the time utility work was being performed on an underground water line east of the building, and five gallons of AFFF reportedly flowed from the drainpipe directly into the open utility ditch. Soil contaminated with AFFF as a result of the spill was excavated from in and around the drainpipe discharge location and the utility ditch, containerized, and stored at Building 1051 before being shipped off-Base for disposal.
The fire suppression system at Building 1006 was removed and replaced in 2020. The new system is currently connected to a water (sprinkler) system, and AFFF was not put into the system. Existing AFFF from the former fire suppression system was disposed of off-Base in 2023, and the two 4,000-gallon underground storage tanks containing AFFF/ water were pumped out in September 2023 (TSDF Manager, per. comm. 2023).</td></tr>
<tr><td>SI Approach</td><td colspan="7">• Soil and groundwater samples were collected from newly installed monitoring well locations at Building 1006. New monitoring well locations were within or downgradient of presumed surface water flow or groundwater flow from the potential PFAS release areas (based on operational history), as described in the PA (CH2M, 2020).
• Five surface soil samples were collected from two new monitoring well locations and three surface soil locations from 0 to 1 foot bgs (Table 4-8, Figure 4-4).
• Two subsurface soil samples were collected from two new monitoring well locations in the shallow subsurface, ranging in depth from 1 to 2 feet bgs (Table 4-8, Figure 4-4).
• Four groundwater samples were collected from four newly installed monitoring wells with screen intervals ranging in depth from 4 to 16 feet bgs (Table 4-9; Figure 4-4).</td></tr>
<tr><td rowspan="5">Sample Stations</td><td rowspan="2">Monitoring Wells</td><td>Well ID</td><td>NBKK-B1006-MW01</td><td colspan="2">NBKK-B1006-MW02</td><td>NBKK-B1006-MW03</td><td>NBKK-B1006-MW04</td></tr>
<tr><td>Screen Interval (feet bgs)</td><td>4 to 14</td><td colspan="2">4 to 14</td><td>6 to 16</td><td>5 to 15</td></tr>
<tr><td rowspan="2">Surface Soil Samples</td><td>Station ID</td><td>NBKK-B1006-SS03</td><td>NBKK-B1006-SS04</td><td>NBKK-B1006-SS05</td><td>NBKK-B1006-SS06</td><td>NBKK-B1006-SS07</td></tr>
<tr><td>Sample Depth (feet bgs)</td><td>0 to 1</td><td>0.5 to 1</td><td>0 to 1</td><td>0 to 1</td><td>0 to 1</td></tr>
<tr><td rowspan="2">Subsurface Soil Samples</td><td>Station ID</td><td colspan="2">NBKK-B1006-SB01</td><td colspan="3">NBKK-B1006-SB02</td></tr>
<tr><td>Sample Depth (feet bgs)</td><td colspan="2">1 to 2</td><td colspan="3">1 to 2</td></tr>
<tr><td>Lithology</td><td colspan="7">Discernable fill material was not observed in borings at Building 1006. In general, the native soil was observed to be relatively homogeneous across the site and included well-graded silty sands with trace gravels overlying lean to fat clays. Soil boring logs and well completion diagrams are provided in Appendix C.</td></tr>
</table>

Table 4-4. Building 1006 Conceptual Site Model

Hydrology	Drainage ditches are present running east-west to the south of Building 1006 along Westfall Road. The Shallow Lagoon lies to the northeast of Building 1006.									
Upper Aquifer Groundwater Flow	Groundwater was observed at depths ranging from 2.75 to 6.9 feet bgs in the soil borings at Building 1006. Based on the synoptic groundwater level measurements collected on January 27, 2023, the upper aquifer groundwater flow at Building 1006 is to the northeast toward the Shallow Lagoon (**Figure 3-4**).									
SI Results Compared to SLs		**Surface Soil Samples**			**Subsurface Soil Samples**			**Groundwater Samples**		
	Analyte	**Frequency of Detection**	**Frequency of Exceedance**	**Maximum Concentration (µg/kg)**	**Frequency of Detection**	**Frequency of Exceedance**	**Maximum Concentration (µg/kg)**	**Frequency of Detection**	**Frequency of Exceedance**	**Maximum Concentration (ng/L)**
	PFOA	3/5	0/5	16.4 at SS05	1/2	0/2	0.325 J at SB02 at 1 to 2 feet bgs	4/4	1/4	75.9 at MW02
	PFOS	5/5	1/5	30.9 at SS05	1/2	1/2	83.1 at SB02 at 1 to 2 feet bgs	4/4	4/4	224 at MW02
	PFBS	0/5	0/5	ND	0/2	0/2	ND	3/4	0/4	4.94 at MW02
	PFHxS	3/5	0/5	4.83 at SSS05	1/2	0/2	0.4 J at SB02 at 1 to 2 feet bgs	3/4	1/4	66.3 at MW02
	HFPO-DA	0/5	0/5	ND	0/2	0/2	ND	0/4	0/4	ND
	PFNA	3/5	0/5	8.12 at SS05	0/2	0/2	ND	2/4	1/4	7.61 at MW02
Proximity to Base Boundary and Drinking Water Exposure Assessment	Based on the shallow groundwater flow direction to the northeast and the site's location in the southwestern portion of the installation, no private wells or public water supply wells exist downgradient of Building 1006, between Building 1006 and the Shallow Lagoon. Shallow groundwater discharges to the Shallow Lagoon rather than traveling vertically downward and moving north, south, and east under Port Orchard Bay toward receptors across the Bay. On-Base supply Well 5 is located within 1-mile of Building 1006, cross-gradient and on the other side of the Shallow Lagoon; however, this well is screened in the lower confined aquifer at depths ranging from 745 to 1,030 feet bgs and is unlikely to be hydraulically connected to shallow groundwater in this area. Further, PFOA and PFOS were not detected during previous sampling of Well 5 (Navy, 2016).									
Results Summary, HHRS Findings, Conclusions, and Recommendations	PFOS was detected in soil samples above the SLs, and PFOA, PFNA, and PFHxS were detected in soil samples below the SLs. PFBS and HFPO-DA were not detected in soil. PFOA, PFOS, PFNA, and PFHxS were detected in groundwater above the SLs; and PFBS was detected in groundwater below the SLs. HFPO-DA was not detected in groundwater. Based on the HHRS (**Appendix L**), PFOA and PFOS were identified as COPCs for groundwater, indicating unacceptable human health risks. There were no COPCs in soil based on available results. The PFOA, PFOS, PFNA, and PFHxS exceedances of the SLs in groundwater indicates a PFAS release occurred at Building 1006. Additionally, PFOA and PFOS were identified as COPCs for groundwater; therefore, an RI is recommended.									

4.1.5 Van Meter Road Spill/Former Drum Storage Area (OU 2/Area 2)

Table 4-5. Van Meter Road Spill/Former Drum Storage Area (OU 2/Area 2) Conceptual Site Model

<table>
<tr><td>Description and Operational History and Potential for PFAS Release</td><td colspan="6">The Van Meter Road Spill/Former Drum Storage Area (OU 2/Area 2) is in the southwestern portion of the installation. It encompasses three adjacent areas, the Van Meter Road Spill west of A Street (formerly Van Meter Road) along the unnamed perennial stream, the Former Drum Storage Area east of A Street associated with Building 957, and a Former Drum Storage Area associated with Former Building 734 west of A Street (Figure 3-4).
The Van meter Road Spill portion of OU 2/Area 2 is a site on which a spill of plating shop wastes from the Former Metal Plating Shop occurred in 1976 from a tank truck parked on Van Meter Road. The Former Drum Storage Area associated with Building 957 currently operates as a construction material laydown yard with four existing structures (Buildings 957, 1017, 1018, and 1077). The Former Building 734 Drum Storage Area is currently wooded. The drum storage areas were operational from the 1940s to 1960s. While operational, drums not completely empty were allowed to drain onto the ground and leaking drums were prevalent. In total, an estimated 4,000 to 8,000 gallons of waste was discharged to the environment between 1940 and the 1960s (NEESA, 1984).
No records were available for review that would confirm disposal, storage, or release of AFFF or other PFAS-containing chemicals at OU 2/Area 2. However, because the Former Drum Storage Areas were in use when AFFF was known to be used by the Navy and releases of drum contents occurred, the PA recommended this area for SI.
The Van Meter Road Spill was not identified as a potential PFAS release area in the PA, based on the review of existing information indicating that neither AFFF nor PFAS-containing materials were used or released in this portion of OU 2/Area 2. However, based on further review, the spill determined to likely be a release of plating waste from the Former Metal Plating Shop (OU 2/Area 8), and although there is no data to imply PFAS was used in plating operations, PFAS have been detected in groundwater at the Former Metal Plating Shop (OU 2/Area 8). Therefore, the Van Meter Road Spill portion of OU 2/Area 2 was also included in the scope of this SI.</td></tr>
<tr><td>SI Approach</td><td colspan="6">• Soil and groundwater samples were collected from newly installed monitoring well locations at Van Meter Road Spill/Former Drum Storage Area (OU 2/Area 2) and one existing monitoring well, MW2-8. New monitoring well locations were located within or downgradient of presumed surface water flow or groundwater flow from the potential PFAS release areas (based on operational history), as described in the PA (CH2M, 2020).
• Three surface soil samples were collected from the new monitoring well locations from 0 to 1 foot bgs (Table 4-8, Figure 4-5).
• Five subsurface soil samples were collected at the new monitoring well locations from the shallow subsurface (1 to 3 feet bgs) and within the capillary fringe, ranging in depth from 1 to 7 feet bgs (Table 4-8, Figure 4-5).
• Six groundwater samples were collected from six newly installed monitoring wells with screen intervals ranging in depth from 4 to 17 and from 1 existing monitoring well (screened from 7-12 feet) (Table 4-9; Figure 4-5).
• Three sediment samples were collected from locations adjacent to A Street along the unnamed perennial stream at the site of the Van Meter Road Spill (Table 4-10, Figure 4-5).</td></tr>
<tr><td rowspan="10">Sample Stations</td><td rowspan="4">Monitoring Wells</td><td>Well ID</td><td>NBKK-OU2A2-MW01</td><td>NBKK-OU2A2-MW02</td><td>NBKK-OU2A2-MW03</td><td>NBKK-OU2A2-MW04</td></tr>
<tr><td>Screen Interval (feet bgs)</td><td>4 to 14</td><td>4 to 14</td><td>4 to 14</td><td>7 to 17</td></tr>
<tr><td>Well ID</td><td colspan="2">NBKK-OU2A2-MW05</td><td colspan="2">NBKK-OU2A2-MW06</td><td>NBKK-OU2A2-MW2-8</td></tr>
<tr><td>Screen Interval (feet bgs)</td><td colspan="2">7 to 17</td><td colspan="2">4 to 14</td><td>7 to 12</td></tr>
<tr><td rowspan="2">Surface Soil Samples</td><td>Station ID</td><td colspan="2">NBKK-OU2A2-SS01</td><td colspan="2">NBKK-OU2A2-SS02</td><td>NBKK-OU2A2-SS06</td></tr>
<tr><td>Sample Depth (feet bgs)</td><td colspan="2">0.5 to 1</td><td colspan="2">0.5 to 1</td><td>0.5 to 1</td></tr>
<tr><td rowspan="2">Subsurface Soil Samples</td><td>Station ID</td><td>NBKK-OU2A2-SB03</td><td>NBKK-OU2A2-SB04</td><td>NBKK-OU2A2-SB05</td><td>NBKK-OU2A2-SB06</td></tr>
<tr><td>Sample Depth (feet bgs)</td><td>2 to 3</td><td>2 to 3</td><td>1 to 2
6 to 7</td><td>3 to 4</td></tr>
<tr><td rowspan="2">Sediment Samples</td><td>Station ID</td><td colspan="2">NBKK-OU2A2-SD01</td><td colspan="2">NBKK-OU2A2-SD02</td><td>NBKK-OU2A2-SD03</td></tr>
<tr><td>Sample Depth (feet bgs)</td><td colspan="2">0 to 0.4</td><td colspan="2">0 to 0.4</td><td>0 to 0.4</td></tr>
</table>

Table 4-5. Van Meter Road Spill/Former Drum Storage Area (OU 2/Area 2) Conceptual Site Model

<table>
<tr><td>Lithology</td><td colspan="9">Discernable fill material was not observed in borings at OU 2/Area 2. In general, the native soil was observed to be relatively heterogenous across the site and included well-graded sands and gravels with silt. Alternating laminations of clayey sand and silty sand and sand layers with few gravel was observed. A moderate to strong hydrocarbon odor was observed at OU2A2-MW04. Soil boring logs and well completion diagrams are provided in Appendix C.</td></tr>
<tr><td>Hydrology</td><td colspan="9">A perennial unnamed stream is present along A Street, running east-west roughly perpendicular to A Street.</td></tr>
<tr><td>Upper Aquifer Groundwater Flow</td><td colspan="9">Groundwater was observed at depths ranging from 4.25 to 8.65 feet bgs in the soil borings during drilling. Based on the synoptic groundwater level measurements collected on January 27, 2023, the upper aquifer groundwater flow at Van Meter Road Spill/Former Drum Storage Area (OU 2/Area 2) is to the northeast toward the Shallow Lagoon (Figure 3-4).</td></tr>
<tr><td rowspan="11">SI Results Compared to SLs</td><td rowspan="2">Analyte</td><td colspan="3">Surface Soil Samples</td><td colspan="3">Subsurface Soil Samples</td><td colspan="3">Groundwater Samples</td></tr>
<tr><td>Frequency of Detection</td><td>Frequency of Exceedance</td><td>Maximum Concentration (µg/kg)</td><td>Frequency of Detection</td><td>Frequency of Exceedance</td><td>Maximum Concentration (µg/kg)</td><td>Frequency of Detection</td><td>Frequency of Exceedance</td><td>Maximum Concentration (ng/L)</td></tr>
<tr><td>PFOA</td><td>1/3</td><td>0/3</td><td>0.808 J at SS06</td><td>1/5</td><td>0/5</td><td>0.767 J at SB06 at 3 to 4 feet bgs</td><td>6/7</td><td>5/7</td><td>358 J at MW2-8</td></tr>
<tr><td>PFOS</td><td>1/3</td><td>1/3</td><td>20.3 at SS06</td><td>3/5</td><td>0/5</td><td>4.03 at SB06 at 3 to 4 feet bgs</td><td>4/7</td><td>4/7</td><td>424 at MW2-8</td></tr>
<tr><td>PFBS</td><td>0/3</td><td>0/3</td><td>ND</td><td>0/5</td><td>0/5</td><td>ND</td><td>1/7</td><td>0/7</td><td>1.11 at MW01</td></tr>
<tr><td>PFHxS</td><td>1/3</td><td>0/3</td><td>1.34 at SS06</td><td>2/5</td><td>0/5</td><td>0.469 J at SB06 at 3 to 4 feet bgs</td><td>5/7</td><td>4/7</td><td>136 at MW06</td></tr>
<tr><td>HFPO-DA</td><td>0/3</td><td>0/3</td><td>ND</td><td>0/5</td><td>0/5</td><td>ND</td><td>0/7</td><td>0/7</td><td>ND</td></tr>
<tr><td>PFNA</td><td>0/3</td><td>0/3</td><td>ND</td><td>0/5</td><td>0/5</td><td>ND</td><td>2/7</td><td>0/7</td><td>5.69 J at MW2-8</td></tr>
<tr><td colspan="9">Sediment Samples</td></tr>
<tr><td>Analyte</td><td colspan="3">Frequency of Detection</td><td colspan="3">Frequency of Exceedance</td><td colspan="3">Maximum Concentration (µg/kg)</td></tr>
<tr><td>PFOA</td><td colspan="3">1/3</td><td colspan="3">0/3</td><td colspan="3">0.286 J at SD01</td></tr>
<tr><td>PFOS</td><td colspan="3">3/3</td><td colspan="3">0/3</td><td colspan="3">4.07 at SD02</td></tr>
<tr><td>PFBS</td><td colspan="3">0/3</td><td colspan="3">0/3</td><td colspan="3">ND</td></tr>
<tr><td>PFHxS</td><td colspan="3">0/3</td><td colspan="3">0/3</td><td colspan="3">ND</td></tr>
<tr><td>HFPO-DA</td><td colspan="3">0/3</td><td colspan="3">0/3</td><td colspan="3">ND</td></tr>
<tr><td>PFNA</td><td colspan="3">0/3</td><td colspan="3">0/3</td><td colspan="3">ND</td></tr>
<tr><td>Proximity to Base Boundary and Drinking Water Exposure Assessment</td><td colspan="9">No private wells or public water supply wells are located downgradient of OU 2/Area 2, between its location and the Shallow Lagoon. Shallow groundwater likely discharges to the Shallow Lagoon rather than traveling vertically downward and moving north, south, and east under Port Orchard Bay toward receptors across the Bay.
On-Base supply Well 5 is within 1 mile of OU 2/Area 2, cross-gradient and on the other side of the Shallow Lagoon. This well is screened in the lower confined aquifer found at depths ranging from 745 to 1,030 feet bgs and is thus unlikely to be hydraulically connected to shallow groundwater in this area. Further, PFOA and PFOS were not detected during previous sampling of Well 5 (Navy, 2016).</td></tr>
</table>

Table 4-5. Van Meter Road Spill/Former Drum Storage Area (OU 2/Area 2) Conceptual Site Model

Results Summary, HHRS Findings, Conclusions, and Recommendations	PFOS was detected in one soil sample above the SL. PFOA, and PFHxS were detected in soil samples below the SLs. PFBS, PFNA, and HFPO-DA were not detected in soil. PFOA, PFOS, and PFHxS were detected in groundwater above the SLs, and PFNA was detected below the SL. PFBS and HFPO-DA were not detected in groundwater. Based on the HHRS **(Appendix L**), PFOA and PFOS were identified as COPCs for groundwater, indicating unacceptable human health risks. There were no COPCs in soil based on available results. The PFOA, PFOS, and PFHxS exceedances of the SLs in groundwater indicates a release occurred at Van Meter Road Spill/Former Drum Storage Area (OU 2/Area 2). Additionally, PFOA and PFOS were identified as COPCs for groundwater; therefore, an RI is recommended.

4.1.6 Keyport Peninsula Fill (Site 7)

Table 4-6. Keyport Peninsula Fill (Site 7) Conceptual Site Model

<table>
<tr><td>Description and Operational History and Potential for PFAS Release</td><td colspan="6">The Keyport Peninsula Fill (Site 7) is in the northeastern portion of the installation in the northern portion of the industrial area, north of Second Street and east of Dedrick Drive. Keyport Peninsula Fill (Site 7), which covers approximately 9 acres, is bordered to the north and east by Port Orchard Bay (Figure 3-5).

Before the placement of fill, Keyport Peninsula Fill (Site 7) was originally shallow tidal flats. Fill was placed in stages from the 1930s until 1972. Fill material used at Keyport Peninsula Fill (Site 7) consisted of dredge spoils from around former Pier 1 adjacent to the Former Metal Plating Shop/Waste Oil Spill Area (OU 2/Area 8), excavation material from the construction of Building 478, and gravels from an offsite gravel pit (NEESA, 1984).

The dredge spoils used as fill at Keyport Peninsula Fill (Site 7) were excavated from the area near former Pier 1, adjacent to OU 2/Area 8 and part of Port Orchard Bay (OU 2/Area 9), an area known to have heavy metal contamination resulting from leakage and spills of plating waste from plating shop operations at OU 2/Area 8 (Navy, 1996). PFAS have been detected in groundwater samples collected during annual long-term monitoring at the Former Metal Plating Shop/Waste Oil Spill Area (OU 2/Area 8), performed under a separate contract. The PFAS PA (CH2M, 2020), identified Site 7 as a potential PFAS release area based on the potential for fill material used at Site 7 to contain PFAS.</td></tr>
<tr><td>SI Approach</td><td colspan="6">• Soil and groundwater samples were collected from newly installed monitoring well locations at Keyport Peninsula Fill (Site 7). New monitoring well locations were across the known lateral extent of fill placement at Keyport Peninsula Fill (Site 7), as described in the PA (CH2M, 2020).
• One surface soil sample was collected from one new monitoring well location from 0 to 1-foot bgs (Table 4-8, Figure 4-6).
• Seven subsurface soil samples were collected at new monitoring well locations from the shallow subsurface (1 to 2 feet bgs) and within the capillary fringe, ranging in depth from 8 to 11 feet bgs (Table 4-8, Figure 4-6).
• Four groundwater samples were collected from four newly installed monitoring wells with screen intervals ranging in depth from 9 to 29 feet bgs (Table 4-9; Figure 4-6).
• One scoped well (NBKK-S7-MW03) was not installed during the SI field effort due to the presence of Base equipment and ongoing pipeline construction in the area. This SAP deviation is described above in Section 3.14 and in FCR #1.</td></tr>
<tr><td rowspan="6">Sample Stations</td><td rowspan="2">Monitoring Wells</td><td>Well ID</td><td>NBKK-S7-MW01</td><td>NBKK-S7-MW02</td><td>NBKK-S7-MW04</td><td>NBKK-S7-MW05</td></tr>
<tr><td>Screen Interval (feet bgs)</td><td>9 to 29</td><td>9 to 29</td><td>9 to 19</td><td>9 to 29</td></tr>
<tr><td rowspan="2">Surface Soil Samples</td><td>Station ID</td><td colspan="4">NBKK-S7-SS02</td></tr>
<tr><td>Sample Depth</td><td colspan="4">0 to 1 foot bgs</td></tr>
<tr><td rowspan="2">Subsurface Soil Samples</td><td>Station ID</td><td>NBKK-S7-SB01</td><td>NBKK-S7-SB02</td><td>NBKK-S7-SB04</td><td>NBKK-S7-SB05</td></tr>
<tr><td>Sample Depth (feet bgs)</td><td>1 to 2
8 to 9</td><td>10 to 11</td><td>1 to 2
9 to 10</td><td>1 to 2
9 to 10</td></tr>
<tr><td>Lithology</td><td colspan="6">Discernable fill material was not observed in each of the borings at Keyport Peninsula Fill (Site 7). In well NBKK-S7-MW04, fill material was encountered to approximately 10 feet bgs, and included asphalt, debris, and concrete. Additionally, shell fragments were observed to depths as much as 30 feet bgs in each of the four borings, indicative of fill material (dredge spoils). In general, the soil was observed to be relatively heterogenous across the site and comprised of silty gravel, silty and clayey sand, and sandy lean clays with shell fragments throughout. Intermittent discontinuous organics were observed at various depths within the soil borings. Soil boring logs and well completion diagrams are provided in Appendix C.</td></tr>
<tr><td>Hydrology</td><td colspan="6">Port Orchard Bay borders Keyport Peninsula Fill (Site 7) to the north and east (Figure 2-1).</td></tr>
</table>

Table 4-6. Keyport Peninsula Fill (Site 7) Conceptual Site Model

Upper Aquifer Groundwater Flow and Tidal Influence	Groundwater was observed at depths ranging from 10.7 to 11.3 feet bgs in the soil borings at Keyport Peninsula Fill (Site 7). Based on the synoptic groundwater level measurements collected on January 27, 2023, the upper aquifer groundwater flow at Keyport Peninsula Fill (Site 7) is directly to the northeast toward Port Orchard Bay (**Figure 3-5**). **Figure 3-9** presents plots of groundwater elevation versus time, as recorded from transducers installed in monitoring wells at Keyport Peninsula Fill (Site 7). In addition to groundwater elevation, the plots on **Figure 3-9** include barometric pressure (converted from millimeters of mercury to feet of water) and the tidal water level at the National Oceanic and Atmospheric Administration buoy 9445958, approximately 11 miles south of NBK-Keyport [a]. Qualitative assessment of the data from the Keyport Peninsula Fill (Site 7) indicates that groundwater levels in these wells are tidally influenced, as would be expected given the site's location just west of Port Orchard Bay. As shown on **Figure 3-9**, groundwater level trends at three of the four wells (NBKK-S7-MW01, NBKK-S7-MW02, and NBKK-S7-MW05) strongly mimic the tidal water level trends with a relatively short lag time. Groundwater levels in Well NBKK-S7-MW04 had a very muted response to tidal fluctuation. The timing of the groundwater level fluctuations does not correlate well with barometric pressure fluctuations in any of the site wells. The lack of significant correlation between tidal fluctuations and groundwater levels observed in Well NBKK-S7-MW04 is likely due to the greater distance between this well and nearby Port Orchard Bay.									
SI Results Compared to SLs	**Analyte**	**Surface Soil Samples**			**Subsurface Soil Samples**			**Groundwater Samples**		
		Frequency of Detection	**Frequency of Exceedance**	**Maximum Concentration (µg/kg)**	**Frequency of Detection**	**Frequency of Exceedance**	**Maximum Concentration (µg/kg)**	**Frequency of Detection**	**Frequency of Exceedance**	**Maximum Concentration (ng/L)**
	PFOA	0/1	0/1	ND	0/7	0/7	ND	1/4	0/4	1.44 J at MW04
	PFOS	1/1	0/1	0.29 J at SS02	1/7	0/7	0.223 J at SB04 at 1 to 2 feet bgs	0/4	0/4	ND
	PFBS	0/1	0/1	ND	0/7	0/7	ND	1/4	0/4	4.81 at MW04
	PFHxS	0/1	0/1	ND	0/7	0/7	ND	0/4	0/4	ND
	HFPO-DA	0/1	0/1	ND	0/7	0/7	ND	0/4	0/4	ND
	PFNA	0/1	0/1	ND	0/7	0/7	ND	0/4	0/4	ND
Proximity to Base Boundary and Drinking Water Exposure Assessment	Based on the shallow groundwater flow direction to the northeast and the site's location in the northeastern portion of the installation, no private wells or public water supply wells exist within 1 mile downgradient of Keyport Peninsula Fill (Site 7), between site and Port Orchard Bay. Shallow groundwater from the site likely discharges to nearby surface water rather than traveling vertically downward and moving north, south, and east under Port Orchard Bay. In addition, per Navy Policy, since the there were no detections of PFOS and/or PFOA in the groundwater wells above 70 ng/L and estimated groundwater flow direction is away from potential off-base drinking water wells, there is not a complete exposure pathway from Site 7 to off-Base drinking water wells.									
Results Summary, HHRS Findings, Conclusions, and Recommendations	PFOS was detected in one soil sample below the SL. PFOA, PFBS, PFHxS, PFNA, and HFPO-DA were not detected in soil. PFOA and PFBS were detected in groundwater samples below the SLs. PFOS, PFHxS, PFNA, and HFPO-DA were not detected in groundwater. Based on the HHRS **(Appendix L**), no COPCs were identified for groundwater or soil. Based on the following lines of evidence, additional investigation is not recommended at this time: • Consistency of the CSM presented in the SAP and three groundwater sample locations are downgradient of the suspected release area and would have identified potential releases to groundwater at the site. • Concentrations of PFOA, PFOS, PFBS, PFNA, PFHxS, and HFPO-DA did not exceed SLs in soil or groundwater, and the HHRS did not identify any COPCs in soil or groundwater. • There is no documentation of a PFAS release from the PA.									

[a] Tides and Currents, 2022.

4.1.7 Landfill Extension (Northeast Portion of Area 22)

Table 4-7. Landfill Extension (Northeast Portion of Area 22) Conceptual Site Model

Description and Operational History and Potential for PFAS Release	The Landfill Extension (Northeast Portion of Area 22) is on the west side of the central portion of the installation, directly east of the main gate and southwest of the intersection of McKittrick Road and A Street (**Figure 3-6**). The Landfill Extension is in the northeastern portion of Area 22. Area 22 operated as a magazine and ordnance storage area from the 1930s to the 1960s when demolition of preexisting buildings began. Ordnance and magazines are believed to have been transported to NBK Bangor, while the disposal of building debris and other materials is unknown (URS, 1992). In 1990, construction along McKittrick Road revealed landfill material and petroleum products in the northeastern portion of Area 22. In response to this discovery, an SI was performed which identified that fill material was present in the area and this material included variable amounts of metal, concrete, wood, plastic, and trash (Navy, 1993b). Because of its proximity, the Landfill Extension (Northeast Portion of Area 22) historically has been linked to the Keyport Landfill (OU 1). No records were available for review that would confirm disposal of AFFF or other PFAS-containing chemicals at the Keyport Landfill or the Landfill Extension (Northeast Portion of Area 22). However, the Landfill Extension (Northeast Portion of Area 22) was in use when AFFF was known to be used by the Navy. The Landfill Extension may also contain waste that may contain PFAS unrelated to AFFF.					
SI Approach	• Soil and groundwater samples were collected from newly installed monitoring well locations at Landfill Extension (Northeast Portion of Area 22). New monitoring well locations were within or downgradient of presumed surface water flow or groundwater flow from the potential PFAS release areas (based on operational history), as described in the PA (CH2M, 2020). • Three surface soil sample were collected from three new monitoring well location from 0 to 1-foot bgs (**Table 4-8**, **Figure 4-7**). • Six subsurface soil sample were collected at new monitoring well location from the shallow subsurface (1 to 2 feet bgs) and within the capillary fringe, ranging in depth from 7 to 8, 17 to 18, and 21 to 28 feet (**Table 4-8**; **Figure 4-7**). • Four groundwater samples were collected from four newly installed monitoring wells with screen intervals ranging in depth from 18 to 39 feet bgs (**Table 4-9**; **Figure 4-7**).					
Sample Stations	**Monitoring Wells**	**Well ID**	NBKK-LFEX-MW01	NBKK-LFEX-MW02	NBKK-LFEX-MW03	NBKK-LFEX-MW04
		Screen Interval (feet bgs)	29 to 39	18 to 28	19.5 to 29.5	23 to 33
	Surface Soil Samples	**Station ID**	NBKK-LFEX-SS01	NBKK-LFEX-SS02	NBKK-LFEX-SS04	
		Sample Depth (feet bgs)	0 to 1	0 to 1	0 to 1	
	Subsurface Soil Samples	**Station ID**	NBKK-LFEX-SB01	NBKK-LFEX-SB02	NBKK-LFEX-SB03	NBKK-LFEX-SB02
		Sample Depth (feet bgs)	27 to 28	21 to 22	1 to 2 7 to 8 17 to 18	26 to 27
Lithology	Asphalt fill material was observed from the surface to approximately 7 feet bgs and debris, including metal and wood, was observed at NBKK-LFEX-MW03. In general, the native soil was observed to be relatively homogeneous across the site and consisted of silty sands with intermittent fat clay layers throughout the borings. Soil boring logs and well completion diagrams are provided in **Appendix C**.					
Hydrology	Hydrologic features were not observed near Landfill Extension (Northeast Portion of Area 22) during monitoring well installation or sampling.					
Upper Aquifer Groundwater Flow	Groundwater was observed starting at depths ranging from 11.5 to 13.15 feet bgs in the soil borings. Based on the synoptic groundwater level measurements collected on January 27, 2023, the upper aquifer groundwater flow at the Landfill Extension (Northeast Portion of Area 22) is south and southwest (**Figure 3-6**).					

Table 4-7. Landfill Extension (Northeast Portion of Area 22) Conceptual Site Model

	Analyte	Surface Soil Samples			Subsurface Soil Samples			Groundwater Samples		
		Frequency of Detection	Frequency of Exceedance	Maximum Concentration (µg/kg)	Frequency of Detection	Frequency of Exceedance	Maximum Concentration (µg/kg)	Frequency of Detection	Frequency of Exceedance	Maximum Concentration (ng/L)
SI Results Compared to SLs	PFOA	0/3	0/3	ND	0/6	0/6	ND	0/4	0/4	ND
	PFOS	1/3	0/3	0.231 J at SS01	0/6	0/6	ND	0/4	0/4	ND
	PFBS	0/3	0/3	ND	0/6	0/6	ND	0/4	0/4	ND
	PFHxS	0/3	0/3	ND	0/6	0/6	ND	0/4	0/4	ND
	HFPO-DA	0/3	0/3	ND	0/6	0/6	ND	0/4	0/4	ND
	PFNA	0/3	0/3	ND	0/6	0/6	ND	0/4	0/4	ND
Proximity to Base Boundary and Drinking Water Exposure Assessment	Although the shallow groundwater flow direction estimated from Site groundwater level measurements is to the south and southwest, because the site is on the west side of the central portion of the installation and along the west side of the assumed groundwater divide, the generalized regional flow at the western Base boundary (owing to the steep topography) is to the north and northeast, toward/ on Base, and would preclude the presence of private wells within 1 mile downgradient of the Landfill Extension (Northeast Portion of Area 22). Additionally, shallow groundwater from the Landfill Extension likely discharges to Marsh Pond to the southwest rather than moving off-Base. In addition, per Navy Policy, since the there were no detections of PFOS or PFOA in the groundwater wells and estimated groundwater flow direction is cross-gradient from potential off-Base drinking water wells, there is not a complete exposure pathway from the Landfill Extension to off-Base drinking water wells.									
Results Summary, HHRS Findings, Conclusions, and Recommendations	PFOS was detected at one surface soil sample location below the SL. PFOA, PFBS, PFNA, PFHxS, and HFPO-DA were not detected in soil, and PFOA, PFOS, PFBS, PFNA, PFHxS, and HFPO-DA were not detected in groundwater. Based on the HHRS, COPCs were not identified in soil[a] or groundwater, indicating there are no unacceptable human health risks associated with exposure to PFAS in soil and groundwater (**Appendix L**). Groundwater samples were collected downgradient and upgradient from Landfill Extension (Northeast Portion of Area 22), which was identified as the potential release location in the PA, and there were no exceedances. Based on the following lines of evidence, additional investigation is not recommended at this time: • Consistency of the CSM presented in the SAP, groundwater sample locations are downgradient of the suspected release area and would have identified potential releases to groundwater related to the site. • Concentrations of PFOA, PFOS, PFBS, and PFHxS did not exceed SLs, and the HHRS did not identify COPCs. • There is no documentation of a PFAS release from the PA.									

[a] Subsurface soil samples at the Landfill Extension were collected at depths of 1, 7, 17, 21, 26, and 27 feet bgs. Subsurface soil samples collected below 15 feet bgs are deeper than a human receptor is expected to contact and therefore were not included in the HHRS for the Landfill Extension.

Table 4-8 Soil Analytical Results

Site Inspection Report for Per- and Polyfluoroalkyl Substances at Keyport Naval Complex

Keyport, Washington

Sample Station	Sample ID	Sample Depth (ft bgs)	Sample Date	PFOA (µg/kg)	PFOS (µg/kg)	PFBS (µg/kg)	PFHxS (µg/kg)	PFHxA (µg/kg)	HFPO-DA (µg/kg)	PFNA (µg/kg)
Screening Levels				19	13	1,900	130	3,200	23	19
Building 76										
NBKK-B76-MW01	NBKK-B76-SB01-0203	2-3	8/30/2022	0.602 U	0.602 U	0.602 U	0.602 U	0.602 U	0.602 U	0.602 U
	NBKK-B76-SB01-2526	25-26	8/30/2022	0.538 U	0.538 U	0.538 U	0.538 U	0.538 U	0.538 U	0.538 U
NBKK-B76-MW02	NBKK-B76-SB02-0203	2-3	8/30/2022	0.573 U	**0.323 J**	0.573 U	0.573 U	0.573 U	0.573 U	0.573 U
	NBKK-B76-SB02-4849	48-49	8/31/2022	0.579 U	0.579 U	0.579 U	0.579 U	0.579 U	0.579 U	0.579 U
NBKK-B76-MW03	NBKK-B76-SB03-0203	2-3	8/30/2022	0.622 U	**25.9**	0.622 U	**0.31 J**	0.622 U	0.622 U	0.622 U
	NBKK-B76-SB03-3334	33-34	9/1/2022	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U
NBKK-B76-MW04	NBKK-B76-SB04-0102	1-2	8/31/2022	0.575 U	**40.3**	0.575 U	**0.809 J**	0.575 U	0.575 U	0.575 U
	NBKK-B76-SB04-5859	58-59	9/6/2022	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U
NBKK-B76-SB05	NBKK-B76-SB05-0304	3-4	10/1/2022	0.499 U	**4.96 J**	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U
NBKK-B76-SS05	NBKK-B76-SS05-0001	0-1	9/2/2022	0.519 U	**0.911 J**	0.519 U	0.519 U	0.519 U	0.519 U	0.519 U
NBKK-B76-MW06	NBKK-B76-SS06-0001	0-1	8/11/2023	0.5 U	**0.875 J**	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
	NBKK-B76-SB06-0910	9-10	8/11/2023	0.496 U	0.496 U	0.496 U	0.496 U	0.496 U	0.496 U	0.496 U
	NBKK-B76-SB06-2325	23-25	8/11/2023	0.496 U	0.496 U	0.496 U	0.496 U	0.496 U	0.496 U	0.496 U
NBKK-B76-MW07	NBKK-B76-SS07-0001	0-1	8/10/2023	0.497 U	**0.431 J**	0.497 U	0.497 U	0.497 U	0.497 U	0.497 U
	NBKK-B76-SB07-1516	15-16	8/10/2023	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
	NBKK-B76-SB07-2223	22-23	8/10/2023	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U
NBKK-B76-MW08	NBKK-B76-SS08-0001	0-1	8/10/2023	**0.369 J**	**7.5**	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
	NBKK-B76-SB08-1516	15-16	8/9/2023	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
	NBKK-B76-SB08-2425	24-25	8/10/2023	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U
NBKK-B76-MW09	NBKK-B76-SS09-0001	0-1	8/9/2023	0.499 U	**0.373 J**	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U
	NBKK-B76-SB09-1415	14-15	8/9/2023	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
	NBKK-B76-SB09-1920	19-20	8/9/2023	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U
NBKK-B76-SS10	NBKK-B76-SS10-0001	0-1	8/9/2023	0.5 U	**2.57**	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
NBKK-B76-SB10	NBKK-B76-SB10-0103	1-3	8/9/2023	0.499 U	**0.876 J**	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U
NBKK-B76-SS11	NBKK-B76-SS11-0001	0-1	8/8/2023	0.5 U	**0.235 J**	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
NBKK-B76-SB11	NBKK-B76-SB11-0103	1-3	8/8/2023	**0.328 J**	**4.72**	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
NBKK-B76-SS12	NBKK-B76-SS12-0001	0-1	8/9/2023	0.5 U	**2.41**	0.5 U	**0.532 J**	0.5 U	0.5 U	0.5 U
NBKK-B76-SB12	NBKK-B76-SB12-0103	1-3	8/9/2023	**0.558 J**	**0.876 J**	0.5 U	**0.231 J**	0.5 U	0.5 U	0.5 U
NBKK-B76-SS13	NBKK-B76-SS13-0001	0-1	8/9/2023	0.501 U	**4.54**	0.501 U	0.501 U	0.501 U	0.501 U	0.501 U
NBKK-B76-SB13	NBKK-B76-SB13-0103	1-3	8/9/2023	**0.218 J**	**5.47**	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

Table 4-8 Soil Analytical Results

Site Inspection Report for Per- and Polyfluoroalkyl Substances at Keyport Naval Complex

Keyport, Washington

Sample Station	Sample ID	Sample Depth (ft bgs)	Sample Date	PFOA (µg/kg)	PFOS (µg/kg)	PFBS (µg/kg)	PFHxS (µg/kg)	PFHxA (µg/kg)	HFPO-DA (µg/kg)	PFNA (µg/kg)
Screening Levels				19	13	1,900	130	3,200	23	19
2008 Car Fire Site										
NBKK-CF1-MW01	NBKK-CF1-SS01-0001	0-1	10/8/2022	**0.693 J**	**1.94**	0.501 U	0.501 U	**0.243 J**	0.501 U	**0.222 J**
	NBKK-CF1-SB01-5152	51-52	10/13/2022	0.501 U	0.501 U	0.501 U	0.501 U	0.501 U	0.501 U	0.501 U
NBKK-CF1-MW02	NBKK-CF1-SS02-0H01	0.5-1	11/1/2022	**0.705 J**	**8.93**	0.5 U	0.5 U	**0.333 J**	0.5 U	**0.256 J**
	NBKK-CF1-SB02-1H2H	1.5-2.5	10/7/2022	**0.286 J**	**1.32**	0.499 U	0.499 U	0.499 U	0.499 U	**0.262 J**
	NBKK-CF1-SB02-3839	38-39	11/2/2022	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U
NBKK-CF1-MW03	NBKK-CF1-SB03-0102	1-2	10/8/2022	**0.339 J**	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U
	NBKK-CF1-SB03-5253	52-53	10/15/2022	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
NBKK-CF1-SS04	NBKK-CF1-SS04-0001	0-1	9/30/2022	0.501 U	**1.48**	0.501 U	0.501 U	0.501 U	0.501 U	0.501 U
NBKK-CF1-SS05	NBKK-CF1-SS05-0001	0-1	9/30/2022	**0.649 J**	**6.83**	0.5 U	0.5 U	**0.254 J**	0.5 U	0.5 U
Keyport Sludge Disposal Area (OU 2/Area 5)										
NBKK-OU2A5-MW01	NBKK-OU2A5-SS01-0H01	0.5-1	9/7/2022	0.559 U	**0.341 J**	0.559 U	0.559 U	0.559 U	0.559 U	0.559 U
	NBKK-OU2A5-SB01-3637	36-37	10/31/2022	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
NBKK-OU2A5-MW02	NBKK-OU2A5-SB02-0102	1-2	9/7/2022	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U
	NBKK-OU2A5-SB02-2930	29-30	10/29/2022	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
NBKK-OU2A5-MW03	NBKK-OU2A5-SB03-0102	1-2	9/7/2022	0.524 U	**0.236 J**	0.524 U	0.524 U	0.524 U	0.524 U	0.524 U
	NBKK-OU2A5-SB03-3334	33-34	9/8/2022	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
NBKK-OU2A5-SB04	NBKK-OU2A5-SB04-0203	2-3	11/1/2022	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U
	NBKK-OU2A5-SB04-0506	5-6	11/1/2022	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
NBKK-OU2A5-SB05	NBKK-OU2A5-SB05-0203	2-3	11/1/2022	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
	NBKK-OU2A5-SB05-1011	10-11	11/1/2022	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Building 1006										
NBKK-B1006-MW01	NBKK-B1006-SB01-0102	1-2	10/1/2022	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
NBKK-B1006-MW02	NBKK-B1006-SB02-0102	1-2	10/1/2022	**0.325 J**	**83.1**	0.5 U	**0.4 J**	**0.401 J**	0.5 U	0.5 U
NBKK-B1006-MW03	NBKK-B1006-SS03-0001	0-1	10/1/2022	0.499 U	**0.206 J**	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U
NBKK-B1006-MW04	NBKK-B1006-SS04-0H01	0.5-1	11/3/2022	**0.28 J**	**2.21**	0.5 U	**0.187 J**	**0.28 J**	0.5 U	**0.203 J**
NBKK-B1006-SS05	NBKK-B1006-SS05-0001	0-1	9/30/2022	**16.4**	**30.9**	0.5 U	**4.83**	**10.7**	0.5 U	**8.12**
NBKK-B1006-SS06	NBKK-B1006-SS06-0001	0-1	9/30/2022	0.501 U	**0.425 J**	0.501 U	0.501 U	0.501 U	0.501 U	0.501 U
NBKK-B1006-SS07	NBKK-B1006-SS07-0001	0-1	9/30/2022	**0.382 J**	**1.01**	0.501 U	**0.238 J**	**0.282 J**	0.501 U	**0.2 J**
Van Meter Road Spill/ Former Drum Storage Area (OU 2/Area 2)										
NBKK-OU2A2-MW01	NBKK-OU2A2-SS01-0H01	0.5-1	11/5/2022	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U
NBKK-OU2A2-MW02	NBKK-OU2A2-SS02-0H01	0.5-1	11/4/2022	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

Table 4-8 Soil Analytical Results

Site Inspection Report for Per- and Polyfluoroalkyl Substances at Keyport Naval Complex

Keyport, Washington

Sample Station	Sample ID	Sample Depth (ft bgs)	Sample Date	PFOA (µg/kg)	PFOS (µg/kg)	PFBS (µg/kg)	PFHxS (µg/kg)	PFHxA (µg/kg)	HFPO-DA (µg/kg)	PFNA (µg/kg)
Screening Levels				19	13	1,900	130	3,200	23	19
NBKK-OU2A2-MW03	NBKK-OU2A2-SB03-0203	2-3	11/4/2022	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U
NBKK-OU2A2-MW04	NBKK-OU2A2-SB04-0203	2-3	11/7/2022	0.5 U	**1.93**	0.5 U	**0.277 J**	0.5 U	0.5 U	0.5 U
NBKK-OU2A2-MW05	NBKK-OU2A2-SB05-0102	1-2	11/8/2022	0.499 U	**1.07**	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U
	NBKK-OU2A2-SB05-0607	6-7	11/8/2022	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
NBKK-OU2A2-MW06	NBKK-OU2A2-SS06-0H01	0.5-1	11/8/2022	**0.808 J**	**20.3**	0.5 U	**1.34**	**0.212 J**	0.5 U	0.5 U
	NBKK-OU2A2-SB06-0304	3-4	11/8/2022	**0.767 J**	**4.03**	0.5 U	**0.469 J**	0.5 U	0.5 U	0.5 U
Keyport Peninsula Fill (Site 7)										
NBKK-S7-MW01	NBKK-S7-SB01-0102	1-2	10/28/2022	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U
	NBKK-S7-SB01-0809	8-9	10/28/2022	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U
NBKK-S7-MW02	NBKK-S7-SS02-0001	0-1	10/27/2022	0.499 U	**0.29 J**	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U
	NBKK-S7-SB02-1011	10-11	10/27/2022	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
NBKK-S7-MW04	NBKK-S7-SB04-0102	1-2	10/25/2022	0.499 U	**0.223 J**	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U
	NBKK-S7-SB04-0910	9-10	10/25/2022	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
NBKK-S7-MW05	NBKK-S7-SB05-0102	1-2	10/26/2022	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U
	NBKK-S7-SB05-0910	9-10	10/26/2022	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Landfill Extenstion (Northwest Portion of Area 22)										
NBKK-LFEX-MW01	NBKK-LFEX-SS01-0001	0-1	10/4/2022	0.499 U	**0.231 J**	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U
	NBKK-LFEX-SB01-2728	27-28	10/6/2022	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
NBKK-LFEX-MW02	NBKK-LFEX-SS02-0001	0-1	10/3/2022	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U
	NBKK-LFEX-SB02-2122	21-22	10/4/2022	0.502 U	0.502 U	0.502 U	0.502 U	0.502 U	0.502 U	0.502 U
NBKK-LFEX-MW03	NBKK-LFEX-SB03-0102	1-2	10/3/2022	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U
	NBKK-LFEX-SB03-0708	7-8	10/3/2022	0.501 U	0.501 U	0.501 U	0.501 U	0.501 U	0.501 U	0.501 U
	NBKK-LFEX-SB03-1718	17-18	10/3/2022	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U
NBKK-LFEX-MW04	NBKK-LFEX-SS04-0001	0-1	10/4/2022	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U	0.499 U
	NBKK-LFEX-SB04-2627	26-27	10/7/2022	0.501 U	0.501 U	0.501 U	0.501 U	0.501 U	0.501 U	0.501 U

µg/kg = micrograms per kilogram

J = Analyte present. Value may or may not be accurate or precise

U = The material was analyzed for but not detected

Bolding indicates detection

Shading indicates exceedance of Screening Levels.

Table 4-9 Groundwater Analytical Results

Site Inspection Report for Per- and Polyfluoroalkyl Substances at Keyport Naval Complex

Keyport, Washington

Sample Station	Sample ID	Sample Date	PFOA (ng/L)	PFOS (ng/L)	PFBS (ng/L)	PFHxS (ng/L)	PFHxA (ng/L)	HFPO-DA (ng/L)	PFNA (ng/L)
Screening Levels			6	4	600	39	990	6	5.9
Building 76									
NBKK-B76-MW01	NBKK-B76-MW01-1122	11/11/2022	2.26 U	2.26 U	**1.82 J**	**3.51 J**	2.26 U	2.26 U	2.26 U
NBKK-B76-MW02	NBKK-B76-MW02-1122	11/11/2022	2.26 U	2.26 U	**1.57 J**	**2.09 J**	2.26 U	2.26 U	2.26 U
NBKK-B76-MW03	NBKK-B76-MW03-1122	11/11/2022	2.49 U	2.49 U	2.49 U	**2.38 J**	2.49 U	2.49 U	2.49 U
NBKK-B76-MW04	NBKK-B76-MW04-1122	11/10/2022	2.31 U	2.31 U	2.31 U	**1.11 J**	2.31 U	2.31 U	2.31 U
NBKK-B76-MW06	NBKK-B76-MW06-0823	8/14/2023	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
NBKK-B76-MW07	NBKK-B76-MW07-0823	8/15/2023	**8.69**	2.38 U	**1.67 J**	**6.3**	**6.38**	2.38 U	2.38 U
NBKK-B76-MW08	NBKK-B76-MW08-0823	8/15/2023	**11.6**	2.28 U	**2.11 J**	**4.1 J**	**8.96**	2.28 U	2.28 U
NBKK-B76-MW09	NBKK-B76-MW09-0823	8/14/2023	**7.92**	2.25 U	**1.27 J**	**3.54 J**	**4.68**	2.25 U	2.25 U
2008 Car Fire Site									
NBKK-CF1-MW01	NBKK-CF1-MW01-1222	12/7/2022	2.4 U	**7.85**	2.4 U	2.4 U	**5.25 J**	2.4 U	2.4 U
NBKK-CF1-MW02	NBKK-CF1-MW02-1122	11/14/2022	**31**	**897**	**32**	**543**	**38.1**	2.35 U	2.35 U
NBKK-CF1-MW03	NBKK-CF1-MW03-1122	11/11/2022	**33**	**288**	**15.5**	**176**	**33.9**	2.34 U	2.34 U
Keyport Sludge Disposal Area (OU 2/Area 5)									
NBKK-OU2A5-MW01	NBKK-OU2A5-MW01-1222	12/1/2022	**27.9**	**47.7**	2.37 U	**8.99**	**9.41**	2.37 U	2.37 U
NBKK-OU2A5-MW02	NBKK-OU2A5-MW02-1222	12/7/2022	2.42 U	2.42 U	2.42 U	2.42 U	2.42 U	2.42 U	2.42 U
NBKK-OU2A5-MW03	NBKK-OU2A5-MW03-1222	12/1/2022	**12.8**	**31.7**	**3.13 J**	**6.41**	**5.89**	2.25 U	2.25 U
Building 1006									
NBKK-B1006-MW01	NBKK-B1006-MW01-1122	11/9/2022	**1.42 J**	**14.5**	**2.63 J**	**6.87**	**2 J**	2.39 U	2.39 U
NBKK-B1006-MW02	NBKK-B1006-MW02-1122	11/9/2022	**75.9**	**224**	**4.94**	**66.3**	**211**	2.18 U	**7.61**
NBKK-B1006-MW03	NBKK-B1006-MW03-1122	11/9/2022	**5.69**	**16.4**	**2.5 J**	**9.85 J**	**11.9**	2.36 U	**1.85 J**
NBKK-B1006-MW04	NBKK-B1006-MW04-1222	12/8/2022	**3.32 J**	**21.3**	2.33 U	2.33 U	**6.19 J**	2.33 U	2.33 U
Van Meter Road Spill/ Former Drum Storage Area (OU 2/Area 2)									
NBKK-OU2A2-MW01	NBKK-OU2A2-MW01-0623	6/1/2023	**7.08**	2.54 U	**1.11 J**	**22.8**	**2.98 J**	2.54 U	**1.02 J**
NBKK-OU2A2-MW02	NBKK-OU2A2-MW02-1222	12/8/2022	**4.09 J**	2.31 U	2.31 U	2.31 U	**4.57 J**	2.31 U	2.31 U
NBKK-OU2A2-MW03	NBKK-OU2A2-MW03-1222	12/8/2022	2.37 U	2.37 U	2.37 U	2.37 U	**4.21 J**	2.37 U	2.37 U
NBKK-OU2A2-MW04	NBKK-OU2A2-MW04-1222	12/8/2022	**15.6**	**29.5**	2.43 U	**88.2**	**19.2**	2.43 U	2.43 U
NBKK-OU2A2-MW05	NBKK-OU2A2-MW05-1222	12/8/2022	**138**	**75.8**	2.39 U	**53.3**	**18.5**	2.39 U	2.39 U
NBKK-OU2A2-MW06	NBKK-OU2A2-MW06-1222	12/8/2022	**35.4**	**123**	2.39 U	**136**	**3.52 J**	2.39 U	2.39 U
NBKK-OU2A2-MW2-8	NBKK-OU2A2-MW2-8-1222	12/8/2022	**358 J**	**424**	2.51 U	**133**	**21.1 J**	2.51 UJ	**5.69 J**

Table 4-9 Groundwater Analytical Results

Site Inspection Report for Per- and Polyfluoroalkyl Substances at Keyport Naval Complex

Keyport, Washington

Sample Station	Sample ID	Sample Date	PFOA (ng/L)	PFOS (ng/L)	PFBS (ng/L)	PFHxS (ng/L)	PFHxA (ng/L)	HFPO-DA (ng/L)	PFNA (ng/L)
Screening Levels			6	4	600	39	990	6	5.9
Keyport Peninsula Fill (Site 7)									
NBKK-S7-MW01	NBKK-S7-MW01-1222	12/2/2022	2.29 U	2.29 U	2.29 U	2.29 U	2.29 U	2.29 U	2.29 U
NBKK-S7-MW02	NBKK-S7-MW02-1222	12/2/2022	2.29 U	2.29 U	2.29 UJ	2.29 U	2.29 U	2.29 U	2.29 U
NBKK-S7-MW03[a]	NA								
NBKK-S7-MW04	NBKK-S7-MW04-1222	12/2/2022	**1.44 J**	2.39 U	**4.81**	2.39 U	**1.93 J**	2.39 U	2.39 U
NBKK-S7-MW05	NBKK-S7-MW05-1222	12/2/2022	2.25 U	2.25 U	2.25 U	2.25 U	2.25 U	2.25 U	2.25 U
Landfill Extenstion (Northwest Portion of Area 22)									
NBKK-LFEX-MW01	NBKK-LFEX-MW01-1122	11/10/2022	2.41 U	2.41 U	2.41 U	2.41 U	2.41 U	2.41 U	2.41 U
NBKK-LFEX-MW02	NBKK-LFEX-MW02-1122	11/10/2022	2.23 U	2.23 U	2.23 U	2.23 U	2.23 U	2.23 U	2.23 U
NBKK-LFEX-MW03	NBKK-LFEX-MW03-1122	11/10/2022	2.33 U	2.33 U	2.33 U	2.33 U	2.33 U	2.33 U	2.33 U
NBKK-LFEX-MW04	NBKK-LFEX-MW04-1122	11/10/2022	2.41 U	2.41 U	2.41 U	2.41 U	2.41 U	2.41 U	2.41 U

[a] Monitoring well NBKK-S7-MW03 was not installed due to access issues and other construction work occurring for the duration of the SI. Removal of this well from the SI scope is described in Field Change Request 1 (**Appendix B**).

µg/kg = micrograms per kilogram

J = Analyte present. Value may or may not be accurate or precise

NA = not applicable

U = The material was analyzed for but not detected

Bolding indicates detection

Shading indicates exceedance of Screening Levels.

Table 4-10. Sediment Analytical Results

Site Inspection Report for Per- and Polyfluoroalkyl Substances at Naval Base Kitsap Keyport

Keyport, Washington

Sample Station	Sample ID	Sample Depth (ft bgs)	Sample Date	PFOA (µg/kg)	PFOS (µg/kg)	PFBS (µg/kg)	PFHxS (µg/kg)	PFHxA (µg/kg)	HFPO-DA (µg/kg)	PFNA (µg/kg)
Screening Levels				19	13	1,900	130	3,200	23	19
Van Meter Road Spill/ Former Drum Storage Area (OU 2/Area 2)										
NBKK-OU2A2-SD01	NBKK-OU2A2-SD01-0004	0-0.4	11/10/2022	**0.286 J**	**0.464 J**	0.519 U	0.519 U	0.519 U	0.519 U	0.519 U
NBKK-OU2A2-SD02	NBKK-OU2A2-SD02-0004	0-0.4	11/10/2022	0.63 U	**4.07**	0.63 U	0.63 U	0.63 U	0.63 U	0.63 U
NBKK-OU2A2-SD03	NBKK-OU2A2-SD03-0004	0-0.4	11/10/2022	1.15 U	**1.95 J**	1.15 U	1.15 U	1.15 U	1.15 U	1.15 U

Sediment analytical results were screened against residential scenario soil screening levels presented in the May 2023 Regional Screening Level Table.

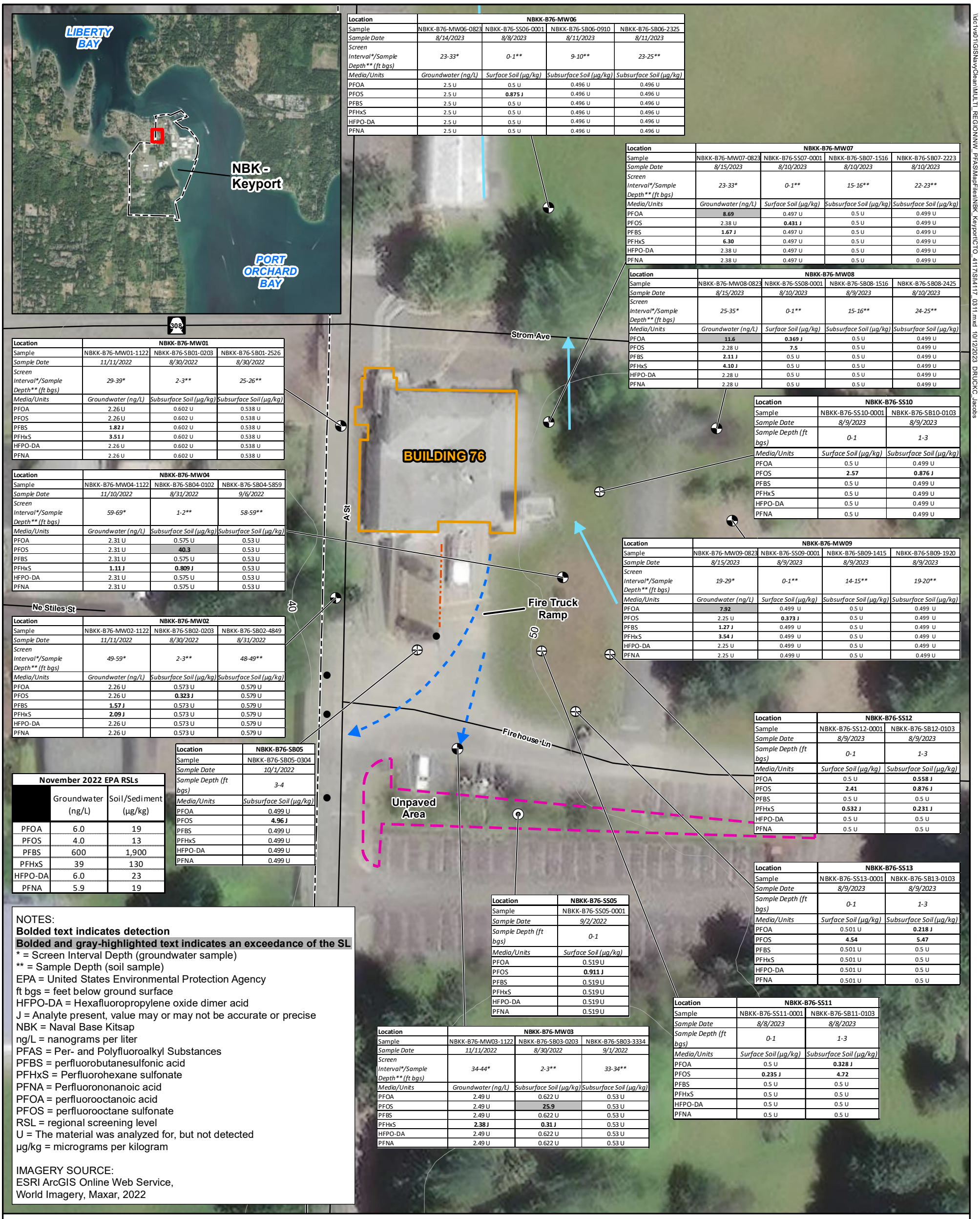
µg/kg = micrograms per kilogram

J = Analyte present. Value may or may not be accurate or precise

OU = Operable Unit

U = The material was analyzed for but not detected

Bolding indicates detection



Location	NBKK-B76-MW06			
Sample	NBKK-B76-MW06-0823	NBKK-B76-SS06-0001	NBKK-B76-SB06-0910	NBKK-B76-SB06-2325
Sample Date	*8/14/2023*	*8/8/2023*	*8/11/2023*	*8/11/2023*
Screen Interval/Sample Depth** (ft bgs)*	*23-33**	*0-1***	*9-10***	*23-25***
Media/Units	*Groundwater (ng/L)*	*Surface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*
PFOA	2.5 U	0.5 U	0.496 U	0.496 U
PFOS	2.5 U	**0.875 J**	0.496 U	0.496 U
PFBS	2.5 U	0.5 U	0.496 U	0.496 U
PFHxS	2.5 U	0.5 U	0.496 U	0.496 U
HFPO-DA	2.5 U	0.5 U	0.496 U	0.496 U
PFNA	2.5 U	0.5 U	0.496 U	0.496 U

Location	NBKK-B76-MW07			
Sample	NBKK-B76-MW07-0823	NBKK-B76-SS07-0001	NBKK-B76-SB07-1516	NBKK-B76-SB07-2223
Sample Date	*8/15/2023*	*8/10/2023*	*8/10/2023*	*8/10/2023*
Screen Interval/Sample Depth** (ft bgs)*	*23-33**	*0-1***	*15-16***	*22-23***
Media/Units	*Groundwater (ng/L)*	*Surface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*
PFOA	**8.69**	0.497 U	0.5 U	0.499 U
PFOS	2.38 U	**0.431 J**	0.5 U	0.499 U
PFBS	**1.67 J**	0.497 U	0.5 U	0.499 U
PFHxS	**6.30**	0.497 U	0.5 U	0.499 U
HFPO-DA	2.38 U	0.497 U	0.5 U	0.499 U
PFNA	2.38 U	0.497 U	0.5 U	0.499 U

Location	NBKK-B76-MW08			
Sample	NBKK-B76-MW08-0823	NBKK-B76-SS08-0001	NBKK-B76-SB08-1516	NBKK-B76-SB08-2425
Sample Date	*8/15/2023*	*8/10/2023*	*8/9/2023*	*8/10/2023*
Screen Interval/Sample Depth** (ft bgs)*	*25-35**	*0-1***	*15-16***	*24-25***
Media/Units	*Groundwater (ng/L)*	*Surface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*
PFOA	**11.6**	**0.369 J**	0.5 U	0.499 U
PFOS	2.28 U	**7.5**	0.5 U	0.499 U
PFBS	**2.11 J**	0.5 U	0.5 U	0.499 U
PFHxS	**4.10 J**	0.5 U	0.5 U	0.499 U
HFPO-DA	2.28 U	0.5 U	0.5 U	0.499 U
PFNA	2.28 U	0.5 U	0.5 U	0.499 U

Location	NBKK-B76-SS10	
Sample	NBKK-B76-SS10-0001	NBKK-B76-SB10-0103
Sample Date	*8/9/2023*	*8/9/2023*
Sample Depth (ft bgs)	*0-1*	*1-3*
Media/Units	*Surface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*
PFOA	0.5 U	0.499 U
PFOS	**2.57**	**0.876 J**
PFBS	0.5 U	0.499 U
PFHxS	0.5 U	0.499 U
HFPO-DA	0.5 U	0.499 U
PFNA	0.5 U	0.499 U

Location	NBKK-B76-MW01		
Sample	NBKK-B76-MW01-1122	NBKK-B76-SB01-0203	NBKK-B76-SB01-2526
Sample Date	*11/11/2022*	*8/30/2022*	*8/30/2022*
Screen Interval/Sample Depth** (ft bgs)*	*29-39**	*2-3***	*25-26***
Media/Units	*Groundwater (ng/L)*	*Subsurface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*
PFOA	2.26 U	0.602 U	0.538 U
PFOS	2.26 U	0.602 U	0.538 U
PFBS	**1.82 J**	0.602 U	0.538 U
PFHxS	**3.51 J**	0.602 U	0.538 U
HFPO-DA	2.26 U	0.602 U	0.538 U
PFNA	2.26 U	0.602 U	0.538 U

Location	NBKK-B76-MW04		
Sample	NBKK-B76-MW04-1122	NBKK-B76-SB04-0102	NBKK-B76-SB04-5859
Sample Date	*11/10/2022*	*8/31/2022*	*9/6/2022*
Screen Interval/Sample Depth** (ft bgs)*	*59-69**	*1-2***	*58-59***
Media/Units	*Groundwater (ng/L)*	*Subsurface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*
PFOA	2.31 U	0.575 U	0.53 U
PFOS	2.31 U	**40.3**	0.53 U
PFBS	2.31 U	0.575 U	0.53 U
PFHxS	**1.11 J**	**0.809 J**	0.53 U
HFPO-DA	2.31 U	0.575 U	0.53 U
PFNA	2.31 U	0.575 U	0.53 U

Location	NBKK-B76-MW02		
Sample	NBKK-B76-MW02-1122	NBKK-B76-SB02-0203	NBKK-B76-SB02-4849
Sample Date	*11/11/2022*	*8/30/2022*	*8/31/2022*
Screen Interval/Sample Depth** (ft bgs)*	*49-59**	*2-3***	*48-49***
Media/Units	*Groundwater (ng/L)*	*Subsurface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*
PFOA	2.26 U	0.573 U	0.579 U
PFOS	2.26 U	**0.323 J**	0.579 U
PFBS	**1.57 J**	0.573 U	0.579 U
PFHxS	**2.09 J**	0.573 U	0.579 U
HFPO-DA	2.26 U	0.573 U	0.579 U
PFNA	2.26 U	0.573 U	0.579 U

Location	NBKK-B76-SB05
Sample	NBKK-B76-SB05-0304
Sample Date	*10/1/2022*
Sample Depth (ft bgs)	*3-4*
Media/Units	*Subsurface Soil (µg/kg)*
PFOA	0.499 U
PFOS	**4.96 J**
PFBS	0.499 U
PFHxS	0.499 U
HFPO-DA	0.499 U
PFNA	0.499 U

Location	NBKK-B76-MW09			
Sample	NBKK-B76-MW09-0823	NBKK-B76-SS09-0001	NBKK-B76-SB09-1415	NBKK-B76-SB09-1920
Sample Date	*8/15/2023*	*8/9/2023*	*8/9/2023*	*8/9/2023*
Screen Interval/Sample Depth** (ft bgs)*	*19-29**	*0-1***	*14-15***	*19-20***
Media/Units	*Groundwater (ng/L)*	*Surface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*
PFOA	**7.92**	0.499 U	0.5 U	0.499 U
PFOS	2.25 U	**0.373 J**	0.5 U	0.499 U
PFBS	**1.27 J**	0.499 U	0.5 U	0.499 U
PFHxS	**3.54 J**	0.499 U	0.5 U	0.499 U
HFPO-DA	2.25 U	0.499 U	0.5 U	0.499 U
PFNA	2.25 U	0.499 U	0.5 U	0.499 U

Location	NBKK-B76-SS12	
Sample	NBKK-B76-SS12-0001	NBKK-B76-SB12-0103
Sample Date	*8/9/2023*	*8/9/2023*
Sample Depth (ft bgs)	*0-1*	*1-3*
Media/Units	*Surface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*
PFOA	0.5 U	**0.558 J**
PFOS	**2.41**	**0.876 J**
PFBS	0.5 U	0.5 U
PFHxS	**0.532 J**	**0.231 J**
HFPO-DA	0.5 U	0.5 U
PFNA	0.5 U	0.5 U

Location	NBKK-B76-SS13	
Sample	NBKK-B76-SS13-0001	NBKK-B76-SB13-0103
Sample Date	*8/9/2023*	*8/9/2023*
Sample Depth (ft bgs)	*0-1*	*1-3*
Media/Units	*Surface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*
PFOA	0.501 U	**0.218 J**
PFOS	**4.54**	**5.47**
PFBS	0.501 U	0.5 U
PFHxS	0.501 U	0.5 U
HFPO-DA	0.501 U	0.5 U
PFNA	0.501 U	0.5 U

Location	NBKK-B76-SS05
Sample	NBKK-B76-SS05-0001
Sample Date	*9/2/2022*
Sample Depth (ft bgs)	*0-1*
Media/Units	*Surface Soil (µg/kg)*
PFOA	0.519 U
PFOS	**0.911 J**
PFBS	0.519 U
PFHxS	0.519 U
HFPO-DA	0.519 U
PFNA	0.519 U

Location	NBKK-B76-MW03		
Sample	NBKK-B76-MW03-1122	NBKK-B76-SB03-0203	NBKK-B76-SB03-3334
Sample Date	*11/11/2022*	*8/30/2022*	*9/1/2022*
Screen Interval/Sample Depth** (ft bgs)*	*34-44**	*2-3***	*33-34***
Media/Units	*Groundwater (ng/L)*	*Subsurface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*
PFOA	2.49 U	0.622 U	0.53 U
PFOS	2.49 U	**25.9**	0.53 U
PFBS	2.49 U	0.622 U	0.53 U
PFHxS	**2.38 J**	**0.31 J**	0.53 U
HFPO-DA	2.49 U	0.622 U	0.53 U
PFNA	2.49 U	0.622 U	0.53 U

Location	NBKK-B76-SS11	
Sample	NBKK-B76-SS11-0001	NBKK-B76-SB11-0103
Sample Date	*8/8/2023*	*8/8/2023*
Sample Depth (ft bgs)	*0-1*	*1-3*
Media/Units	*Surface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*
PFOA	0.5 U	**0.328 J**
PFOS	**0.235 J**	**4.72**
PFBS	0.5 U	0.5 U
PFHxS	0.5 U	0.5 U
HFPO-DA	0.5 U	0.5 U
PFNA	0.5 U	0.5 U

November 2022 EPA RSLs		
	Groundwater (ng/L)	Soil/Sediment (µg/kg)
PFOA	6.0	19
PFOS	4.0	13
PFBS	600	1,900
PFHxS	39	130
HFPO-DA	6.0	23
PFNA	5.9	19

NOTES:
Bolded text indicates detection
Bolded and gray-highlighted text indicates an exceedance of the SL
* = Screen Interval Depth (groundwater sample)
** = Sample Depth (soil sample)
EPA = United States Environmental Protection Agency
ft bgs = feet below ground surface
HFPO-DA = Hexafluoropropylene oxide dimer acid
J = Analyte present, value may or may not be accurate or precise
NBK = Naval Base Kitsap
ng/L = nanograms per liter
PFAS = Per- and Polyfluoroalkyl Substances
PFBS = perfluorobutanesulfonic acid
PFHxS = Perfluorohexane sulfonate
PFNA = Perfluorononanoic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
RSL = regional screening level
U = The material was analyzed for, but not detected
µg/kg = micrograms per kilogram

IMAGERY SOURCE:
ESRI ArcGIS Online Web Service,
World Imagery, Maxar, 2022

LEGEND

- Monitoring Well Installation/Groundwater Sampling/Soil Sampling Location
- Shallow Subsurface Soil Sampling Location
- Surface Soil Sampling Location
- Stormwater Catch Basin
- Surface Water Drainage Direction (Estimated)
- Upper Aquifer Groundwater Flow Direction
- Unpaved Area
- Trench Drain
- 10' Topographic Contour
- Road
- Potential PFAS Release Area
- Installation Boundary

Figure 4-1
PFAS Results: Building 76
Site Inspection for PFAS
NBK Keyport, Keyport, Washington

0 25 50
1 inch = 50 feet
N

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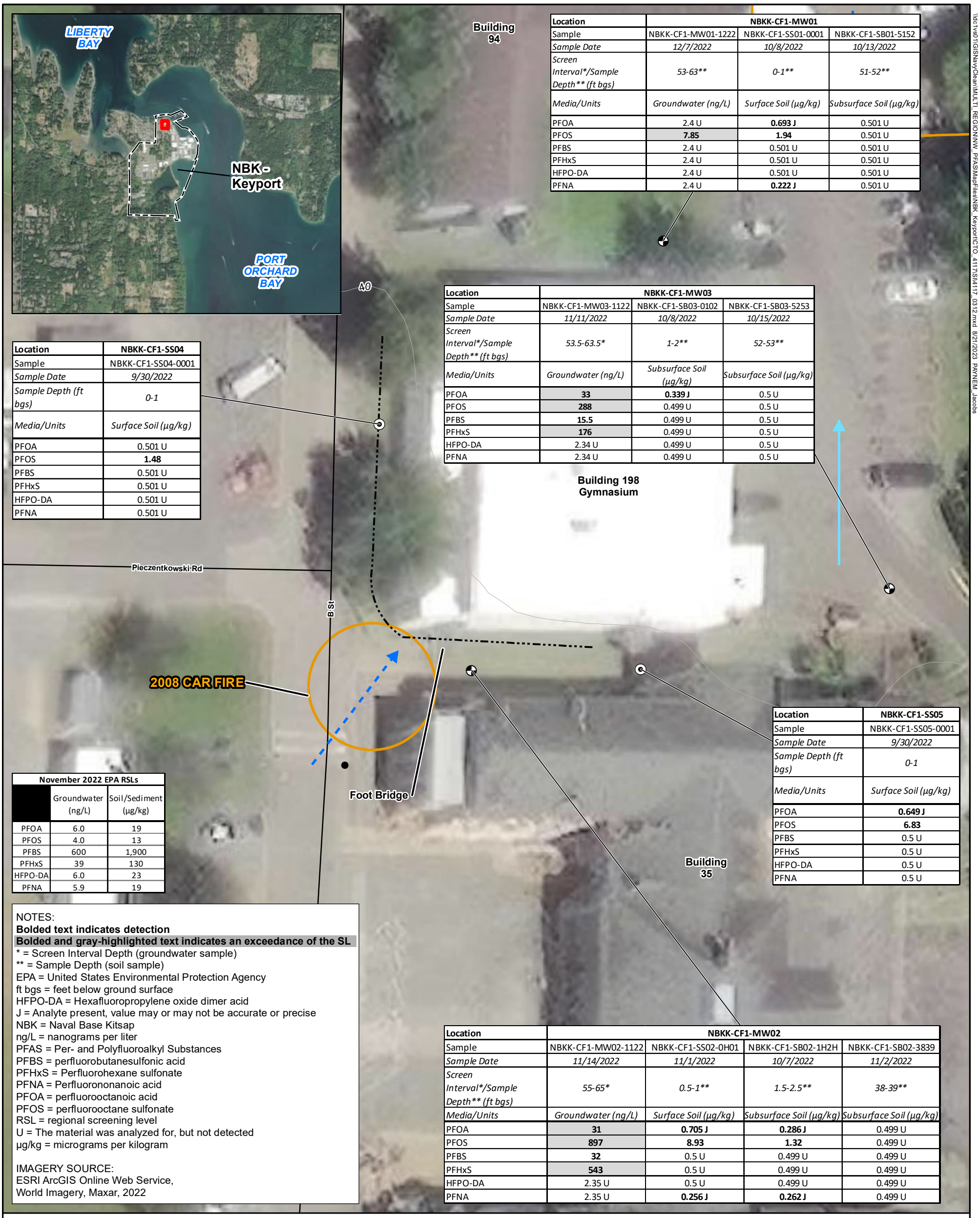


Location	NBKK-CF1-MW01		
Sample	NBKK-CF1-MW01-1222	NBKK-CF1-SS01-0001	NBKK-CF1-SB01-5152
Sample Date	*12/7/2022*	*10/8/2022*	*10/13/2022*
Screen Interval/Sample Depth** (ft bgs)*	*53-63***	*0-1***	*51-52***
Media/Units	*Groundwater (ng/L)*	*Surface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*
PFOA	2.4 U	**0.693 J**	0.501 U
PFOS	**7.85**	**1.94**	0.501 U
PFBS	2.4 U	0.501 U	0.501 U
PFHxS	2.4 U	0.501 U	0.501 U
HFPO-DA	2.4 U	0.501 U	0.501 U
PFNA	2.4 U	**0.222 J**	0.501 U

Location	NBKK-CF1-MW03		
Sample	NBKK-CF1-MW03-1122	NBKK-CF1-SB03-0102	NBKK-CF1-SB03-5253
Sample Date	*11/11/2022*	*10/8/2022*	*10/15/2022*
Screen Interval/Sample Depth** (ft bgs)*	*53.5-63.5**	*1-2***	*52-53***
Media/Units	*Groundwater (ng/L)*	*Subsurface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*
PFOA	**33**	**0.339 J**	0.5 U
PFOS	**288**	0.499 U	0.5 U
PFBS	**15.5**	0.499 U	0.5 U
PFHxS	**176**	0.499 U	0.5 U
HFPO-DA	2.34 U	0.499 U	0.5 U
PFNA	2.34 U	0.499 U	0.5 U

Location	NBKK-CF1-SS04
Sample	NBKK-CF1-SS04-0001
Sample Date	*9/30/2022*
Sample Depth (ft bgs)	*0-1*
Media/Units	*Surface Soil (µg/kg)*
PFOA	0.501 U
PFOS	**1.48**
PFBS	0.501 U
PFHxS	0.501 U
HFPO-DA	0.501 U
PFNA	0.501 U

Location	NBKK-CF1-SS05
Sample	NBKK-CF1-SS05-0001
Sample Date	*9/30/2022*
Sample Depth (ft bgs)	*0-1*
Media/Units	*Surface Soil (µg/kg)*
PFOA	**0.649 J**
PFOS	**6.83**
PFBS	0.5 U
PFHxS	0.5 U
HFPO-DA	0.5 U
PFNA	0.5 U

November 2022 EPA RSLs		
	Groundwater (ng/L)	Soil/Sediment (µg/kg)
PFOA	6.0	19
PFOS	4.0	13
PFBS	600	1,900
PFHxS	39	130
HFPO-DA	6.0	23
PFNA	5.9	19

NOTES:
Bolded text indicates detection
Bolded and gray-highlighted text indicates an exceedance of the SL
* = Screen Interval Depth (groundwater sample)
** = Sample Depth (soil sample)
EPA = United States Environmental Protection Agency
ft bgs = feet below ground surface
HFPO-DA = Hexafluoropropylene oxide dimer acid
J = Analyte present, value may or may not be accurate or precise
NBK = Naval Base Kitsap
ng/L = nanograms per liter
PFAS = Per- and Polyfluoroalkyl Substances
PFBS = perfluorobutanesulfonic acid
PFHxS = Perfluorohexane sulfonate
PFNA = Perfluorononanoic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
RSL = regional screening level
U = The material was analyzed for, but not detected
µg/kg = micrograms per kilogram

IMAGERY SOURCE:
ESRI ArcGIS Online Web Service,
World Imagery, Maxar, 2022

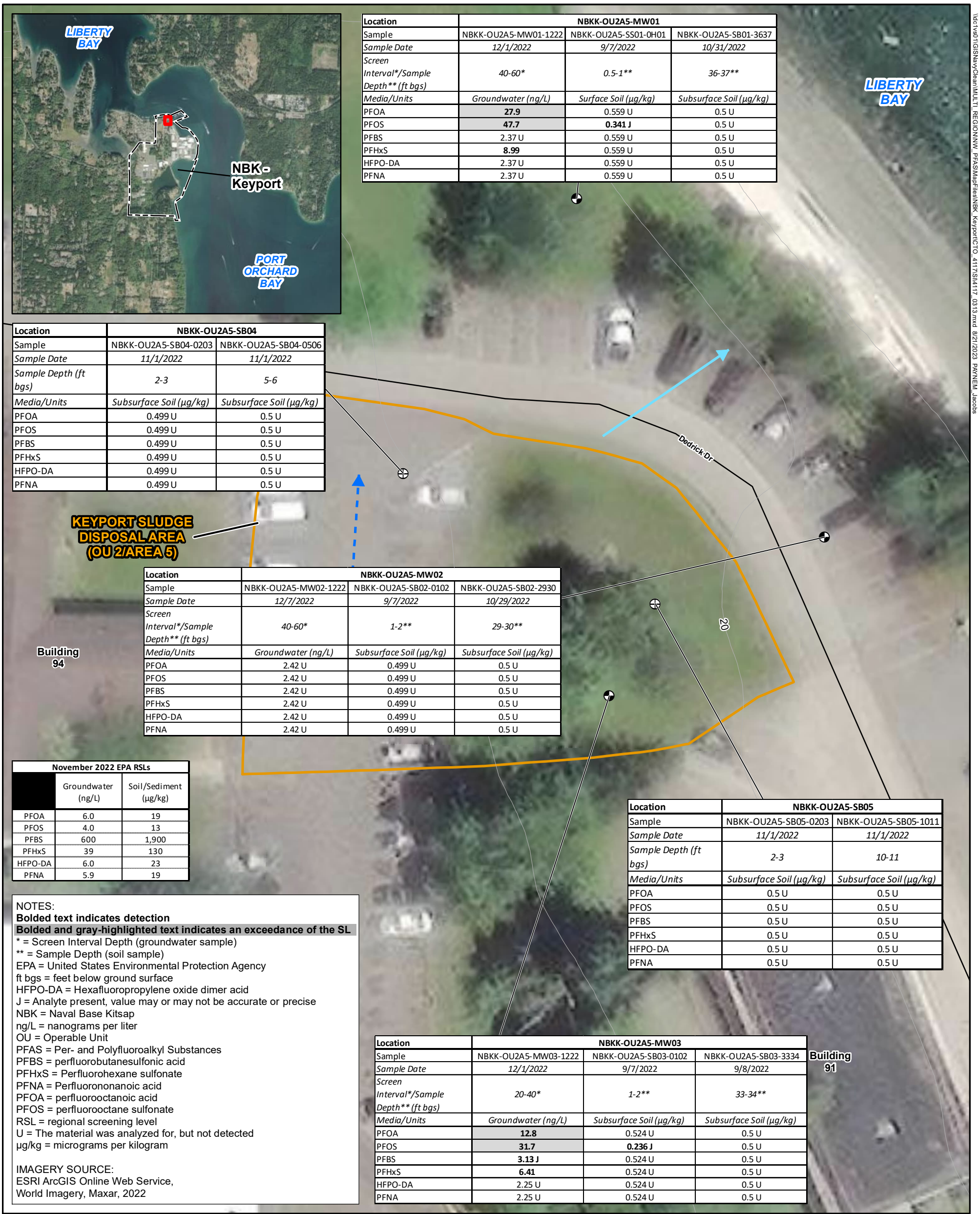
Location	NBKK-CF1-MW02			
Sample	NBKK-CF1-MW02-1122	NBKK-CF1-SS02-0H01	NBKK-CF1-SB02-1H2H	NBKK-CF1-SB02-3839
Sample Date	*11/14/2022*	*11/1/2022*	*10/7/2022*	*11/2/2022*
Screen Interval/Sample Depth** (ft bgs)*	*55-65**	*0.5-1***	*1.5-2.5***	*38-39***
Media/Units	*Groundwater (ng/L)*	*Surface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*
PFOA	**31**	**0.705 J**	**0.286 J**	0.499 U
PFOS	**897**	**8.93**	**1.32**	0.499 U
PFBS	**32**	0.5 U	0.499 U	0.499 U
PFHxS	**543**	0.5 U	0.499 U	0.499 U
HFPO-DA	2.35 U	0.5 U	0.499 U	0.499 U
PFNA	2.35 U	**0.256 J**	**0.262 J**	0.499 U

LEGEND

- Monitoring Well Installation/Groundwater Sampling/Soil Sampling Location
- Surface Soil Sampling Location
- Stormwater Catch Basin
- Surface Water Drainage Direction (Estimated)
- Upper Aquifer Groundwater Flow Direction
- Unpaved Area
- Drainage Ditch
- 10' Topographic Contour
- Road
- Potential PFAS Release Area
- Installation Boundary

Figure 4-2
PFAS Results:
2008 Car Fire
Site Inspection for PFAS
NBK Keyport, Keyport, Washington

0 15 30
1 inch = 30 feet
N



Location	NBKK-OU2A5-MW01		
Sample	NBKK-OU2A5-MW01-1222	NBKK-OU2A5-SS01-0H01	NBKK-OU2A5-SB01-3637
Sample Date	*12/1/2022*	*9/7/2022*	*10/31/2022*
Screen Interval/Sample Depth** (ft bgs)*	*40-60**	*0.5-1***	*36-37***
Media/Units	*Groundwater (ng/L)*	*Surface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*
PFOA	**27.9**	0.559 U	0.5 U
PFOS	**47.7**	**0.341 J**	0.5 U
PFBS	2.37 U	0.559 U	0.5 U
PFHxS	**8.99**	0.559 U	0.5 U
HFPO-DA	2.37 U	0.559 U	0.5 U
PFNA	2.37 U	0.559 U	0.5 U

Location	NBKK-OU2A5-SB04	
Sample	NBKK-OU2A5-SB04-0203	NBKK-OU2A5-SB04-0506
Sample Date	*11/1/2022*	*11/1/2022*
Sample Depth (ft bgs)	*2-3*	*5-6*
Media/Units	*Subsurface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*
PFOA	0.499 U	0.5 U
PFOS	0.499 U	0.5 U
PFBS	0.499 U	0.5 U
PFHxS	0.499 U	0.5 U
HFPO-DA	0.499 U	0.5 U
PFNA	0.499 U	0.5 U

Location	NBKK-OU2A5-MW02		
Sample	NBKK-OU2A5-MW02-1222	NBKK-OU2A5-SB02-0102	NBKK-OU2A5-SB02-2930
Sample Date	*12/7/2022*	*9/7/2022*	*10/29/2022*
Screen Interval/Sample Depth** (ft bgs)*	*40-60**	*1-2***	*29-30***
Media/Units	*Groundwater (ng/L)*	*Subsurface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*
PFOA	2.42 U	0.499 U	0.5 U
PFOS	2.42 U	0.499 U	0.5 U
PFBS	2.42 U	0.499 U	0.5 U
PFHxS	2.42 U	0.499 U	0.5 U
HFPO-DA	2.42 U	0.499 U	0.5 U
PFNA	2.42 U	0.499 U	0.5 U

November 2022 EPA RSLs		
	Groundwater (ng/L)	Soil/Sediment (µg/kg)
PFOA	6.0	19
PFOS	4.0	13
PFBS	600	1,900
PFHxS	39	130
HFPO-DA	6.0	23
PFNA	5.9	19

Location	NBKK-OU2A5-SB05	
Sample	NBKK-OU2A5-SB05-0203	NBKK-OU2A5-SB05-1011
Sample Date	*11/1/2022*	*11/1/2022*
Sample Depth (ft bgs)	*2-3*	*10-11*
Media/Units	*Subsurface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*
PFOA	0.5 U	0.5 U
PFOS	0.5 U	0.5 U
PFBS	0.5 U	0.5 U
PFHxS	0.5 U	0.5 U
HFPO-DA	0.5 U	0.5 U
PFNA	0.5 U	0.5 U

Location	NBKK-OU2A5-MW03		
Sample	NBKK-OU2A5-MW03-1222	NBKK-OU2A5-SB03-0102	NBKK-OU2A5-SB03-3334
Sample Date	*12/1/2022*	9/7/2022	9/8/2022
Screen Interval/Sample Depth** (ft bgs)*	*20-40**	*1-2***	*33-34***
Media/Units	*Groundwater (ng/L)*	*Subsurface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*
PFOA	**12.8**	0.524 U	0.5 U
PFOS	**31.7**	**0.236 J**	0.5 U
PFBS	**3.13 J**	0.524 U	0.5 U
PFHxS	**6.41**	0.524 U	0.5 U
HFPO-DA	2.25 U	0.524 U	0.5 U
PFNA	2.25 U	0.524 U	0.5 U

NOTES:
Bolded text indicates detection
Bolded and gray-highlighted text indicates an exceedance of the SL
* = Screen Interval Depth (groundwater sample)
** = Sample Depth (soil sample)
EPA = United States Environmental Protection Agency
ft bgs = feet below ground surface
HFPO-DA = Hexafluoropropylene oxide dimer acid
J = Analyte present, value may or may not be accurate or precise
NBK = Naval Base Kitsap
ng/L = nanograms per liter
OU = Operable Unit
PFAS = Per- and Polyfluoroalkyl Substances
PFBS = perfluorobutanesulfonic acid
PFHxS = Perfluorohexane sulfonate
PFNA = Perfluorononanoic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
RSL = regional screening level
U = The material was analyzed for, but not detected
µg/kg = micrograms per kilogram

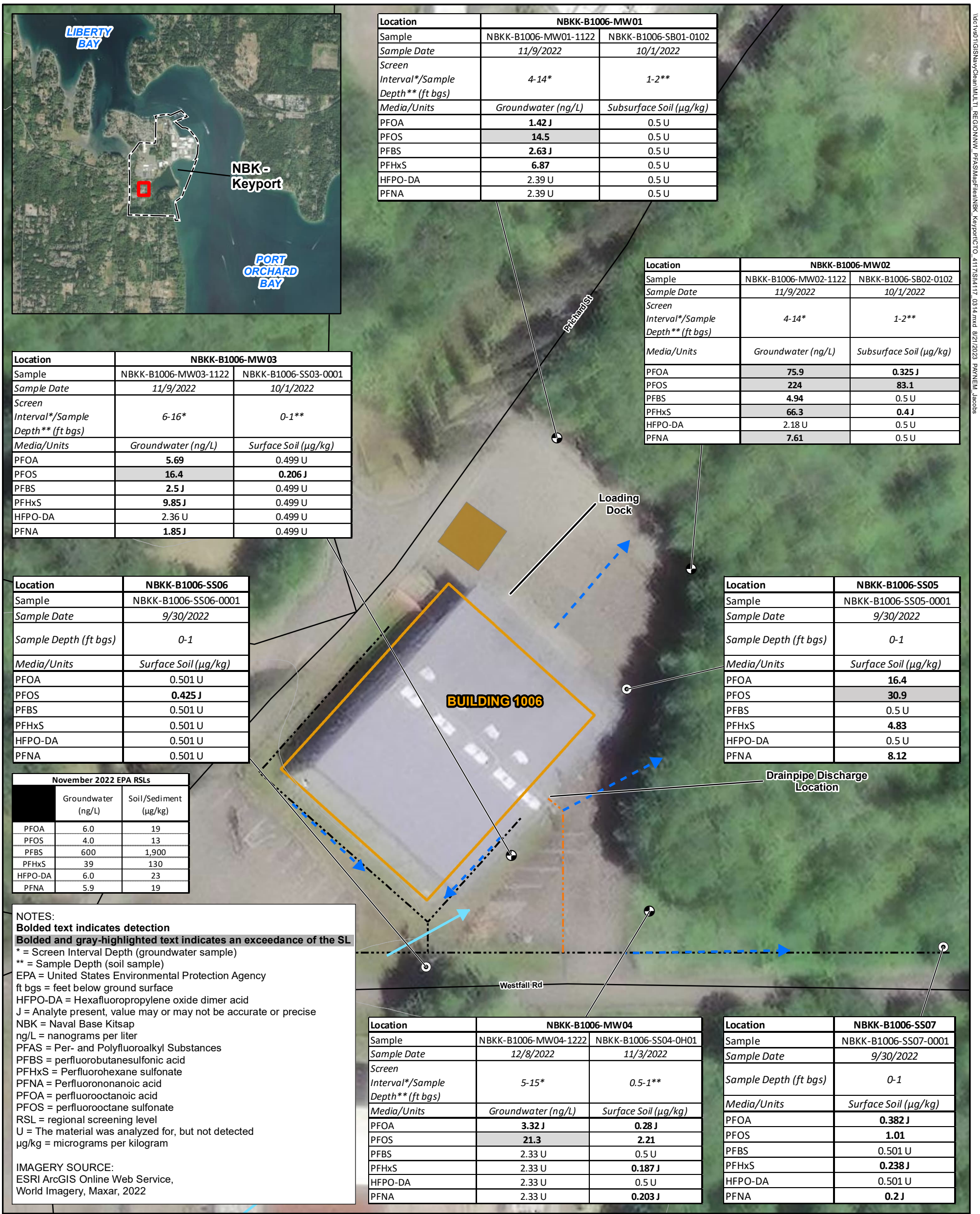
IMAGERY SOURCE:
ESRI ArcGIS Online Web Service,
World Imagery, Maxar, 2022

LEGEND

- Monitoring Well Installation/Groundwater Sampling/Soil Sampling Location
- Shallow Subsurface Soil Sampling Location
- Stormwater Catch Basin
- Surface Water Drainage Direction (Estimated)
- Upper Aquifer Groundwater Flow Direction
- 10' Topographic Contour
- Road
- Potential PFAS Release Area
- Installation Boundary

Figure 4-3
PFAS Results:
Keyport Sludge Disposal Area (OU 2/Area 5)
Site Investigation for PFAS
NBK Keyport, Keyport, Washington

0 15 30
1 inch = 30 feet
N



Location	NBKK-B1006-MW01	
Sample	NBKK-B1006-MW01-1122	NBKK-B1006-SB01-0102
Sample Date	*11/9/2022*	*10/1/2022*
Screen Interval/Sample Depth** (ft bgs)*	*4-14**	*1-2***
Media/Units	*Groundwater (ng/L)*	*Subsurface Soil (µg/kg)*
PFOA	**1.42 J**	0.5 U
PFOS	**14.5**	0.5 U
PFBS	**2.63 J**	0.5 U
PFHxS	**6.87**	0.5 U
HFPO-DA	2.39 U	0.5 U
PFNA	2.39 U	0.5 U

Location	NBKK-B1006-MW02	
Sample	NBKK-B1006-MW02-1122	NBKK-B1006-SB02-0102
Sample Date	*11/9/2022*	*10/1/2022*
Screen Interval/Sample Depth** (ft bgs)*	*4-14**	*1-2***
Media/Units	*Groundwater (ng/L)*	*Subsurface Soil (µg/kg)*
PFOA	**75.9**	**0.325 J**
PFOS	**224**	**83.1**
PFBS	**4.94**	0.5 U
PFHxS	**66.3**	**0.4 J**
HFPO-DA	2.18 U	0.5 U
PFNA	**7.61**	0.5 U

Location	NBKK-B1006-MW03	
Sample	NBKK-B1006-MW03-1122	NBKK-B1006-SS03-0001
Sample Date	*11/9/2022*	*10/1/2022*
Screen Interval/Sample Depth** (ft bgs)*	*6-16**	*0-1***
Media/Units	*Groundwater (ng/L)*	*Surface Soil (µg/kg)*
PFOA	**5.69**	0.499 U
PFOS	**16.4**	**0.206 J**
PFBS	**2.5 J**	0.499 U
PFHxS	**9.85 J**	0.499 U
HFPO-DA	2.36 U	0.499 U
PFNA	**1.85 J**	0.499 U

Location	NBKK-B1006-SS06
Sample	NBKK-B1006-SS06-0001
Sample Date	*9/30/2022*
Sample Depth (ft bgs)	*0-1*
Media/Units	*Surface Soil (µg/kg)*
PFOA	0.501 U
PFOS	**0.425 J**
PFBS	0.501 U
PFHxS	0.501 U
HFPO-DA	0.501 U
PFNA	0.501 U

Location	NBKK-B1006-SS05
Sample	NBKK-B1006-SS05-0001
Sample Date	*9/30/2022*
Sample Depth (ft bgs)	*0-1*
Media/Units	*Surface Soil (µg/kg)*
PFOA	**16.4**
PFOS	**30.9**
PFBS	0.5 U
PFHxS	**4.83**
HFPO-DA	0.5 U
PFNA	**8.12**

November 2022 EPA RSLs		
	Groundwater (ng/L)	Soil/Sediment (µg/kg)
PFOA	6.0	19
PFOS	4.0	13
PFBS	600	1,900
PFHxS	39	130
HFPO-DA	6.0	23
PFNA	5.9	19

NOTES:
Bolded text indicates detection
Bolded and gray-highlighted text indicates an exceedance of the SL
* = Screen Interval Depth (groundwater sample)
** = Sample Depth (soil sample)
EPA = United States Environmental Protection Agency
ft bgs = feet below ground surface
HFPO-DA = Hexafluoropropylene oxide dimer acid
J = Analyte present, value may or may not be accurate or precise
NBK = Naval Base Kitsap
ng/L = nanograms per liter
PFAS = Per- and Polyfluoroalkyl Substances
PFBS = perfluorobutanesulfonic acid
PFHxS = Perfluorohexane sulfonate
PFNA = Perfluorononanoic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
RSL = regional screening level
U = The material was analyzed for, but not detected
µg/kg = micrograms per kilogram

IMAGERY SOURCE:
ESRI ArcGIS Online Web Service,
World Imagery, Maxar, 2022

Location	NBKK-B1006-MW04	
Sample	NBKK-B1006-MW04-1222	NBKK-B1006-SS04-0H01
Sample Date	*12/8/2022*	*11/3/2022*
Screen Interval/Sample Depth** (ft bgs)*	*5-15**	*0.5-1***
Media/Units	*Groundwater (ng/L)*	*Surface Soil (µg/kg)*
PFOA	**3.32 J**	**0.28 J**
PFOS	**21.3**	**2.21**
PFBS	2.33 U	0.5 U
PFHxS	2.33 U	**0.187 J**
HFPO-DA	2.33 U	0.5 U
PFNA	2.33 U	**0.203 J**

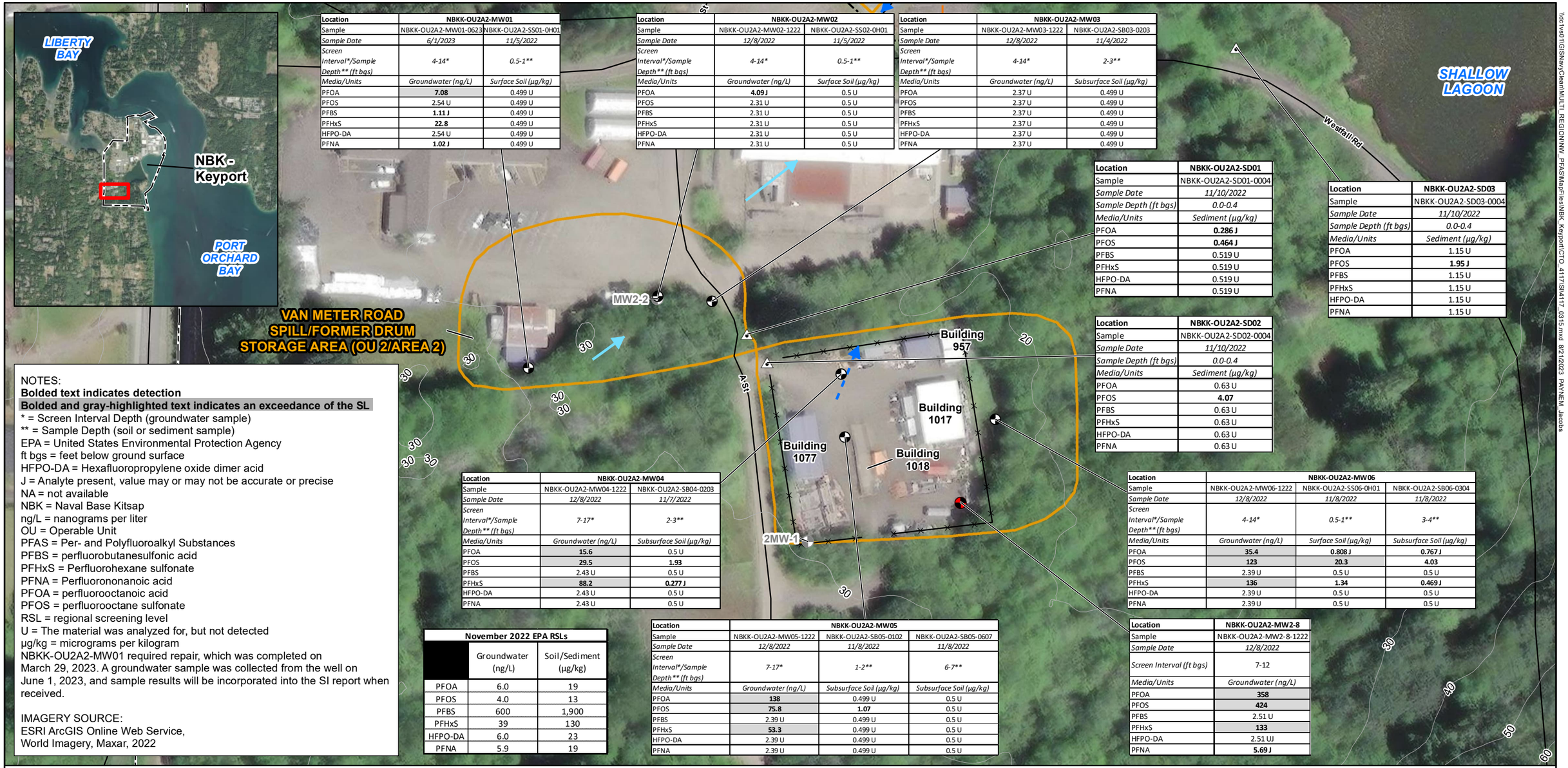
Location	NBKK-B1006-SS07
Sample	NBKK-B1006-SS07-0001
Sample Date	*9/30/2022*
Sample Depth (ft bgs)	*0-1*
Media/Units	*Surface Soil (µg/kg)*
PFOA	**0.382 J**
PFOS	**1.01**
PFBS	0.501 U
PFHxS	**0.238 J**
HFPO-DA	0.501 U
PFNA	**0.2 J**

LEGEND

- Monitoring Well Installation/Groundwater Sampling/Soil Sampling Location
- Surface Soil Sampling Location
- Surface Water Drainage Direction (Estimated)
- Upper Aquifer Groundwater Flow Direction
- Drainage Ditch
- Open Utility Ditch (at time of release)
- 10' Topographic Contour
- Road
- StorageTank
- Potential PFAS Release Area
- Installation Boundary

Figure 4-4
PFAS Results: Building 1006
Site Inspection for PFAS
NBK Keyport, Keyport, Washington

0 25 50
1 inch = 50 feet
N



Location	NBKK-OU2A2-MW01	
Sample	NBKK-OU2A2-MW01-0623	NBKK-OU2A2-SS01-0H01
Sample Date	*6/1/2023*	*11/5/2022*
Screen Interval/Sample Depth** (ft bgs)*	*4-14**	*0.5-1***
Media/Units	*Groundwater (ng/L)*	*Surface Soil (µg/kg)*
PFOA	**7.08**	0.499 U
PFOS	2.54 U	0.499 U
PFBS	**1.11 J**	0.499 U
PFHxS	**22.8**	0.499 U
HFPO-DA	2.54 U	0.499 U
PFNA	**1.02 J**	0.499 U

Location	NBKK-OU2A2-MW02	
Sample	NBKK-OU2A2-MW02-1222	NBKK-OU2A2-SS02-0H01
Sample Date	*12/8/2022*	*11/5/2022*
Screen Interval/Sample Depth** (ft bgs)*	*4-14**	*0.5-1***
Media/Units	*Groundwater (ng/L)*	*Surface Soil (µg/kg)*
PFOA	**4.09 J**	0.5 U
PFOS	2.31 U	0.5 U
PFBS	2.31 U	0.5 U
PFHxS	2.31 U	0.5 U
HFPO-DA	2.31 U	0.5 U
PFNA	2.31 U	0.5 U

Location	NBKK-OU2A2-MW03	
Sample	NBKK-OU2A2-MW03-1222	NBKK-OU2A2-SB03-0203
Sample Date	*12/8/2022*	*11/4/2022*
Screen Interval/Sample Depth** (ft bgs)*	*4-14**	*2-3***
Media/Units	*Groundwater (ng/L)*	*Subsurface Soil (µg/kg)*
PFOA	2.37 U	0.499 U
PFOS	2.37 U	0.499 U
PFBS	2.37 U	0.499 U
PFHxS	2.37 U	0.499 U
HFPO-DA	2.37 U	0.499 U
PFNA	2.37 U	0.499 U

Location	NBKK-OU2A2-SD01
Sample	NBKK-OU2A2-SD01-0004
Sample Date	*11/10/2022*
Sample Depth (ft bgs)	*0.0-0.4*
Media/Units	*Sediment (µg/kg)*
PFOA	**0.286 J**
PFOS	**0.464 J**
PFBS	0.519 U
PFHxS	0.519 U
HFPO-DA	0.519 U
PFNA	0.519 U

Location	NBKK-OU2A2-SD03
Sample	NBKK-OU2A2-SD03-0004
Sample Date	*11/10/2022*
Sample Depth (ft bgs)	*0.0-0.4*
Media/Units	*Sediment (µg/kg)*
PFOA	1.15 U
PFOS	**1.95 J**
PFBS	1.15 U
PFHxS	1.15 U
HFPO-DA	1.15 U
PFNA	1.15 U

Location	NBKK-OU2A2-SD02
Sample	NBKK-OU2A2-SD02-0004
Sample Date	*11/10/2022*
Sample Depth (ft bgs)	*0.0-0.4*
Media/Units	*Sediment (µg/kg)*
PFOA	0.63 U
PFOS	**4.07**
PFBS	0.63 U
PFHxS	0.63 U
HFPO-DA	0.63 U
PFNA	0.63 U

Location	NBKK-OU2A2-MW04	
Sample	NBKK-OU2A2-MW04-1222	NBKK-OU2A2-SB04-0203
Sample Date	*12/8/2022*	*11/7/2022*
Screen Interval/Sample Depth** (ft bgs)*	*7-17**	*2-3***
Media/Units	*Groundwater (ng/L)*	*Subsurface Soil (µg/kg)*
PFOA	**15.6**	0.5 U
PFOS	**29.5**	**1.93**
PFBS	2.43 U	0.5 U
PFHxS	**88.2**	**0.277 J**
HFPO-DA	2.43 U	0.5 U
PFNA	2.43 U	0.5 U

Location	NBKK-OU2A2-MW06		
Sample	NBKK-OU2A2-MW06-1222	NBKK-OU2A2-SS06-0H01	NBKK-OU2A2-SB06-0304
Sample Date	*12/8/2022*	*11/8/2022*	*11/8/2022*
Screen Interval/Sample Depth** (ft bgs)*	*4-14**	*0.5-1***	*3-4***
Media/Units	*Groundwater (ng/L)*	*Surface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*
PFOA	**35.4**	**0.808 J**	**0.767 J**
PFOS	**123**	**20.3**	**4.03**
PFBS	2.39 U	0.5 U	0.5 U
PFHxS	**136**	**1.34**	**0.469 J**
HFPO-DA	2.39 U	0.5 U	0.5 U
PFNA	2.39 U	0.5 U	0.5 U

November 2022 EPA RSLs	Groundwater (ng/L)	Soil/Sediment (µg/kg)
PFOA	6.0	19
PFOS	4.0	13
PFBS	600	1,900
PFHxS	39	130
HFPO-DA	6.0	23
PFNA	5.9	19

Location	NBKK-OU2A2-MW05		
Sample	NBKK-OU2A2-MW05-1222	NBKK-OU2A2-SB05-0102	NBKK-OU2A2-SB05-0607
Sample Date	*12/8/2022*	*11/8/2022*	*11/8/2022*
Screen Interval/Sample Depth** (ft bgs)*	*7-17**	*1-2***	*6-7***
Media/Units	*Groundwater (ng/L)*	*Subsurface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*
PFOA	**138**	0.499 U	0.5 U
PFOS	**75.8**	**1.07**	0.5 U
PFBS	2.39 U	0.499 U	0.5 U
PFHxS	**53.3**	0.499 U	0.5 U
HFPO-DA	2.39 U	0.499 U	0.5 U
PFNA	2.39 U	0.499 U	0.5 U

Location	NBKK-OU2A2-MW2-8
Sample	NBKK-OU2A2-MW2-8-1222
Sample Date	*12/8/2022*
Screen Interval (ft bgs)	7-12
Media/Units	*Groundwater (ng/L)*
PFOA	**358**
PFOS	**424**
PFBS	2.51 U
PFHxS	**133**
HFPO-DA	2.51 UJ
PFNA	**5.69 J**

NOTES:
Bolded text indicates detection
Bolded and gray-highlighted text indicates an exceedance of the SL
* = Screen Interval Depth (groundwater sample)
** = Sample Depth (soil or sediment sample)
EPA = United States Environmental Protection Agency
ft bgs = feet below ground surface
HFPO-DA = Hexafluoropropylene oxide dimer acid
J = Analyte present, value may or may not be accurate or precise
NA = not available
NBK = Naval Base Kitsap
ng/L = nanograms per liter
OU = Operable Unit
PFAS = Per- and Polyfluoroalkyl Substances
PFBS = perfluorobutanesulfonic acid
PFHxS = Perfluorohexane sulfonate
PFNA = Perfluorononanoic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
RSL = regional screening level
U = The material was analyzed for, but not detected
µg/kg = micrograms per kilogram
NBKK-OU2A2-MW01 required repair, which was completed on March 29, 2023. A groundwater sample was collected from the well on June 1, 2023, and sample results will be incorporated into the SI report when received.

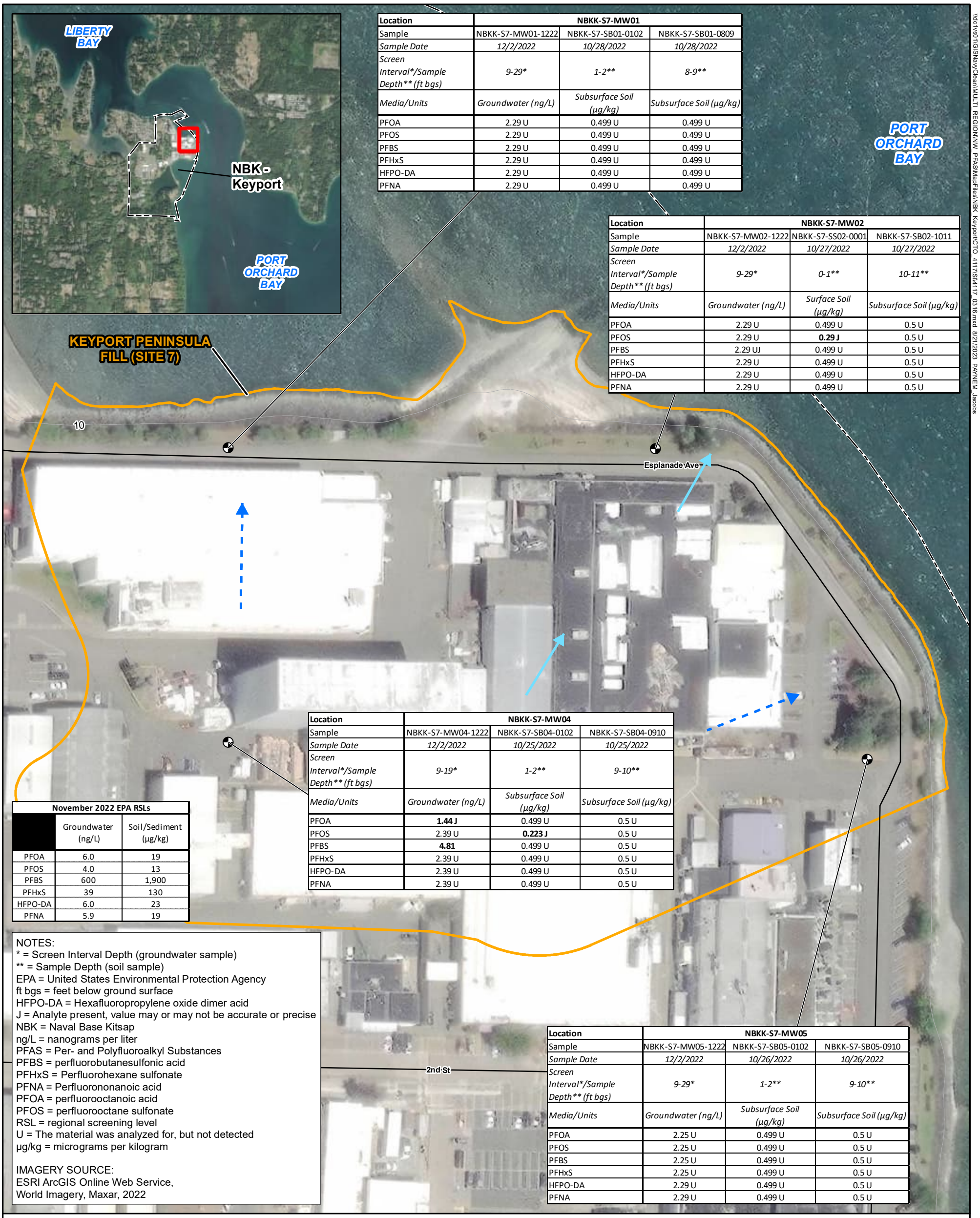
IMAGERY SOURCE:
ESRI ArcGIS Online Web Service,
World Imagery, Maxar, 2022

LEGEND

- Existing Monitoring Well Groundwater Sampling Location – well not found
- Monitoring Well Installation/Groundwater Sampling/Soil Sampling Location
- Existing Monitoring Well Groundwater Sampling Location
- Surface Soil Sampling Location
- Sediment Sampling Location
- Surface Water Drainage Direction (Estimated)
- Upper Aquifer Groundwater Flow Direction
- Fence
- Drainage Ditch
- Open Utility Ditch (at time of release)
- 10' Topographic Contour
- Road
- Potential PFAS Release Area
- Installation Boundary

Figure 4-5
PFAS Results:
Van Meter Road Spill/Former Drum Storage Area (OU 2/Area 2)
Site Inspection for PFAS
NBK Keyport, Keyport, Washington

0 50 100
1 inch = 100 feet
N



Location	NBKK-S7-MW01		
Sample	NBKK-S7-MW01-1222	NBKK-S7-SB01-0102	NBKK-S7-SB01-0809
Sample Date	*12/2/2022*	*10/28/2022*	*10/28/2022*
Screen Interval/Sample Depth** (ft bgs)*	*9-29**	*1-2***	*8-9***
Media/Units	*Groundwater (ng/L)*	*Subsurface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*
PFOA	2.29 U	0.499 U	0.499 U
PFOS	2.29 U	0.499 U	0.499 U
PFBS	2.29 U	0.499 U	0.499 U
PFHxS	2.29 U	0.499 U	0.499 U
HFPO-DA	2.29 U	0.499 U	0.499 U
PFNA	2.29 U	0.499 U	0.499 U

Location	NBKK-S7-MW02		
Sample	NBKK-S7-MW02-1222	NBKK-S7-SS02-0001	NBKK-S7-SB02-1011
Sample Date	*12/2/2022*	*10/27/2022*	*10/27/2022*
Screen Interval/Sample Depth** (ft bgs)*	*9-29**	*0-1***	*10-11***
Media/Units	*Groundwater (ng/L)*	*Surface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*
PFOA	2.29 U	0.499 U	0.5 U
PFOS	2.29 U	**0.29 J**	0.5 U
PFBS	2.29 UJ	0.499 U	0.5 U
PFHxS	2.29 U	0.499 U	0.5 U
HFPO-DA	2.29 U	0.499 U	0.5 U
PFNA	2.29 U	0.499 U	0.5 U

Location	NBKK-S7-MW04		
Sample	NBKK-S7-MW04-1222	NBKK-S7-SB04-0102	NBKK-S7-SB04-0910
Sample Date	*12/2/2022*	*10/25/2022*	*10/25/2022*
Screen Interval/Sample Depth** (ft bgs)*	*9-19**	*1-2***	*9-10***
Media/Units	*Groundwater (ng/L)*	*Subsurface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*
PFOA	**1.44 J**	0.499 U	0.5 U
PFOS	2.39 U	**0.223 J**	0.5 U
PFBS	**4.81**	0.499 U	0.5 U
PFHxS	2.39 U	0.499 U	0.5 U
HFPO-DA	2.39 U	0.499 U	0.5 U
PFNA	2.39 U	0.499 U	0.5 U

Location	NBKK-S7-MW05		
Sample	NBKK-S7-MW05-1222	NBKK-S7-SB05-0102	NBKK-S7-SB05-0910
Sample Date	*12/2/2022*	*10/26/2022*	*10/26/2022*
Screen Interval/Sample Depth** (ft bgs)*	*9-29**	*1-2***	*9-10***
Media/Units	*Groundwater (ng/L)*	*Subsurface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*
PFOA	2.25 U	0.499 U	0.5 U
PFOS	2.25 U	0.499 U	0.5 U
PFBS	2.25 U	0.499 U	0.5 U
PFHxS	2.25 U	0.499 U	0.5 U
HFPO-DA	2.29 U	0.499 U	0.5 U
PFNA	2.29 U	0.499 U	0.5 U

November 2022 EPA RSLs	Groundwater (ng/L)	Soil/Sediment (µg/kg)
PFOA	6.0	19
PFOS	4.0	13
PFBS	600	1,900
PFHxS	39	130
HFPO-DA	6.0	23
PFNA	5.9	19

NOTES:
* = Screen Interval Depth (groundwater sample)
** = Sample Depth (soil sample)
EPA = United States Environmental Protection Agency
ft bgs = feet below ground surface
HFPO-DA = Hexafluoropropylene oxide dimer acid
J = Analyte present, value may or may not be accurate or precise
NBK = Naval Base Kitsap
ng/L = nanograms per liter
PFAS = Per- and Polyfluoroalkyl Substances
PFBS = perfluorobutanesulfonic acid
PFHxS = Perfluorohexane sulfonate
PFNA = Perfluorononanoic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
RSL = regional screening level
U = The material was analyzed for, but not detected
µg/kg = micrograms per kilogram

IMAGERY SOURCE:
ESRI ArcGIS Online Web Service,
World Imagery, Maxar, 2022

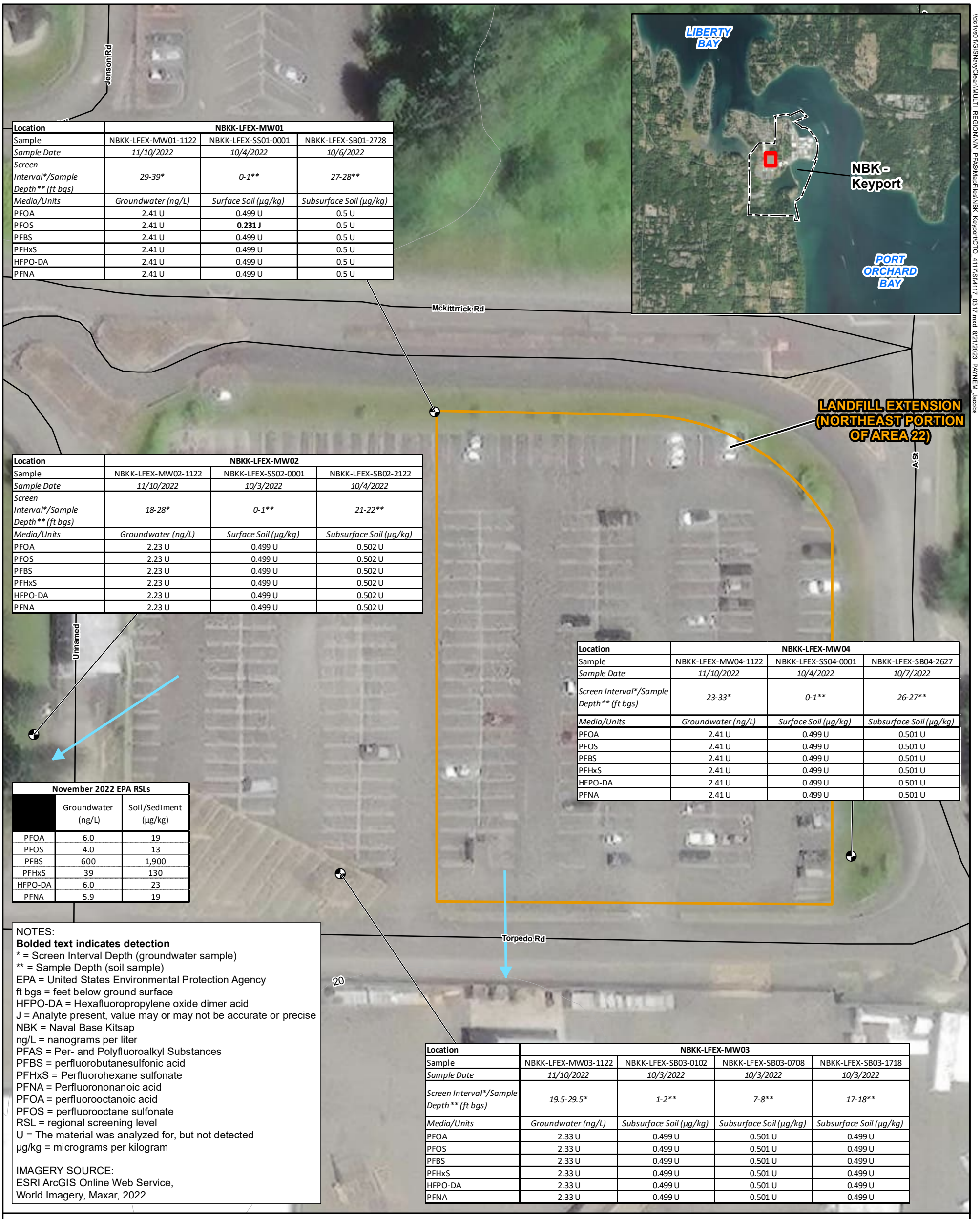
LEGEND

- Monitoring Well Installation/Groundwater Sampling/Soil Sampling Location
- Surface Water Drainage Direction (Estimated)
- Upper Aquifer Groundwater Flow Direction
- 10' Topographic Contour
- Road
- Potential PFAS Release Area
- Installation Boundary

Figure 4-6
PFAS Results: Keyport Peninsula Fill (Site 7)
Site Investigation for PFAS
NBK Keyport, Keyport, Washington

0 45 90
1 inch = 90 feet
N

\\dc1vs01\GIS\Navy\Clean\MULTI_REGION\NW_PFAS\MapFiles\NBK_Keyport\CTO_4117\SI\4117_0316.mxd 8/21/2023 PAYNEM_Jacobs



Location	NBKK-LFEX-MW01		
Sample	NBKK-LFEX-MW01-1122	NBKK-LFEX-SS01-0001	NBKK-LFEX-SB01-2728
Sample Date	*11/10/2022*	*10/4/2022*	*10/6/2022*
Screen Interval/Sample Depth** (ft bgs)*	*29-39**	*0-1***	*27-28***
Media/Units	*Groundwater (ng/L)*	*Surface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*
PFOA	2.41 U	0.499 U	0.5 U
PFOS	2.41 U	**0.231 J**	0.5 U
PFBS	2.41 U	0.499 U	0.5 U
PFHxS	2.41 U	0.499 U	0.5 U
HFPO-DA	2.41 U	0.499 U	0.5 U
PFNA	2.41 U	0.499 U	0.5 U

Location	NBKK-LFEX-MW02		
Sample	NBKK-LFEX-MW02-1122	NBKK-LFEX-SS02-0001	NBKK-LFEX-SB02-2122
Sample Date	*11/10/2022*	*10/3/2022*	*10/4/2022*
Screen Interval/Sample Depth** (ft bgs)*	*18-28**	*0-1***	*21-22***
Media/Units	*Groundwater (ng/L)*	*Surface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*
PFOA	2.23 U	0.499 U	0.502 U
PFOS	2.23 U	0.499 U	0.502 U
PFBS	2.23 U	0.499 U	0.502 U
PFHxS	2.23 U	0.499 U	0.502 U
HFPO-DA	2.23 U	0.499 U	0.502 U
PFNA	2.23 U	0.499 U	0.502 U

Location	NBKK-LFEX-MW04		
Sample	NBKK-LFEX-MW04-1122	NBKK-LFEX-SS04-0001	NBKK-LFEX-SB04-2627
Sample Date	*11/10/2022*	*10/4/2022*	*10/7/2022*
Screen Interval/Sample Depth** (ft bgs)*	*23-33**	*0-1***	*26-27***
Media/Units	*Groundwater (ng/L)*	*Surface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*
PFOA	2.41 U	0.499 U	0.501 U
PFOS	2.41 U	0.499 U	0.501 U
PFBS	2.41 U	0.499 U	0.501 U
PFHxS	2.41 U	0.499 U	0.501 U
HFPO-DA	2.41 U	0.499 U	0.501 U
PFNA	2.41 U	0.499 U	0.501 U

November 2022 EPA RSLs	Groundwater (ng/L)	Soil/Sediment (µg/kg)
PFOA	6.0	19
PFOS	4.0	13
PFBS	600	1,900
PFHxS	39	130
HFPO-DA	6.0	23
PFNA	5.9	19

NOTES:
Bolded text indicates detection
* = Screen Interval Depth (groundwater sample)
** = Sample Depth (soil sample)
EPA = United States Environmental Protection Agency
ft bgs = feet below ground surface
HFPO-DA = Hexafluoropropylene oxide dimer acid
J = Analyte present, value may or may not be accurate or precise
NBK = Naval Base Kitsap
ng/L = nanograms per liter
PFAS = Per- and Polyfluoroalkyl Substances
PFBS = perfluorobutanesulfonic acid
PFHxS = Perfluorohexane sulfonate
PFNA = Perfluorononanoic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
RSL = regional screening level
U = The material was analyzed for, but not detected
µg/kg = micrograms per kilogram

IMAGERY SOURCE:
ESRI ArcGIS Online Web Service,
World Imagery, Maxar, 2022

Location	NBKK-LFEX-MW03			
Sample	NBKK-LFEX-MW03-1122	NBKK-LFEX-SB03-0102	NBKK-LFEX-SB03-0708	NBKK-LFEX-SB03-1718
Sample Date	*11/10/2022*	*10/3/2022*	*10/3/2022*	*10/3/2022*
Screen Interval/Sample Depth** (ft bgs)*	*19.5-29.5**	*1-2***	*7-8***	*17-18***
Media/Units	*Groundwater (ng/L)*	*Subsurface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*
PFOA	2.33 U	0.499 U	0.501 U	0.499 U
PFOS	2.33 U	0.499 U	0.501 U	0.499 U
PFBS	2.33 U	0.499 U	0.501 U	0.499 U
PFHxS	2.33 U	0.499 U	0.501 U	0.499 U
HFPO-DA	2.33 U	0.499 U	0.501 U	0.499 U
PFNA	2.33 U	0.499 U	0.501 U	0.499 U

LEGEND

- Monitoring Well Installation/Groundwater Sampling/Soil Sampling Location
- Upper Aquifer Groundwater Flow Direction
- 10' Topographic Contour
- Road
- Potential PFAS Release Area
- Installation Boundary

Figure 4-7
PFAS Results: Landfill Extension (Northeast Portion of Area 22)
Site Inspection for PFAS
NBK Keyport, Keyport, Washington

0 25 50
1 inch = 50 feet
N

SECTION 5

Conclusions and Recommendations

Of the seven potential PFAS release areas identified for SI activities in the PA, four are recommended for further investigation in the form of an RI and three are recommended for no further investigation at this time. The conclusions and recommendations from the SI are summarized in **Table 5-1**.

Table 5-1. Site Inspection Summary and Recommendations

Potential PFAS Release Area	Rationale	Recommendation
Building 76	• PFBS and PFHxS are present in groundwater in five and seven of the eight monitoring wells at Building 76, respectively, but concentrations are below SLs. PFOA exceeds the SL in three monitoring wells. • PFOS is present in soil at concentrations in exceedance of the SL at two well/boring locations, at depths above 3 feet. The location of the two soil samples with PFOS concentrations above SLs east of and potentially down- or cross-gradient of areas where PFAS (as AFFF) was used. • Although the HHRS did not identify COPCs in soil or groundwater, there are sufficient uncertainties regarding the hydraulic conditions at the site, coupled with the proximity to the Base boundary, to support recommendation of an RI.	• Initiate RI.
2008 Car Fire	• PFOA, PFOS, and PFHxS are present in groundwater at concentrations above the SLs. PFOS exceeds the SL in three monitoring wells, and PFOA and PFHxS each exceed the SL in two monitoring wells. • PFOA, PFOS, and PFNA are present in soil at concentrations below the SLs. • HHRS identified potential unacceptable human health risk for PFOS, PFOA, and PFHxS in groundwater.	• Initiate RI.
Keyport Sludge Disposal Area (OU 2/Area 5)	• PFOA and PFOS are present in groundwater at concentrations above the SLs. PFOA and PFOS each exceed the SL in two monitoring wells. • PFOS was present in soil at two locations, at concentrations below the SL. • HHRS identified potential unacceptable human health risk for PFOS and PFOA in groundwater.	• Initiate RI.
Building 1006	• PFOA, PFOS, PFNA, and PFHxS are present in groundwater at concentrations above the SLs. PFOS exceeds the SL in four monitoring wells, and PFOA, PFNA, and PFHxS each exceed the SL in one well. • PFOS is present in soil at concentrations above the SL at two surface soil sample locations. • HHRS identified potential unacceptable human health risk for PFOS and PFOA in groundwater.	• Initiate RI.
Van Meter Road Spill/ Former Drum Storage Area (OU 2/Area 2)	• PFOA, PFOS, and PFHxS are present in groundwater at concentrations above the SLs, each exceeding the SL in four monitoring wells. • PFOS is present in soil at a concentration above the SL at one surface soil sample locations. • PFOS and PFOA is present in sediment at concentrations below the SL. • HHRS identified potential unacceptable human health risk for PFOS and PFOA in groundwater.	• Initiate RI.

Table 5-1. Site Inspection Summary and Recommendations

Keyport Peninsula Fill (Site 7)	• PFBS and PFOA are present in groundwater at Site 7 at concentrations below the SLs, at one location. • PFOS is present in soil at Site 7 at concentrations below the SL, at two surface soil sample locations. • Upper aquifer groundwater flow and lithology were consistent with the CSM. • Three groundwater sample locations downgradient of the suspected source exhibited no PFAS detections in groundwater; these results would have identified potential releases to groundwater at the site. • The HHRS did not identify COPCs, indicating there are no unacceptable human health risks associated with exposure to PFOA, PFOS, PFBS, PFHxS, HFPO-DA, and PFNA in soil or groundwater based on available results. • There is no documentation of a PFAS release from the PA.	• No further investigation at this time.
Landfill Extension (Northeast Portion of Area 22)	• PFAS analyzed were not detected in groundwater at the Landfill Extension. • PFOS is present in soil at the Landfill Extension at a concentration below the SL, at one location. • Upper aquifer groundwater flow and lithology were consistent with the CSM. • There are two groundwater sample locations downgradient of the suspected release area and at which PFAS was not detected in groundwater; these results would have identified potential releases to groundwater at the site. • The HHRS did not identify COPCs, indicating there are no unacceptable human health risks associated with exposure to PFOA, PFOS, PFBS, PFHxS, HFPO-DA, and PFNA in soil or groundwater based on available results. • There is no documentation of a PFAS release from the PA.	• No further investigation at this time.

SECTION 6

References

CH2M HILL, Inc. (CH2M). 2018. *Initial Screening of Potential Per- and Polyfluoroalkyl Substances (PFAS) Source Areas at Naval Base Kitsap Keyport and Associated Special Areas, Keyport, Washington.* December.

CH2M. 2020. *Preliminary Assessment for Per- and Polyfluoroalkyl Substances (PFAS), Naval Base Kitsap Keyport and Associated Special Areas, Keyport, Washington.* October.

CH2M. 2022a. *Sampling and Analysis Plan, Site Inspection for Per- and Polyfluoroalkyl Substances for Naval Base Kitsap Keyport, Keyport, Washington*. September.

CH2M. 2022b. *Combined Waste Management Plan (WMP) and Environmental Protection Plan (EPP), Site Inspection for Per- and Polyfluoroalkyl Substances, Naval Base Kitsap Keyport, Keyport, Washington*. August.

Department of Defense (DoD) 2019. Instruction 4715.18: Emerging Chemicals (ECs) of Environmental Concern. September.

DoD. 2023. Memo: *Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program*. August.

Department of the Navy (Navy). 1993a. *Remedial Investigation Report, NUWC Keyport*. Prepared by URS Consultants and Science Applications International Corporation for EFA NW under CLEAN Contract No. N62474-89-D-9295, CTO 10.

Keyport Public Utility District Water Resources Director. 2022. Personal communication (email with NAVFAC Northwest). December 6.

Navy. 1993b. *Inspection Report, Study Areas 7 and 22*. March 31.

Navy. 1995. *Sampling and Analysis Plan for Operable Unit 2, Area 5, Sludge Disposal Area, Naval Undersea Warfare Center Division, Keyport, Washington.* July.

Navy. 1996. *Results of Post-ROD Confirmatory Sampling at Area 9, Liberty Bay, Operable Unit 2, Naval Undersea Warfare Center Division Keyport, Washington*. July.

Navy. 2005. *Second Five-Year Review of Records of Decision, Operable Unit 1 and Operable Unit 2*. May 12.

Navy. 2016. *PFC Drinking Water Testing Summary 071916*. July 19.

Navy. 2018. *Class 1 Property Record, Well Site-Kitsap County Fairground*. June 25.

Naval Energy and Environmental Support Activity (NEESA). 1984. *Initial Assessment Study of Naval Undersea Warfare Engineering Station, Keyport, Washington*. September.

Pioneer Technologies Corporation, 2008. *U.S. Navy Human Health Risk Assessment Guidance.* Prepared for Naval Facilities Engineering Command and Navy and Marine Corps Public Health Center. December.

Tides and Currents. 2022. *Bremerton, WA - Station ID: 9445958*. https://tidesandcurrents.noaa.gov/stationhome.html?id=9445958.

TSDF Manager. 2023. Personal communication (email with CH2M and NAVFAC Northwest). November 1.

URS Consultants (URS). 1992. *Site Inspection Area 7 and Area 22; Naval Undersea Warfare Center; Division Keyport; Keyport, Washington; CTO-D048; Project Plans*. February 10.

URS. 1993. *Final Site Inspection Report, Study Areas 7 and 22, Naval Undersea Warfare Center; Division Keyport; Keyport, Washington; CTO-0077.* March 31.

United States Environmental Protection Agency (USEPA). 2022. *Regional Screening Level (RSL) Summary Table (TR=1E-06, HQ=0.1)*. November.

USEPA. 2023. *Regional Screening Level (RSL) Summary Table (TR=1E-06, HQ=0.1)*. May.

Weatherbase. 2023. Keyport Weather Summary. Accessed December 28, 2022. http://www.weatherbase.com/weather/weather-summary.

Appendix A
Field Documentation

Projects (continued)

~~Holt Drilling Services Inc.~~

~~Team:~~

~~Quaid Curtis - Lead Driller~~

~~Gavin Hardin - Helper~~

~~Brandon Smeal - Helper~~

~~Isaiah Whalawitsa - Air Knife~~

~~Kristian Thomas - Air Knife~~

Yellow Jacket Drilling

Team:

Michael Anderson - Lead Driller

Eric Clifford - Helper

Riley Jonson - Helper

Luke Thompson - Helper

Keyport, WA 8/30/2022

NBK - Keyport

Personnel On-Site: Ilka D. Dinkelman, Jordan Peery-Lemon, Camden Corio > Jacobs

Holt Drilling - Drillers + Air Knife Crews

Weather: Clear Skies, Calm Winds, 60's-80's

Heat Advisory beginning at 12:00

Objective: First day mobilization activities Air Knife at locations surrounding NBKK-B76. Begin with MW-01 and MW-02.

7:50 Arrive on Site at Storage area. Pick up equipment and materials for daily field activities.

8:05 Call from Holt Team - Quaid Curtis. Send location information and directions to lay-down/IDW Staging area.

8:15 Drill team on Site. Begin off-loading materials and equipment from Semi-Truck and Support Rig.

8:35 Begin Health and Safety Meeting with all Field team members. Topics include.

- Proper PPE

- No eating/drinking in exclusion zones
- Use spotters when backing in areas of traffic, pedistrian walk-ways or limited line-of-sight
- Heat Stress / Hydration
- Good Communication.

8:55 Complete HSEQ Meeting.
9:00 Mobilize to location NBKK-B76-MWØ1
9:15 Speak to fire-station. All permits approved. Road closure and dig permits are in place.
9:30 Begin Cutting Concrete at location NBKK-B76-MWØ1.
10:50 Complete cutting asphalt. ~9.0"
11:00 Begin Air Knife
11:05 Collect Sample 2.0-3.0' bgs [NBKK-B76-SØ1-0203]
11:15 Complete Air Knife to 6.75' Backfill Material into hole. Prepare to move air knife to NBKK-B76-MWØ2
11:20 Move air Knife. Mobilize Rig into Position at B76-MWØ1
11:45 Begin drilling activities at NBKK-B76-MWØ1
11:50 Pull core 6.0-10.0' bgs (100%)
12:00 Pull core 10.0-20.0' bgs (80%)
12:15 Pull core 20.0-30.0' bgs (60%)
12:25 Pull core 30.0-40.0' bgs
12:30 Drillers Break
12:50 Drillers off Break. Meet up with Air Knife Crew
13:10 Camden Corio bringing water level meter to location.
13:20 Measure DTW ~ 13.52' bgs.
13:25 Contact Peter Lawson / SME RE: Lithology vs. DTW. Lithology observed no significant water bearing zones from 10.0-30.0', Soil from 6.0-9.0' was wet. Above a more competent lithology from 10.0-16.0' Based on lithology, best water bearing zone ~30.0-40.0' and a screen interval from 29.0'-39.0' will likely provide best water, Peter Lawson will send e-mail to confirm with team best approach for setting well.
13:45 Complete call with Peter Lawson. Send Photo via e-mail of core.
13:55 Collect Sample 25-26.0'

13:55 NBKK-B76-SB01-2526

14:05 Contact Rachel Clennon with update on drilling activities. Summarized call with peter lawson.

14:10 Drillers case to 40.0' bgs and perform clean-out. Will await decision of screened interval prior to setting well.

14:45 Finish clean out. Depth @ of casing is 40.0'

14:50 Discuss well specifications with drillers. Screen from 29.0-39.0'
#12/20 Sand - 27.0 - 40.0' (5)
3/8" Bentonite 2.0 - 27.0'
Note: Drillers begin setting well Drillers will likely place chips/ seal on filter pack and allow for hydration. Drillers likely to depart for day and complete setting well and well completion on 8/31/2022. [BPL-420]

15:00 Air knife crew will stage truck at laydown area and complete location B76-MW04 in grass area in morning. Clean and secure site.

Teams finish end-of-day activities.

15:10 Drillers depart Site.

15:25 Complete call with Rachel Clennon RE: Surface / Near surface soil samples. Will generate table for field staff presenting Site History (Area history), Fill locations vs. native soil and likely preferential depths where samples should be collected. Will likely also vary from location to location. Staff should reach out to SME's for further guidance.

16:10 Jacobs team completes daily field activities and departs Site for day.

Mike D. Quintelma
August 30, 2022

Keyport, WA — August 31, 2022
NBK-Keyport

Personel On Site: Ilka D. Dinkelman, Jordan Peery-Lemon, Cameron Corio > Jacobs
Holt Drilling and Air Knife teams on-site.
Weather: Clear Skies, 60's-80's, Calm Winds
Objective: Complete setting well at NBKK-B76-MW01. Set up and drill at NBKK-B76-MW02. Air Knife B76-MW04

7:50 Arrive on Site. Meet with Jacobs Staff at laydown area discuss daily objectives
8:00 Join HSE Call RE: Holt. Discuss ongoing issues with field staff
8:40 During Call Travis Stephens arrived on Site. Team members for Jacobs and Holt have safety briefing and discuss on-going field concerns
9:25 Complete Meeting. Field re-set actions in place. Further discussions with Travis Stevens as team Mobilizes
10:00 Arrive on Site @ NBKK-B76-MW01. Drillers finish setting well and Perform well completion activities
10:15 Call with Loren Kaehn
10:20 Depart Site to pick up Tablet/ RI
10:50 Return to Site. Drillers staged at NBKK-B76-MW02. Repairing Jaws on Rig.
11:15 Complete Repair
11:20 Begin drilling activities. Gavin Hardin / Helper at controls operating Rig. Driller providing oversight-helper.
11:25 Pull core 6.0-10.0' (100%)
11:30 Pull core 10.0-20.0' (~~80~~ 70%)
11:35 Perform clean out. Case to 20.0' Soil removed is wet and did not hold in core barrell.
11:45 Contact Peter Lawson. RE: Lithology Soil at 20.0' appears moist not dry. Water may be perched and flowed down-hole during casing/ cleanout Check DTW ~17.0' bgs.
12:00 Instruct Drillers to resume and pull sample to 30.0' bgs.
12:10 Pull core 20-30.0' (80%)
12:30 Pull core 30-40.0'
12:40 Drillers break for Lunch

13:10 Return from Lunch. Have drillers advance to 50.0' bgs.

13:45 Pull core from 40-50.0' (75%)

13:50 Drillers to advance to 60.0'

14:05 Water observed to come out from top of drill rod

14:15 Pull core from 50-60.0' (70%) Water observed ~51.0' bgs.

14:20 Contact Rachel Clennon RE: Field observations.
- Storm drains and retaining wall west of A Street
- Lithology
- DTW observations / changes
- well placement / objectives.

1435 Drillers will case to 60.0' and perform clean-out. Current DTW ~20.0' & bottom of casing.. W.S.E. likely to increase

1445 Call with Peter Lawson. Summarize previous discussions with R. Clennon. Confirm wellspecs. Screen 49.0-59.0' bgs

1505 Drillers complete clean out and case to 60.0' bgs.

Clean area and secure Site. Will tag bottom of borehole prior to setting well.

1510 Collect Sample 48.0-49.0' NBKK-B76-SB02-4849 Depth to Water ~51.0' bgs

1515 Holt departs Site. Jacobs team cleans samplers area. Secure Site.

1600 Depart Site for day.

Aug 31, 2022

Keyport, WA Sept 1, 2022

Personnel On-Site: Ilka D. Dinkelman, Jordan Peery-Lemon, Camden Corio > Jacobs
Holt Drilling Services Team
Weather: Clear Skies, Calm, 60-70's
Objective: Set well NBKK-B76-MW02
Mobilize, begin drilling NBKK-B76-MW03

7:50 Arrive on Site. Meet with field team at laydown area.
8:00 Jordan-Peery-Lemon leads HSEQ. Topics include PPE, Hydration, daily objectives & Slip-Trip-Fall. Also discuss placement of Materials and equipment on/near storm drains and wrapping rig when working on slopes to Mitigate-contain any potential releases.
8:20 Mobilize to location B76-MW02. Discuss well specs. as follows:
Screen 49-59.0'
#12/20 Sand 47.0-60.0'
3/8" Chips 2.0-47.0'
8:40 Begin Setting well. Jordan Peery-Lemon labels drums containing IDW from B76-MW01 and B76-MW02. Soil has been mixed from first two locations.
9:00 Complete addition of sand/filter pack add Bentonite. Allow for hydration
10:00 Bentonite in. Finish setting well.
10:15 Amanda Rohrbaugh Navy RPM on Site to check drilling status
Will try and locate documentation
RE: NUWC Stormwater design
Will confirm location for water use.
10:40 Finish setting well. Begin mobilization to location NBKK-B76MW03. In parking area on Slope. Load support truck with four drums generated with IDW to take to laydown area and tooling for decon.
10:55 Amanda Rohrbaugh departs Site. Complete well activities at NBKK-B76-MW02 [BPL-421]
11:00 Holt Safety Manager Sean Sewell on-Site.
11:20 Complete Set up at NBKK-B76-MW03 Drillers depart to laydown area to drop off drums and decon activities.

Jordan Peery-Lemon and Camden Corlo to oversee lay-down area activities. Sean Sewell Departed

1235 Drillers return to Site. Complete Set up at NBKK-B76-MWØ3

1250 Begin drilling activities at MWØ3

1255 Pull Core 6.0-10.0' (60%)

1300 Pull Core 10.0-20.0' (90%)

1315 Pull Core 20.0-30.0' (65%)
Drillers case to 30.0' and

1325 perform clean out. *Note:

1335 Jordan measures DTW ~ 24.85' bgs

1340 Message Rachel Clennon and Peter Lawson. Send photos of core up to 30.0' bgs.

1350 Speak with Rachel Clennon RE: Current depth small W.B.Z. at ~ 23.75-24.25' bgs.

1405 Speak with peter lawson.

1415 Have drillers continue to 40.0'

1430 Pull Core from 30.0-40.0' Potential W.B.Z. encountered at ~35.0' bgs. Currently cased to 30.0' DTW ~ 31.0' Have drillers continue to 45.0' bgs.

1445 Pull casing from 40-45 (65%)

1450 Call with P. Lawson / R. Clennon RE: Well. Set from 34.0-44.0' Drillers will case off to 45.0' and perform clean-out.

1505 Drillers complete clean-out. Depart for day. Will set well and Mobilize to NBKK-B76-MWØ4 prior to weekend Mobilization.

1510 DTW MWØ1 = 11.31' DTW MWØ2 = 12.94'

1325 Note: Jordan Peery-Lemon collect Field Blank Sample
NBKK-B76-FBØ1-090122

1510 Collect Sample 33.0'-34.0'
NBKK-B76-SBØ3-3334

1525 ~~1525~~ Jacobs staff complete end-of-day activities. Clean and secure Site

1600 ~~1600~~ Jacobs Staff departs Site.

* Gavin Hardin drilling.

Keyport, Wa
NBK-Keyport

Sept 2, 2022

Personnel On-Site: Ilka D. Dinkelman, Jordan Peery-Lemon, Camden Corio > Jacobs
Welt Drillers - No Air Knife
Weather: Foggy, Cool 50's-70's Mild breeze. Clearing Skies ~11:00 am
Objective: Set well NBKK-B76-MW03
Mobilize Rig and Stage at MW-04

7:45 Meet team at laydown area
All field staff present.
7:50 Jordan Peery-Lemon leads HSEQ Meeting. Discuss traffic safety. Use of spotters when backing skidsteer. Moving tooling/materials on Slope.
8:05 Mobilize to NBKK-B76-MW03
Contact Rachel Clennon RE: Daily objective and field status.
8:15 Warm up Rig. Prepare for daily field activities.
8:20 Perform clean-out. DTW at B76-MW03 = 23.45 Hole is cased to 45.0' and tag depth is 40.0' bgs. Discuss well specification with drillers.
Screen 34.0-44.0'
#12/20 Sand 32-45.0' (4)
3/8" Chips 2.0-32.0' (14)
Concrete 0-2.0'
8:40 Begin Setting Well
9:00 Complete Filter Pack. Add Bentonite for Seal. Hydrate.
9:05 Check locations NBKK-B76-SS05 in grass Median and B76-SB05 located south of Firehouse adjacent to Sump. Discuss with Rachel Clennon. Send Photos
9:30 Have drillers access Man-hole adjacent to Proposed B76-SB05
Depth of Vault is ~6.0'
Utility lines present. Also open access panel. 1.5-2.0' Depth "Cut" wires inside.
10:00 Complete hydration on Finish setting well and begin well completion. [BPL-422]
10:30 Finish well completion activities. Begin Mobilizing equipment

to location NBKK-B76-MW04.

10:50 Prepare to collect sample NBKK-B76-SS05. Located in grass median between Parking lots south of Fire Station

10:55 Decon trowell. Collect Equipment Blank [NBKK-B76-EB01-09022250]

11:05 Collect Sample 0.0-1.0' [NBKK-B76-SS05-0001]

11:15 Drillers depart for lay-down area to drop off drums.

11:30 Arrive at laydown area Discuss IDW area with drillers.
- Double lined visqueen
- Sweep area
- Expand Secondary Containment

11:45 Drillers depart Site

12:00 Jacobs Staff drop off Materials at Storage Unit. Depart Site for day.

9-7-2022

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Week #2 9/6-9/9

Keyport, WA 9/6/2022
NBK-Keyport

Personnel On-Site: Ilka D. Dinkelman, Jordan Peery-Lemon, Caitlin Dronfield > Jacobs; Quaid Curtis, Brandon Small, Kristian Thomas > Holt Drilling Services
Weather > Clear Skies, Mild Breeze, 50's-70's. Cold a.m, Warm p.m.
Objective: Drill location NBKK-B76-MW04
Mobilize to OU2-Area 5

7:45 Arrive On-Site. Meet with Jordan Drillers arrive awaiting additional Staff. Gavin Hardin not on Site. Replaced by Kristian Thomas.
8:15 Caitlin Dronfield on Site. Drillers complete arranging IDW.
8:20 Jordan Peery-Lemon leads HSEQ. Review Hospital Route. St. Michael's Medical in Silverdale, WA
8:40 Complete HSEQ. Team mobilize to NBKK-B76-MW04. Rig set up prior to weekend departure.
9:10 Begin drilling B76-MW04
9:05 Pull core 6.0-10.0' (85%)
9:20 Pull core 10.0-20.0' (85%)
9:50 Pull core 20.0-30.0' (80% Recovery)
10:05 Pull core 30.0-40.0' (70%)
10:20 Pull core 40.0-50.0' (65%)
10:45 Pull core 50.0-60.0' (70% Recovery)
11:35 Pull core 60.0-70.0' Material More wet. Better W.B.Z. DTW ~ 28.25'
Contact Peter Lawson and Rachel Clennon. Since water Screen 59-69
11:40 Collect Sample 58.0-59.0' bgs
NBKK-B76-SB04-5859
11:45 Speak with drillers RE: Well Specifications. Will set well screen:
Screen 58.0-59.0
#12/20 Sand 56-70.0' (5 bags)
3/8" Chips 2.0-56.0' (10)
Concrete 0.0-2.0' (2)
Caitlin Dronfield to check utilities May require purchase of Paints to highlight/re-mark utilities. locates to resume' 09-07-2022
11:50 Begin Setting well to specifications.
12:20 Complete addition of filter pack and lower seal. Begin hydration.
13:30 Complete hydration BPL-423

1345 Complete setting well. Begin well completion activities.
1400 Off Call with Rachel Clennon RE: Excavation Permits at Site 7. Drums / Equipment still in place at NBKK-S7-MW03. Will contact client / NAVY RPM to confirm movement of materials prior to utility locate
1405 Finish well completion. Label drums. (3) generated Soil.
1430 Jordan Peery-Lemon escorts lead driller to OU2/Area 5 well. Scope NBKK-OU2A5-MW03
1435 Drillers depart to laydown area @ ~~from~~ for decon. Place drums in IDW secondary containment area.
1455 Drillers depart Site.
1515 Jacobs staff depart Site. Complete end-of-day activities.

Ilka D. Dinkelman
9-6-2022

Sept 7, 2022

Keport, WA
NBK-Keyport

Personnel on-Site: Ilka D. Dinkelman, Jordan Peery-Lemon, Caitlin Dronfield > Jacobs
Holt Drillers + Air Knife Crew.
Weather: Partly Cloudy, Cool, Calm 50's-70's
Objective: Move materials and equipment from B76 area to OU2 Area 5
Set up and drill NBKK-OU2A5-MW03

7:50 Arrive on-Site. Meet with Team.
8:10 Air-Knife Crew arrives. APS on-Site at Site 7. Have APS meet at B76.
8:15 Jordan Peery-Lemon leads HSEQ. Discuss hydration, Mobilization hazards, traffic, Slip-Trip-Fall.
8:30 Complete HSEQ. Caitlin Dronfield to meet with APS at B76 to mark Jordan Peery-Lemon to oversee air-knife activities at OU2-Area 5
8:40 Mobilize to work areas. Drillers begin to Mobilize equipment and Materials from Fire Station to north (OU2-Area 5).
Check In with APS. Crew

is at badging.

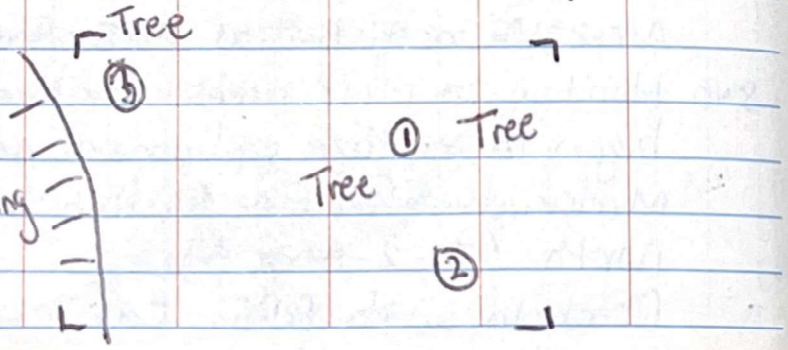
8:55 Arrive at NBKK-OU2AS-MW03. Air knife activities underway.

9:30 Refusal at ~4.0' just ~~below~~ above ~3.75' bgs. Very hard Material

9:35 Contact Rachel Clennon. Move to second location E-NE. Discussed soil samples Collection of surface soil Below vegetation vs. Asphalt Depths 0.0-1.0'; 1.0-2.0', 2.0-3.0' if soil collected deeper, may need to adjust nomenclature to Subsurface Sample (SB).

9:50 Refusal ~3.0' at second attempt. Maybe encountering CDF? Controlled density fill. Move to third location.

10:25 Refusal at third location.



10:45 Contact R. Clennon. Backfill with soil cuttings and replace grass on locations. Likely to drill at deepest hole [location 1].

10:55 Contact Loren Kaehn RE: Refusal. Required to perform due diligence and review history of area. Confer with client.

11:20 Speak with Travis Stephens (Holt PM) also emphasizes due diligence. Will contact APS on-site and mark-out Man-holes.

11:35 Contact Caitlin Dronfield. Will bring APS to location for marking area.

11:45 APS at location. Will check area.

12:15 APS marked two manhole locations along dedrick drive. No utilities to west toward boring location. Also used GPR in white-line area. No new observable findings. Contact Travis Stephens and Rachel Clennon for final approval.

12:20 Quaid Curtis/Holt begins set up at location NBKK-OU2AS-MW03

12:50 Begin drilling activitie at OU2AS-MW03.

NBK Keyport PFAS SI 9/7/22

0835 C. Dronfield meets APS @ Bldg 76. Perform recon of areas which need utility locate

0855 Open up manholes @ ramp, start GPR in areas near NBKK-B76-MW03, original location

0905 APS reports GPR doesn't pick anything up @ NBKK-B76-MW03. RD-8200 used to hook onto lines, trace from manhole + vault. Steam lines appear to terminate, Jacobs employee servicing boiler @ Fire Station advises that steam lines are abandoned.

0915 APS personnel w/ storm drain locating capability @ pass + ID office Troy/APS mobs to escort them to site.

0950 APS all onsite. Prepare to trace storm drain lines. Use RD7000/ see snake

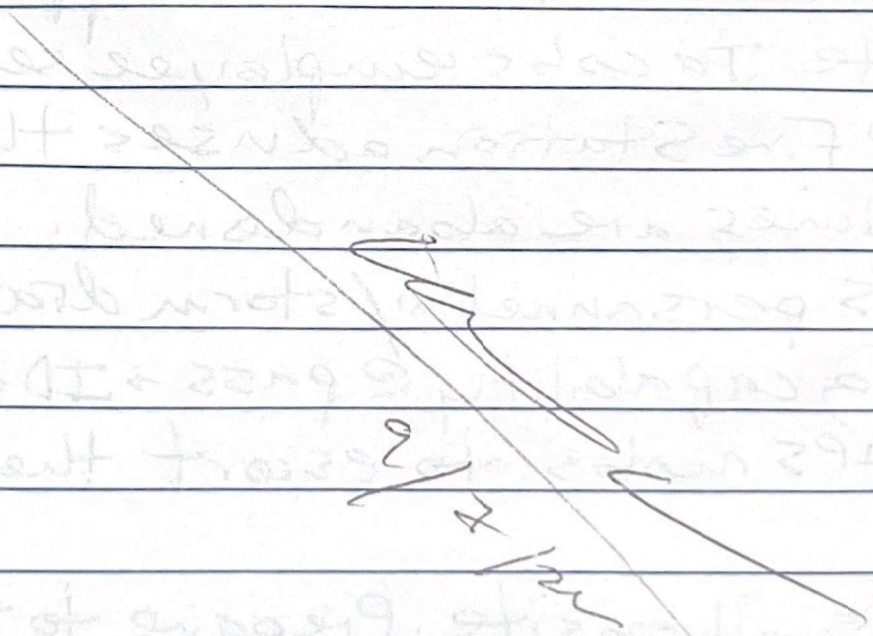
1255 Complete tracing storm drains No impact to existing locations. Mob to site 7, trace storm drain lines.

1350 Complete tracing storm drains

NBK Keyport 9/7/22

@ Site 7. No impact to existing locations. Mob to OU5, begin locate @ SB04, SB05 locations

1500 complete utility locate @ SB04, SB05. No utilities necessitate moving locations



12:55 Pull Core 3.5-4.0'
13:00 Pull Core 4.0-7.5'
13:05 Pull Core 7.5-10.0'
Total recovery ~5.5' for 3.5-10.0' bgs
13:10 Pull Core 10.0-15.0'/15.0-20.0' (80% Recovery)
13:35 Pull Core 20.0-30.0' (60%)
No water observed in core or lithology to current depth.
14:05 Pull core 30.0-40.0' (90%)
Note: Pulled 30-37.0' @ ~13:45 and went back down-hole to retrieve 37.0-40.0'
14:10 Pull core 40.0-50.0' (80%)
14:50 Pull core 50.0-60.0'
14:55 Measure DTW = 49.8' bgs.
No indication of W.B.Z.
15:15 Clean and secure area. Drillers will resume 9/8.
1530 Drillers depart Site
1545 Block area for Air Knife at NBKK-OU2A5-MW03
1600 Jacobs staff departs Site.

Keyport, WA
NBK-Keyport

9/8/2022

Personnel On-Site: Ilka Dinkelman, Jordan Peery-Lemon, Caitlin Dronfield > Jacobs
~~Weather~~ Drillers + Air Knife Crew > HOLT
Weather: Clear Skies, Mild Breeze, 50's-70's
Objective: Complete drilling and set well at NBKK-OU2A5-MW03. Move and Set up Rig at OU2A5-MW02

8:00 Arrive at laydown area. Meet field team. Loren Kaehn may be on Site today.
8:10 Jordan Peery-Lemon leads HSEQ.
Discuss working on Slope. Ergonomics. Use spotters when moving Skid Steer.
8:30 Scope location at B76 (SB05)
Adjacent to Manhole-Sump/Vault.
Confirm with R. Clemon on location.
8:35 Mobilize to NBKK-OU2A5-MW03
Meet up with drillers.
8:45 Measure DTW = 16.4' bgs.
8:55 Contact Peter Lawson RE: Boring location OU2A5-MW03. Discuss lithology, Water Levels and general field observations. Best option for a

"shallower" well would be screen 20-40.0' bgs. Most notable water identified at 35.0-40.0' not wet, but very moist.

9:00 Have drillers extend borehole to 70.0' bgs to confirm no W.B.Z.

9:20 Contact with Client/RPM Amanda Rohrbaugh RE: Van obstructing NBKK-OU2AS-MW02. Will be moved for air-knifing.

9:25 Well screen approved via e-mail of 20.0-40.0' bgs by Peter Lawson. Will backfill boring from 70.0'-41.0' with bentonite chips, Allow 30 min. hydration. Add Sand to 40.0' and set well from 20.0-40.0'

9:30 Confirm with drillers well specifications and placement.

↱ 9:50 Confirm with Rachel TD.

↳ 9:45 Pull core from 60.0-70.0' (88%) Drillers begin Clean-out and addition of Bentonite.

10:10 Complete addition of Bentonite allow 30 min for hydration.

10:45 Drillers TD bentonite to 43.0' bgs add Sand to 40.0' and set well as follows: Chips 43.0-70.0'
Screen: 20.0-40.0'
#12/20 Sand: 18.0-43.0'
3/8" Bentonite: 2.0-18.0'
Concrete: 0.0-2.0'

11:00 Complete addition of Sand and Bentonite. Allow 1 hr. hydration.

11:05 Caitlin Dronfield departs site to Ship Samples.

11:10 Collect Sample 33.0-34.0' bgs. Screen targeting zone from 35.0-40.0' identified as most likely zone for water.
NBKK-OU2AS-SB03-3334

12:00 Return from break. Complete addition of Bentonite Chips and Begin/~~Finish~~ well completion activities. Move materials to Hob Rig.

12:35 ~~12:45~~ Finish well completion. Begin mobilization to next location NBKK-OU2AS-MW02.

12:55 Clear area around OU2AS-MW03

13:00 Notify R. Clennon RE: Well completion. Does not meet the standards. Request drillers to improve final well completion.

Sept 9, 2022

Keyport, WA
NBK-Keyport

Personnel On-Site: Ilka Dinkelman, Jordan Peery-Lemon, Caitlin Dronfield, Beth Davis, Loren Kaehn > Jacobs
Weather: Clear Skies, 50's-70's, Mild Breeze
Objective: Begin drilling NBKK-OU2AS-MWϕ2 Set well. Mobilize to NBKK-OU2AS-MWϕ1.

7:50 Arrive On-Site. HOH team is short one staff member (Brandon Small) Two drillers on Site. One air-knife member Isaiah Whalawitsa on Site.
8:00 Jordan Peery-Lemon leads HSEQ. Discuss end-of-week complacency, traffic safety, use spotters. Loren Kaehn addresses additional health and Safety - PPE, biological hazards (BEES)
8:30 Complete Safety Meeting. Air-knife to check location NBKK-OU2AS-SBϕ4 for access. If not accessible will purge generated soil from OU2AS prior to air knife activities at B76.
8:40 Air-knife returns. Place waste into two drums. Loren Kaehn observes

13:45 Drillers complete cleaning area and securing location at MW-02. Mobilize to laydown area to place drums in IDW and decon tooling. [BPL-424]
14:25 Drillers complete decon. Return to Rig. Finish labeling IDW drums generated at OU2AS-MWϕ3.
14:35 Mobilize to Rig with Caitlin Dronfield. location OU2AS-MWϕ2
14:40 Pass drillers on return to Rig. Drillers departing for day. Contact Rachel Clennon RE: Early departure
15:00 Check on Air-Knife crew
15:30 Caitlin Dronfield departs Site.
~~15:40~~ ~~16:00~~ Meet with Jordan Peery-Lemon Air knife to resume at B76-SB05 9/9/22.
15:45 Complete daily field activities. Depart Site.

Ilka D. Dinkelman 9-8-2022

lack of PPE. No gloves, No hard-hat, no safety glasses.
- Moving drums with no gloves
- Heavy equipment no hard hat
- Removed Safety glasses. following request to don during soil removal from Vac Truck.

8:50 Loren Kaehn contact Rachel Clennon RE: Short Staff, No PPE

9:00 Loren Kaehn contact Paul Townley RE: PPE concerns Stop Work Issued for day.

9:10 Loren Kaehn issues Stop Work for Holt field team. Isaiah Whalawitsa departs Site. Drillers pick up Skid Steer from NBKK-OUZA5-HW02 to relocate drums into secondary containment.

9:25 Return with Skid-Steer and Move drums into secondary containment.

9:30 Drillers depart Site. Loren Kaehn follow-up with Jacobs Staff documenting on-going concerns including communication, PPE, early departure, working with no oversight.

1005 Call with Rachel Clennon discuss Daily Stop-work, FTL transition with Beth Davis, Excavation Permit at Site 7, Air-knife to resume activities on 9/13/2022. Drillers SOW.

1030 Complete call with R. Clennon. Recieve via e-mail update on outage permit for Site 7.

1045 Jordan Peery-Lemon departs Site

1055 Caitlin Dronfield departs Site

1100 Conference call with NAVFAC PNW team RE: Stop Work at NBK-Keyport Loren Kaehn, Beth Davis also present.
- Replace drilling crew
- Stop Work until further notice.

11:30 Perform Site Walk with Loren Kaehn and Beth Davis.
- North landfill (4 locations)
  - Incorrect Color - Storm drains are not marked.
- B76 (4 locations)
  - have utility <3' from installed well not previously marked.

- No white line at SB05
- Incorrect colors used
- Utility not marked at B76-HW#2 encountered during air-knife
- Car Fire location (2 locations)
  - Incorrect color used (Mostly Silver) - Tall Pin Flags
  - Not all utilities marked (storm drain), Corridor
- OU2 Area 5 (5 locations)
  - no white line at SB04 and SB05 (already air-knifed)
  - Utility markings use correct color. Secure SB04 location.

1325 Break for Lunch
1405 Return to lay-down area. Loren Kaehn departs for day
1415 Dead Battery. Meet with Pass/ID - Security. Sending help
1445 Request assistance from Fire Station (get cables)
1505 Vehicle Started. Mob to Field Shed
1520 Site Visit to Site 7 wells.
1550 Return to laydown area.
1605 Depart Site for day.

Ilka D. Dinkelman
9-9-2022

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Week #3 9/12 - 9/16

KEYPORT, WA
NBK KEYPORT 9/13/22

PERSONNEL: BETH DAVIS - JACOBS
BOBBY WALKOWAIK > APS
RICARDO GOMEZ

WEATHER: 59F, CLOUDY, 0 MPH,
MODERATE AIR QUALITY (SMOKE)

OBJECTIVE: REMARK UTILITIES (NON CONDUCTABLES). DRILLERS STILL ON STOP WORK.

0800 ARRIVE ON SITE. SAFETY BRIEF.

0820 MARK UTILITIES (STORM; SEWER) AT B716.

1020 MOVE TO CAR FIRE & SLUDGE DISPOSAL AREA TO MARK NON-CONDUCTABLES.

1320 LOCATORS BREAK FOR LUNCH

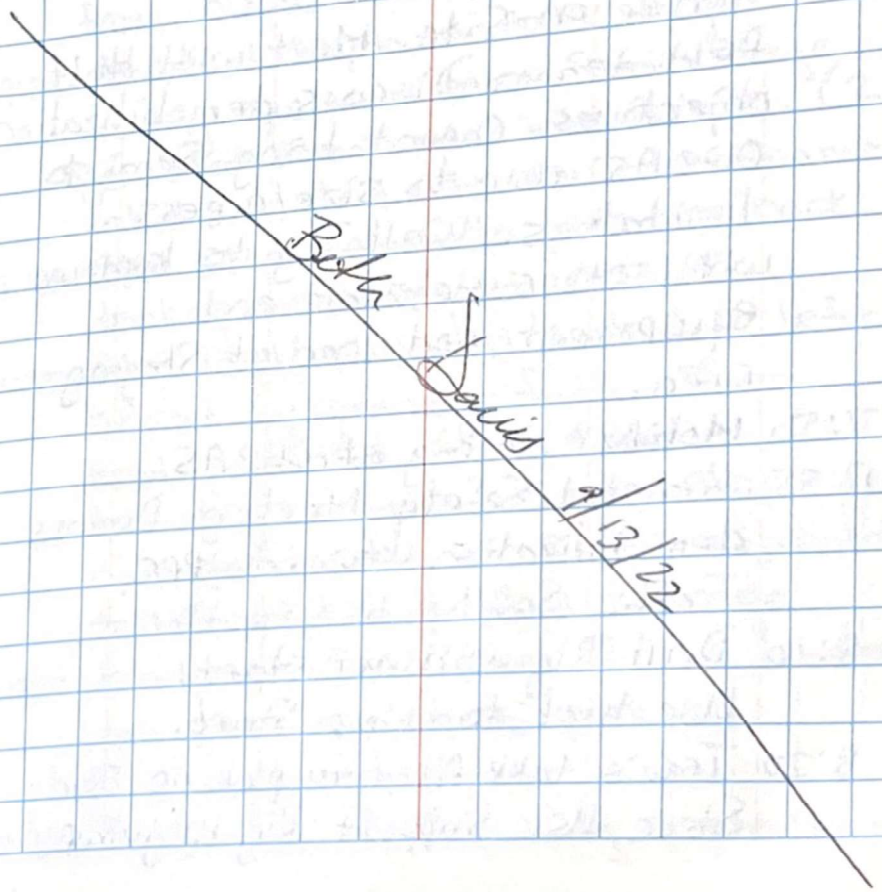
1400 MOVE TO SITE 7.
NBKK-57-MW03 STILL BLOCKED BY PALLETS.
ADDITIONAL STORM WATER DRAIN MARKED → INTERSECTING NBKK-57-MW05 MARK. WILL NEED TO MOVE MW05 TOWARDS WATER.

1450 MOVE TO BUILDING 1006, MARKED ADDITIONAL STORM DRAIN.

1535 MOVE TO OUZ/AZ. NO ACCESS TO NBKK-OUZAZ-MW04, MW05, MW06

1600 MOVE TO LANDFILL EXTENSION MARK DRAINS, INCLUDING ONE CLOSE TO NBKK-LFEX-MW03.

1630 ALL PERSONNEL OFF SITE



NBK Keyport PFAS SI 9/7/22

0835 C. Dronfield meets APS @ Bldg 76. Perform recon of areas which need utility locate

0855 Open up manholes @ ramp, start GPR in areas near NBKK-B76-MW03, original location

0905 APS reports GPR doesn't pick anything up @ NBKK-B76-MW03. RD-8200 used to hook onto lines, trace from manhole + vault. Steam lines appear to terminate, Jacobs employee servicing boiler @ Fire Station advises that steam lines are abandoned.

0915 APS personnel w/ storm drain locating capability @ pass + ID office Troy/APS mobs to escort them to site.

0950 APS all onsite. Prepare to trace storm drain lines. Use RD7000/ see snake

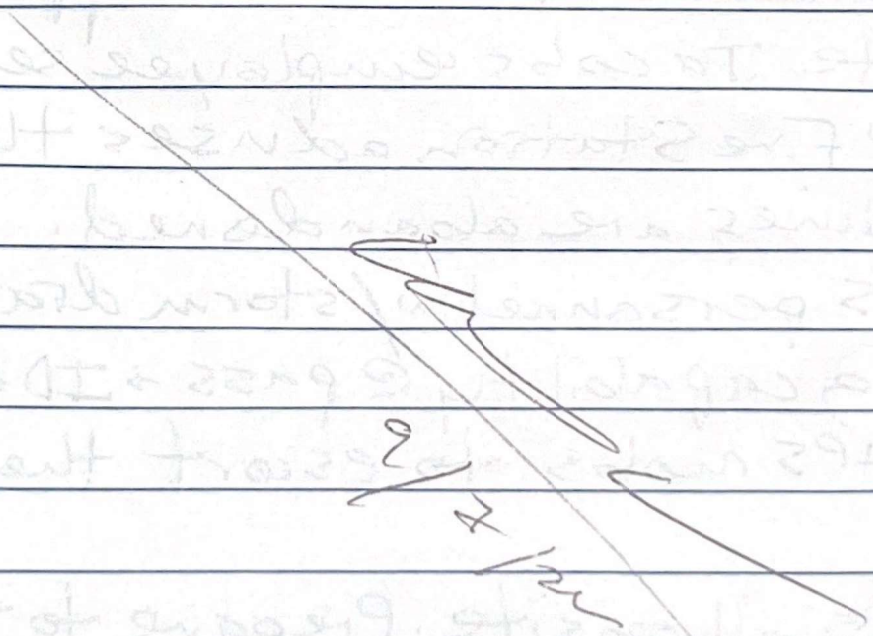
1255 Complete tracing storm drains No impact to existing locations. Mob to site 7, trace storm drain lines.

1350 Complete tracing storm drains

NBK Keyport 9/7/22

@ Site 7. No impact to existing locations. Mob to OU5, begin locate @ SB04, SB05 locations

1500 complete utility locate @ SB04, SB05. No utilities necessitate moving locations



Keyport, WA
NBK- Keyport

9/19/22

Personnel On-Site: Ilka D Dinkelman > Jacobs
Trevor Morey, Alex Hehman, Kristian Thomas, Travis Stephens > Holt
Weather: Clear Skies, Cool a.m - Warming 50's - 70's, Calm Winds
Objective: Holt demobilization

7:40 Arrive on-Site. Meet with Holt field team. Discuss demobilization objectives. Cannot bring Semi to OU2A5 due to size/access limitations. Walk Rig to laydown with other Materials and equipment and load at Staging area.
7:50 Mobilize to Rig at OU2A5
7:55 General Safety Meeting. Discuss demobilization hazards, PPE, Traffic Safety. Use spotters.
8:10 Drill Rig will not start. Use truck to Jump Start.
8:20 Travis take Alex to pick up Skid-Steer. Use support Rig to jump start drill Rig. Equipment switch not turned off draining battery on Rig.
8:40 Alex Returns with Skid Steer. Begin Moving tooling.
8:55 Rig Started. Allow for warm-up.
9:10 Begin Moving Rig - Walk Rig to Staging area. Travis Stevens escort w/ Rig.
9:20 Skid Steer and support Truck Mobilize from OU2A5 to laydown area.
9:35 Arrive at laydown Area. Begin loading equipment onto Semi. Purge generated decon water into drums. (2) label and place into IDW containment.
9:45 Skid Steer return to pick up rack & tooling remaining at OU2A5
9:50 Also load additional Materials left behind by previous field effort Holt performed with Battelle. Including 1-drum, Sand, Chips and concrete. Located in B1032 adjacent to Quonset hut IDW Storage.
9:55 Additional field staff Josh Laubert from Holt on Site to pick up additional Materials.
10:45 Truck from Holt picking up previous

Materials left behind departs laydown area. Removed pallets of sand, full pallet chips and some concrete.

1045 Place drums on pallet into secondary containment.

1050 Load Skid-Steer onto Semi and Secure into place.

10:55 Asked Travis Stephens about portable toilet left at 0U2AS. He has contacted their contractor for pick up. Unclear why not moved to laydown area. for pick up. Will be picked up on 9/20 or 9/21.

1105 Complete load of Materials and equipment. Wrap-up day

1110 Holt departs Site.

1115 Jacobs departs Site.

9-19-2022

Keyport, WA
NBK-Keyport

9/20/2022

Personnel On-Site: Ilka Dinkelman > Jacobs
Bobby Walkowiak, Ricardo Gomez, ~~Tony~~
Troy Marcum, Andrew Harden > APS
Weather: Sunny, 50's-70's, Mild Breeze
Objective: Utility Locate, Intrusive, GPR and Conductible

8:05 Arrive at laydown area. Call Troy Marcum. Meet team in Main Parking Area at landfill extension.

8:30 Arrive at B76. Show near miss at MW-01 and MW-02 where Sewer/Storm drains not previously marked prior to drilling.

8:40 Call with Loren Kaehn and APS. Loren has requested Pink Paint multiple times for temporary/unknown utilities. Troy Marcum to depart Site ~~to with~~ to Purchase needed material.

8:50 Drums and pallets are still impeding utility locate activities at Site 7. Contact Rachel Clennon. She will contact Client. Provide Figures

of utility Maps to APS.

8:55 Mobilize to OU2A2 in fenced area. Scope area in fenced zone (MW-04, MW-05, location MW-06 is just out side of fence

9:30 Check locations MW-01, MW-02 and MW-03.
MW-02 may require veg clearance
MW-03 move south along road
MW-01 - OK - behind building

10:00 Move MW-05 to south of utility (unknown).

10:10 Mobilize from OU2A2. Will meet locators at Car Fire location. Stop at Site 7 to check what needs to be moved from area.

10:25 Contact Rachel Clennon.
5 pallets of drums and
4 torpedo canisters need to be moved. Alley to narrow for Rig and would block access to/from stairs.

10:30 Select Alternate location. MW-03 at corner of building west of selected/proposed MW-03,

11:15 Team at Car Fire location. No sign of birds on light tower. Re-mark areas.

12:00 Check final areas at OU2A5 (SB04 and MW01). Mobilize back to Site 7.

12:15 Mark out possible locations for MW-03 and MW-03 Alternate. Also re-mark MW-04 area with correct colors. Identify electric in area. Other Marks in "pink."

12:20 Mobilize to Landfill Extension area (Base parking). Mark out Storm drains. Check all locations. Confirm no power at LFEX-MW02. Adjacent to former check station.

12:45 Intrusive team departs Site. Finalize remaining marks. Locations Marked per APWA color code standards.

13:05 Depart Site.

Mike D. Dinkelman
9-20-2022

Begin New Mobilization Yellow Jacket:

9/28/2022

Keyport, WA
NBK- Keyport
Personnel On-Site: Ilka Dinkelman > Jacobs
Michael Anderson, Eric Clifford,
Riley Jonson > Yellow Jacket
Weather: Partly Cloudy, cool a.m. 50's-
70's in afternoon. Mild Breeze.
Objective: Mobilization / Set up.

12:30 Meet Yellow Jacket crew at badging office. Await final access.
13:45 All badges received. Printer at office down. Drillers will need to return when able to update DBIDS photos and access zones.
14:00 Review APP / SSHP. Discuss details of Scope, Field objectives, Safety Requirements, PPE, Lessons Learned.
15:00 Complete Safety Briefing. Yellow Jacket Prepares to Mobilize to Bangor Naval Base to pick up equipment and materials.
16:35 Drillers return and begin unload
17:15 Complete activities for day. Depart Site.

Ilka Dinkelman
9-28-2022

Keyport, WA 9/29/2022
NBK- Keyport

Personnel On-Site: Ilka D. Dinkelman > Jacobs; Michael Anderson, Eric Clifford, Riley Jonson > Yellow Jacket
Objective: Continue Mobillization and Set up in preparation for drilling
Weathe: Mostly Cloudy, cool am 50's to Partly Cloudy/Mostly Sunny and warm pm. Mild Breeze.

7:30 Field Team on Site.
7:35 Lead HSEQ. Discoss PPE, pinch points, spotting, traffic and road safety. Objectives finishing Mobilization and set up activities
7:50 Complete daily briefing. Complete unload of supplies and materials
8:25 Complete call with Rachel Clennon RE: Schedule, Kick-off field activities, Permits
8:35 Drillers depart Site for Bangor to pick up final Materials and equipment.
10:55 Mike Anderson Returns to Site with Trailer. Unload Materials. Helpers still loading Semi-Truck / Trailer at Bangor he will return to Bangor to pick up final load.
11:20 Michael Anderson Returns to Bangor to pick up Semi-Trailer and last load of Supplies - Materials - Equipment.
12:15 Drillers return to Staging area. Still have materials to pick-up and Semi-Truck remains at Bangor Unload trailer and truck with supplies. Riley Jonson to depart Site for training with truck. Michael Anderson and Eric Clifford to pick up additional Materials
12:30 Drillers break for Lunch. Riley Jonson departs Site. Drillers depart for Bangor to pick up additional load
13:40 Drillers drop off materials and return to Bangor for final pick-up
14:00 Speak with Rachel Clennon RE: Filter-Pack Sand. Drillers have #12/20 and #8/12 Confirm filterpack to use.
14:20 Nathan Lu and Patrick Elliot

Successfully badged and on Site. Review APP/SSHP and specific AHA's.

1555 Complete HSE review. Sign field documentation. Patrick Elliot and Nathan Lu depart Site. Nathan to pick up Materials and supplies.

1600 Drillers return to Site. Final load-off of Materials and equipment.

1715 Complete end of day activities Clean and secure Site.

1730 Drillers depart Site. Meet with Sam Moore / Battelle storing equipment in Quonset hut Some equipment and materials stored by Cal Clean will be removed beginning 10/1. Do not block for access.

1745 Depart Site.

Ilka D. Dinkelman 9-29-2022

Keyport, WA
NBK-Keyport

9/30/2022

Personnel On-Site: Ilka D. Dinkelman, Patrick Elliot, Nathan Lu > Jacobs; Michael Anderson, Eric Clifford > Yellow Jacket

Weather: Partly Cloudy. Calm Winds, Cool a.m. Warming to 70's in afternoon

Objective: Complete set up at laydown area, decon all tooling, collect surface samples, begin air-knife Unload drill Rig when arrives.

7:40 Arrive on Site at Storage Unit. Pick up materials and equipment to Calibrate Multi-Rae's

7:45 Arrive at Staging area. Drillers arriving from Bangor with Water Truck

7:55 Lead Health and Safety Briefing. Discuss PPE, Ergonomics, Proper Lifting. & Daily objectives w/ Team

8:15 Complete HSEQ.

8:20 Calibrate Multi-Rae [see Cal Log]

8:30 Discuss surface soil and equipment blank sample collection with

Patrick Elliot and Nathan Lu. Will collect samples at 2008 Car Fire location and at Building 1006. Go over general Tablet use. Methodology of collecting samples.

845 Pick up sampling and decon materials at Storage Unit.

9:00 Mobilize to Car Fire location to show area to sample team. Look at locations.

9:30 Return to laydown/staging area with drillers.

10:10 Calibrate second Multi-Rae (see calibration log).

10:50 Drillers filling water totes with source from B951 (identified as PFAS free).

11:30 Drillers Break for Lunch. Mobilize with Patrick Elliot and Nathan Lu to B 1006.

11:40 Realize new location MW04 originally scoped by HOLT has overhead power lines. Cannot drill location. Need to relocate

1155 Contact Rachel Clennon RE: B1006 - MW04. Identify alternate location between transformer and hydrant.

12:00 If location approved will need utility locator to confirm no underground lines. Will require another visit by either APS or suggest GPRS (Jesse?).

12:10 Return to staging area. Decon set up is complete. Eric Clifford begins decon.

12:15 Mobilize with Michael Anderson to drilling locations. Landfill extension, Car fire, OU2AS, Site 7, OU2AZ and B1006. Confirms Rig can fit in proposed MW-04 location.

1245 Confirm with sample team no sediment sample collection until approved by Juan Acaron.

1255 Return to laydown/staging area.

1315 Decon Complete. Load trailer with clean tooling. Will stage Rig and tooling at Landfill extension area.

1350 Sample team returns to staging area. Task team with updating locations with RI and Tablet

14:00 Sample team will break for Lunch and resume tasks at 14:30.

14:10 Drill team brings tooling to location NBKK-LFEX-MW03. Will stage in area for weekend in preparation of drilling to begin on 10-3.

14:15 Speak with Rachel Clennon confirm use of #8/12 Sand after using #12/20 Sand. Both are on Site. Also confirm air-knife locations for 10/1 at B1006. will not air-knife MW-04 due to utility locate requirements. If air-knife complete will finish location NBKK-B76-SB05 adjacent to Firehouse ramp.

1455 Drillers Mobilize to Pass & ID to meet up with Rig and escort to Landfill Extension. Rig expected ~1515-1525.

1545 Rig unloaded and Staged at NBKK-LFEX-MW03.

1615 Exclusion Zone at location set in place.

1630 Nathan Lu and Patrick Elliot Return to Site. Patrick Elliot departs for day

1645 Receive Photos and DTW details at Wells previously set by HOLT.

Samples Collected:

1008	NBKK-CF1-SS05-0001
1033	NBKK-CF1-EB01-093022-SO
1055	NBKK-CF1-SS04-0001
1203	NBKK-B1006-SS05-0001
1225	NBKK-B1006-EB01-093022-SO
1237	NBKK-B1006-SS06-0001
1303	NBKK-B1006-SS07-0001

* See Patrick Elliot Notes for details

1650 Mobilize with Nathan Lu to Storage Shed to unload supplies used. Drillers depart Site.

1705 Complete daily field activities Depart Site.

9-30-2022

Keyport, WA Oct 1, 2022
NBK-Keyport

Personnel On-Site: Ilka Dinkelman, Patrick Elliot > Jacobs; Michael Anderson, Eric Clifford, Riley Jonson, Luke Thompson > Yellow Jacket
Weather: Clear Skies, Calm Winds, 50's-70's
Objective: Air knife activities at B1006 and B76 if time permits

0735 Arrive on Site. Meet with drillers. New driller helper Luke Thompson on-Site
0745 Patrick Elliot on Site.
0750 Lead HSEQ Meeting. Discuss Air-knife hazards, vacuum, blowing debris, PPE, lifting. Discuss daily objectives. Air knife locations at B1006 and if time permits B76 location.
815 Complete HSEQ. Prepare for daily field activities. Pick up supplies from storage shed.
840 Mobilize to B1006 area. Set up Air knife and sampling area.
845 Begin cut concrete.
900 Begin air knife activities at NBKK-B1006-MWØ1.
9:35 Collect Sample 1.0-2.0' below asphalt 3.75" thickness.
NBKK-B1006-SS01-0102
9:50 Water encountered at ~3.0' bgs Stop air-knife activities
9:55 Contact Loren Kaehn RE: Loader during air knife. Continue with hand auger until refusal. LM Dennis Ballam
10:05 Call from Dennis Ballam. Call to confirm path forward if water is encountered during air-knife activities.
1010 Soft "muddy" Material rock, silt and Sand. Complete Hand auger to 6.0' bgs
1015 Complete activities at B1006-MWØ1
1020 Mobilize to NBKK-B1006-MWØ2
1025 Cut asphalt at B1006-MWØ2
1045 Begin air knife activities. Same as previous lithology
1055 Collect Sample 1.0-2.0' bgs
NBKK-B1006-SSØ2-0102
Water encountered ~2.75' bgs

1115 Complete hand auger to 6.0'
1120 Mobilize and set up at B1006-MW03. No asphalt. In grass. Remove organics from top 2.0" and hand auger to 1.0' bgs.
1130 Collect Sample 0.0-1.0'
NBKK-B1006-SS03-0001
Begin Air knife activities.
1150 Complete air knife activities
Drillers mobilize to laydown area
1155 Drillers depart for lunch
1235 Drillers return. Prepare to purge cuttings. Put asphalt and upper soil into drum.
1245 Inspect drum for air-knife cuttings. PID=0.0 ppm No odor, clean, no dents, or rust
1255 Purge water from vac truck.
1310 Complete purge of water. ~170 gallons removed. Put into clean tote.
1315 Will shovel remaing soil into separate drum. *Air knife has only a very little "wet" soils remaining in the Vac Truck. Placed asphalt into drum. Contact Levi Pratt to confirm if OK to mix.
1325 Levi Pratt confirms to keep Asphalt seperate from soils. All asphalt cut will be kept in an alternate secondary storage area.
1330 Patrick Elliot departs Site for day. Drillers set up secondary containment area for asphalt. Drums with "dents" will be separated out and used for storing the cut asphalt.
1345 Drum inspection PID=0.0 ppm use drum "dented". Levi Pratt okay with using reclaimed drums for soil. New drums for water and soil when on Site. Reclaimed drums for asphalt.
1405 Mobilize with Air knife to B76-SB05 Concrete previously cut by Holt adjacent to Manhole. Ring bell at Fire Station. No response.
1410 Still no response from firehouse.

set up air-knife at location
Depth of concrete 12.0"
crack in man-hole ~3.5'
Total depth 6.0'
1420 Prepare for air knife
1485 Collect Sample 3.0-4.0' bgs
NBKK-B76-SB05-0304
Continue w/ air knife to 6.0'
1500 Obstruction at 6.0' bgs.
Cannot get past to collect required sample. Drillers do not have auger extension. Spoke with Rachel Clennon. Will Ship Sample collected (3.0-4.0') and wait to collect deeper sample with proper auger or with rig if needed. Permit would be required.
1510 Clean wells MW-01, MW-02, MW-03 and MW-04 at B76. attach tags as needed..
1530 Complete activities return to staging area.
1615 Drillers depart site
1630 Drop off Materials. Depart Site

Ilka O. Dinkelman
10-1-2022

Keyport, WA
NBK-Keyport
10-3-2022

Personnel On-Site: Ilka D. Dinkelman, Patrick Elliot, Jarod Schmidt, Riley Griffin > Jacobs Michael Anderson, Eric Clifford, Riley Jonson, Luke Thompson > Yellow Jacket
Objective: Begin drilling at Landfill Extension
Weather: Clear skies, little Hazy, cool Morning warming to low 80's calm winds.

7:35 Arrive on Site. Pick up supplies and Materials at storage shed.
7:50 Lead HSEQ Briefing. Will review APP/SSHP when Griffin Riley arrives. with Jarod Schmidt. Discuss drilling safety. Debris, traffic safety, PPE, hydration (heat/cold stress)
8:05 Jarod Schmidt discusses Rad Safety with team - Scan Process.
8:15 Complete safety briefing. Mobilize with Patrick Elliot and Jarod Schmidt to drilling location
8:20 Set up exclusion zone
8:35 Relocated drilling location ~2.0' south to distance from storm drain

Need to purge cuttings from B76 out of air knife. Crew returns to yard. Need to keep different sites separated.

8:45 Calibrate Multi-Rae [see log] Griffin Riley arrives on site.

8:50 Jarod Schmidt discusses Rad safety with Griffin Riley

8:55 Air knife truck returns

9:00 Cut Concrete/Asphalt at NBKK-LFEX-HWΦ3.

9:10 Decon Hand Auger

9:15 Complete cutting concrete, ~3 3/4" thickness ~0.25'

9:25 Begin air knife activities. Review APP/SSHP with Jarod Schmidt and Griffin Riley.

1000 Collect Sample 1.0-2.0' bgs.

NBKK-LFEX-SS03-0102

Patrick Elliot stops work briefly. Observed sea shell fragments in soil beginning at ~3.0' bgs current auger/air knife depth. Confirm if need to move location.

1015 Drillers resume utility clearance activities using air-knife/hand auger. Obstruction at ~3.0'. Will remove obstruction and determine if shell fragments are lithology based vs. possible cultural and determine if location should be moved 5-10.0' west.

1035 Observe saw-cut lumber. Determine to be in fill material. Metal and other debris. Okay to stay in place.

1050 Contact Rachel Clennon RE: Possible stop work (cultural) due to location. Patrick Elliot contacts Cultural RPM and Matt Steinkamp. OK to resume work. Matt Steinkamp not aware of landfill status at Keyport.

1120 Complete hand auger/air knife activities to 6.0' bgs. Begin Mobilization of Rig to location.

1155 Complete Set up.

1200 Drillers break for lunch. Griffin Riley departs to ship samples

1230 Drillers return from lunch. Complete setup of drilling area.

1240 Complete drum inspection. PID=0.0ppm

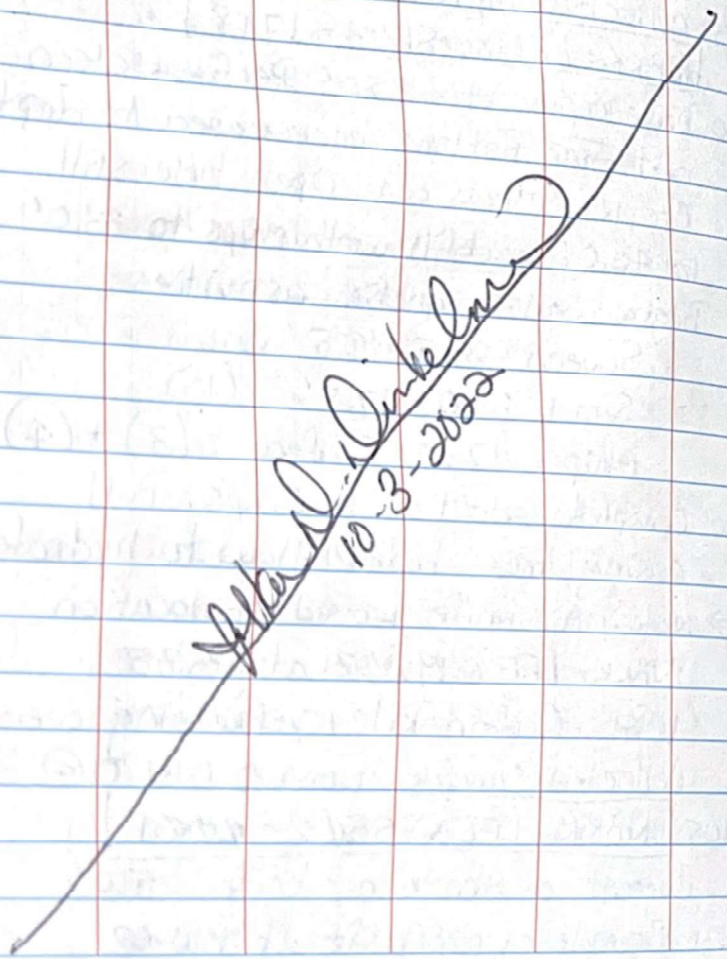
no dents, rust or debris. OK for use.
Drilling commenced
1250 Pull core 6.0-10.0' full recovery. Stretch to sample bags due to clay content 8.0' in core.
1305 Pull core 10.0-20.0' 100% recovery
1310 Perform Clean-out to 20.0'
1340 Pull core 20-30.0' 100% recovery.
1425 Pull core 30.0-40.0' 75% recovery
1430 Measure DTW ~11.5' may be up due to hydrostatic pressure
1435 Discussions with Peter Lawson and Rachel Clennon. Will set well screen 19.5-29.5', Encountered Water bearing zone ~20-24.5'
1445 Currently cased to 20.0'
Drive Casing to 35.0' check Depth. Add Sand. Note: Ryan Hume from Keyport Base Stopped by. NAVFAC may be on Site performing crane inspections, May inspect bridge crane. Provided Contact Info. Site Contact and Contract / CTO numbers. Speak with Rachel Clennon RE:

14 Sample collection. Collect 1 sample 7.0-8.0 in native soil (glacial deposits) and one sample above WBZ. 17.0-18.0' WBZ ~20-24.5' bgs.
1450 Collect Sample 7.0-8.0'
NBKK-LFEX-SB03-0708
1455 Collect Sample 17.0-18.0'
NBKK-LFEX-SB03-1718
1500 Drive casing to 35.0'. Perform clean out. Tag bottom once cased to depth.
1530 Complete clean out. Open hole still to 40.0' backfill with chips to 33.0'
16 Begin well completion activities
Screen 29.5-19.5'
Sand 33.0'-17.5' (10)
Chips 17.5'-Surface (3)+(4)
1700 Complete addition of Chips. Pull casing from hole. Allow to hydrate.
⇒ Note: Air knife moved to location NBKK-LFEX-MW02 at 13:35. With Griffin Riley performing oversight
Collected sample from 0.0-1.0@
1405 NBKK-LFEX-SS02-0001
Current depth to air knife ~5.0'
1630 Complete air knife at MW-02

1715 Complete addition of chips. Allow to hydrate overnight. Drillers depart Site.

1730 Jacobs staff completes cleaning and securing area.

1735 Depart Site.



10/4/2022

Keyport, WA
NBK-Keyport

Personnel on-Site: Ilka Dinkelman, Patrick Elliot, Jarod Schmidt, Griffin Riley > Jacobs Michael Anderson, Riley Jonson, Luke Thompson [Eric Clifford to arrive late getting physical/medical]. > Yellow Jacket

Weather: Cloudy, Foggy, Cool am. 50's-60's

Objective: Complete Setting well NBKK-LFEX-MW03. Mobilize and drill NBKK-LFEX-MW02

7:45 Arrive on Site. Meet Field team. Navy Staff Deborah Kindt about laydown area RE: Jim Crane used by Yellow Jacket.

7:50 Contact Rachel Clennon RE: Crane Permit. Require P1/P2 Form.

8:00 Lead HSEQ Meeting. Discuss field observations from 10/3. Stay alert to surroundings. Put digging bar down on air hose. Repaired for use and replace with new hose. Slip-Trip-Falls and Lifting also topics for day.

8:25 Mobilize to drilling location

at landfill. Pick up water tote from B951 for hydrating bentonite

8:35 Amanda Rohrbaugh on-site. Will be meeting with Deborah Kindt RE: Crane DTW = 7.15'

8:40 Calibrate Multi-Rae (see log)

8:45 Deborah Kindt on site and Meeting with Amanda Rohrbaugh Need to fix strap on crane.

8:50 Move Rig off hole. Begin Well completion. Added four additional bags of bentonite hydrate. Tooling to decon

9:25 Amanda Rohrbaugh departs Site.

9:40 Spoke w/ Rachel Clennon. RE: Drilling at Landfill, Crane Inspections P1/P2, Repair Strap on Rig and drillers to don Cotton Coveralls for Pad Locations (Landfill Extension and Site 7).

1000 Complete decon of tooling

1015 Complete well at NBKK-LFEX-MW03. Begin

* Used 4 Bags concrete for pad.

Mobilization to NBKK-LFEX-MW02

1130 Complete Mobilization to MW-02 Drillers break for Lunch. Mob with Griffin Riley to laydown to task with IDW Management QA/QC and labels. Label drums on peeling or torn labels.

12:00 Drillers return from Lunch. Prepare for drilling at NBKK-LFEX-MW02

12:10 Begin drilling

12:20 Pull core to 8.0' and retrieve to 10.0'

12:45 Pull core 10-20.0' 100% recovery Clean out DTW = 10.89

13:40 Pull core 20.0-30.0' 100% recovery

13:50 Contact Peter Lawson and Rachel Clennon RE: Setting well. Eric Clifford Returned to Site. If OK to set well will have two crew from Yellow Jacket set well and two crew air knife. Will send Griffen Riley to oversee air-knife activities.

14:00 Collect Materials for well MW-02 Patrick Elliot and Jarod Schmidt to mobilize with Air Knife Crew.

14:15 Approve for setting well.
Screen 18-28.0'
Well Specifications will be
Screen 18.0-28.0'
Sand 16-30.0'
Chips 2-16.0'

14:25 Collect Sample 21.0-22.0'
NBKK-LFEX-SB02-2122

14:30 Begin setting well.

14:35 Griffin Riley collects sample at NBKK-LFEX-MW01 with hand auger
NBKK-LFEX-SS01-0001

1500 Notice well is sitting high measure at 27.0' so 7.0' too high. Need to clean out want screen 18.0-28.0'

1550 Clean out complete. Resume setting well.

1615 Driller pulled up to high on casing above sand. Casing depth is 14.0' and sand is tagged at depth 17.0'. Likely well is compromised. Tag line is stuck at depth ~16.0' either wrapped around well or lodged below casing. Instruct drillers to re-drill. Only sand added to ~17.0' okay to overdrill and reconstruct. Will need new materials, pull well.

1630 Air knife crew completed activities at MW-01 and moved to location NBKK-LFEX-MW04.

1705 Air knife crew collect sample
NBKK-LFEX-SS04-0001

1520
1720 Collect Equipment Blank
NBKK-LFEX-EB01-100422-SO

1750 Complete air knife activities at MW-04 to 3.0' bgs. Will resume in morning. Patrick Elliot departs Site.

1805 Clean and secure site.

1815 Drillers depart Site. Will retrieve well and re-set in morning.

1830 Secure Parking spots at MW-01 and MW-04.

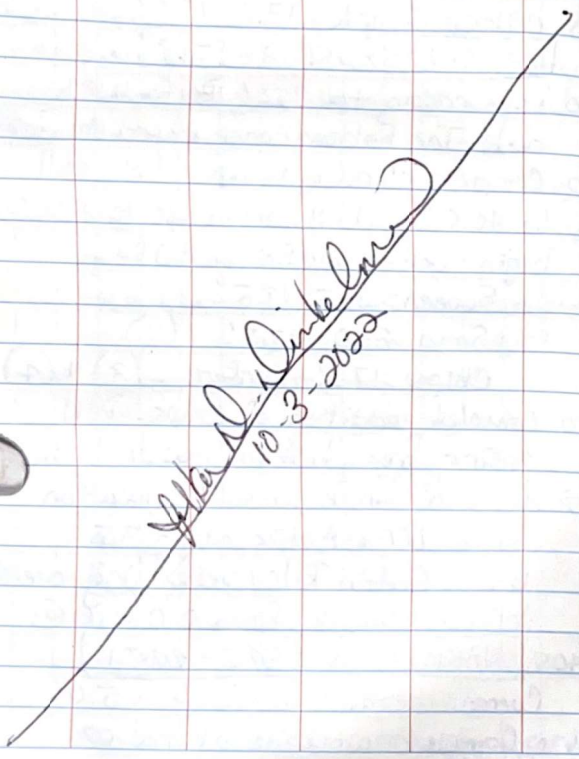
1835 Remaining Jacobs Staff depart Site.

Mike D. Anikulm
10-4-2022

1715 Complete addition of chips. Allow to hydrate overnight Drillers depart Site

1730 Jacobs staff completes cleaning and securing area.

1735 Depart Site.



Keyport, WA
NBK-Keyport

10/4/2022

Personnel On-Site: Ilka Dinkelman, Patrick Elliot, Jarod Schmidt, Griffin Tilley > Jacobs Michael Anderson, Riley Jonson, Luke Thompson [Eric Clifford to arrive late getting physical/medical]. > Yellow Jacket

Weather: Cloudy, Foggy, Cool am. 50's-60's

Objective: Complete Setting well NBKK-LFEX-MW03. Mobilize and drill NBKK-LFEX-MW02

7:45 Arrive on Site. Meet Field team. Navy Staff Deborah Kindt about laydown area RE: Jim Crane used by Yellow Jacket.

7:50 Contact Rachel Clennon RE: Crane Permit. Require P1/P2 Form.

8:00 lead HSEQ meeting. Discuss field observations from 10/3. Stay alert to surroundings. Put digging bar down on air hose. Repaired for use and replace with new hose. Slip-Trip-Falls and Lifting also topics for day.

8:25 Mobilize to drilling location

at landfill. Pick up water tote from B951 for hydrating bentonite

8:35 Amanda Rohrbaugh on-site. Will be meeting with Deborah Kindt RE: Crane DTW = 7.15'

8:40 Calibrate Multi-Rae (see log)

8:45 Deborah Kindt on Site and Meeting with Amanda Rohrbaugh Need to fix strap on crane.

8:50 Move Rig off hole. Begin Well completion. Added four additional bags of bentonite hydrate. Tooling to decon

9:25 Amanda Rohrbaugh departs Site.

9:40 Spoke w/ Rachel Clennon. RE: Drilling at Landfill, Crane Inspections P1/P2, Repair Strap on Rig and drillers to don Cotton Coveralls for Pad Locations (Landfill Extension and Site 7).

1000 Complete decon of tooling

1015 Complete well at NBKK-LFEX-MW03. Begin

*Used 4 Bags concrete for pad.

Mobilization to NBKK-LFEX-MW02

1130 Complete Mobilization to MW-02 Drillers break for Lunch. Mob with Griffin Riley to Laydown to task with IDW Management QA/QC and labels. Label drums on peeling or torn labels.

12:00 Drillers return from Lunch. Prepare for drilling at NBKK-LFEX-MW02

12:10 Begin drilling

12:20 Pull core to 8.0' and retrieve to 10.0'

12:45 Pull core 10-20.0' 100% recovery Clean out DTW = 10.89

13:40 Pull core 20.0-30.0' 100% recovery

13:50 Contact Peter Lawson and Rachel Clennon RE: Setting well. Eric Clifford Returned to Site. If ok to set well will have two crew from Yellow Jacket set well and two crew air knife. Will send Griffen Riley to oversee air-knife activities.

14:00 Collect Materials for well MW-02 Patrick Elliot and Jarod Schmidt to mobilize with Air Knife Crew.

14:15 Approve for setting well.
Screen 18-28.0'
Well Specifications will be
Screen 18.0-28.0'
Sand 16-30.0'
Chips 2-16.0'

14:25 Collect Sample 21.0-22.0'
NBKK-LFEX-SB02-2122

14:30 Begin setting well.

14:35 Griffin Riley collects sample at NBKK-LFEX-MW01 with hand auger
NBKK-LFEX-SS01-0001

1500 Notice well is sitting high measure at 27.0' so 1.0' too high. Need to clean out want screen 18.0-28.0'

1550 Clean out complete. Resume setting well.

1615 Driller pulled up to high on casing above sand. Casing depth is 14.0' and sand is tagged at depth 17.0'. Likely well is compromised. Tag line is stuck at depth ~16.0' either wrapped around well or lodged below casing. Instruct drillers to re-drill. Only sand added to ~17.0' okay to overdrill and reconstruct. Will need new materials, pull well.

1630 Air knife crew completed activities at MW-01 and moved to location NBKK-LFEX-MW04.

1705 Air knife crew collect sample
1520 NBKK-LFEX-SS04-0001

1720 Collect Equipment Blank
NBKK-LFEX-EB01-100422-SO

1750 Complete air knife activities at MW-04 to 3.0' bgs. Will resume in morning. Patrick Elliot departs Site.

1805 Clean and secure site.

1815 Drillers depart Site. Will retrieve well and re-set in morning.

1830 Secure Parking spots at MW-01 and MW-04.

1835 Remaining Jacobs Staff depart Site.

10-4-2022

Keyport, WA
NBK-Keyport

10-5-2022

Personnel on-Site: I. Dinkelman, P. Elliot, G. Riley, J. Schmidt > Jacobs; M. Anderson, E. Clifford, R. Jonson, L. Thompson > Y.J.
Weather: Cloudy, cool a.m. 50's - 60's. Calm some light rain/fog to clear in p.m.
Objective: Complete air knife at LFEX re-drill and set well LFEX-MWϕ2 Mobilize rig a begin drilling MW-ϕ1.

7:35 Arrive on-Site. Prepare for daily field activities.
7:45 Lead tailgate Safety HSEQ. Discuss hydration. Looking out for one another. Use hazard lights if in roadway or impeding traffic.
8:00 Complete briefing.
8:20 Mobilize to Rig location. Team to Mobilize to air-knife. to complete to 6.0'
8:30 Begin overdrill to pull well and sand from LFEX-MWϕ2
9:10 Air knife activities complete at MW-04 location total depth 5.8' crew at large rock cannot be removed OK to Move to LFEX-MWϕ1.
10:00 Complete removal of all Materials and well at LFEX-MWϕ2.
10:15 Begin setting well at MWϕ2
10:20 Air knife complete at LFEX-MWϕ1 total depth 5.10'. Air knife crew to purge waste into drums and add to Waste Mgmt. Forms.
10:50 Riley Jonson departs Site. Air knife activities complete and staged at laydown area. Will return for two days on Friday-Sat. Likely air knife at 2008 Car Fire location. and B1000 MW-04 if possible.
1100 Still have problems with well floating. Came up 1.5'; need to pull and reset to specifications. Will hang "suspend" well to set
1200 Well removed. Drillers break for Lunch
1220 Patrick Elliot Departs Site. No additional drilling to occur today.
1230 Drillers return from Lunch.
1245 Wiring on drill head loose. Jarod Schmidt Mobilizes to Bangor ←

Repair wires.

1330 Begin clean out of NBKK-LFEX-MW∅2 and suspend well.

1400 Amanda Rohrbaugh on-Site. Meet with inspector

1415 Crane inspection with M. Anderson, A. Rohrbaugh and D. Kindt. Documentation approved

1430 Inspection complete. Adhere paperwork to crane. Amanda Rohrbaugh will return to observe Crane in operation Resume well installation activities. Measure well at 28.1'

1615 Filterpack addition complete add chips for seal. Allow to hydrate overnight. Will complete well construction on 10/6 for NBKK-MW∅2.

1630 Complete addition of chips for seal. All casing out. Chips to 2.0'

1700 Complete Site clean up. Take drums to laydown/staging area

1730 Drum storage complete. Finish field activities. Depart Site.

Ilka Dinkelman
10-5-2022

10-6-2022

Keyport, WA
NBK-Keyport

Personnel On-Site: Ilka Dinkelman, Griffin Riley, Patrick Elliot, Jarod Schmidt > Jacobs; Mike Anderson, Eric Clifford, Luke Thompson > Yellow Jacket.

Weather: Cool-Foggy a.m, to Mostly Sunny P.M. 50's-70's. Calm winds.

Objective: Finish Pad at LFEX-MW∅2 and mobilize & drill at LFEX-MW∅1.

7:35 Arrive on Site. Prepare for daily field activities. P. Elliot, J. Schmidt and G. Riley will be on Site at 9:00.

7:45 Perform Safety Briefing. Discuss housekeeping, Slips-Trips-Falls. traffic awareness when mobilizing through parking area to LFEX-MW∅1.

8:00 Complete Meeting. Mobilize to Rig location.

8:30 APS on Site for Clearance at B1006-MW-∅9. Meet with Bobby Walkowaik

8:40 Mobilize to B1006 white-line area extend to large area incase well requires to be relocated.

9:00 Return to Rig area. Finishing Pad

Completion and Rig Mobilization.

9:30 APS complete locate activities Depart Site. Will check with Scheduler RE: GPR and conductibles locate to occur on Mon. or Tues.

9:40 Spoke with Kristen Ponack, Server has been down. Upload all field documents.

9:45 Tag well NBKK-LFEX-MW02 Washington Unique ID # BPK 456

11:00 Finish all well completion activities and Mobilization to location NBKK-LFEX-MW01. Mobilize to staging area for decon.

11:30 Complete decon

1140 45 drums (new drums) for IDW soils and aqueous decon and purge water.

1200 Complete unload of drums. Drillers break for Lunch.

1210 Griffin Riley completes QA/QC of IDW drums.

1235 Drillers return from Lunch.

1240 Amanda Rohrbaugh on Site for crane inspections.

1250 Repair/Replace hose connector to high pressure line prior to use or inspection.

1345 Inspection complete. Begin drilling activities at NBKK-LFEX-MW01

1350 Amanda Rohrbaugh departs Site.

1355 Pull core 6-10.0' 100% recovery Hand auger to 3.0' air knife to ~~6.0'~~ 5.10' bgs.

1400 Griffin Riley collects Field Blank NBKK-LFEX-FB01-100622

1415 Pull core 10.0-20.0' 90% recovery

1440 Pull core 20.0-30.0' 80% recovery Water observed in core barrel DTW = 11.74' but not observed in lithology as a WBZ.

1455 Have drillers continue to 40.0' Message Peter Lawson and Rachel Clennon with update

1515 Pull core 30-40.0' 80% recovery Sand from ~30.5-29.0' WBZ.

1520 Send update to Peter Lawson & Rachel Clennon. Provide photo and suggest Screen 29.0-39.0'; Drillers case and clean out to 40.0' based on

field observations.

1535 Clean out complete. Drillers bio break and hydrate.

1550 Approve to set well per specifications as follows:
Screen 29.0-39.0 (6)
Filter Pack 27-40.0' (7)
Bentonite Seal ~~20~~-27'

1555 Begin Setting well

1615 To much sand added. Need to clean out. Request to suspend well as discussed. Patrick departs

1630 Suspend well.

1620 Collect Sample 27.0-28.0'
NBKK-SP-LFEX-SB01-2728

1745 Complete setting well.

1755 Griffin Riley secures site at NBKK-LFEX-MW04. Drillers clean area at MW-01. Will finish well completion in morning

1800 Drillers depart Site.

1820 Complete load out. Label and secure two drums.

1830 Jacobs staff departs Site.

Mike D. Dinkelman
10-6-2022

10-7-2022

Keyport, WA
NBK-Keyport

Personnel On-Site: J. Dinkelman, P. Elliot, J. Schmidt, G. Riley > Jacobs; M. Anderson, E. Clifford, R. Jonson, L. Thompson > Y. J.

Weather: Mostly Fog in am. clearing skies early PM 50's-70's. Mild Breeze.

Objective: Mobilize to LFEX-MW04 and begin drilling. Air knife at car fire location when R. Jonson arrives ~ 10:30.
* Delay start for P. Elliot, J. Schmidt and G. Riley during am mobilization.

7:25 Arrive on Site. Prepare for daily field activities.

7:30 Perform Health and Safety Meeting. Discuss Fatigue. Good Housekeeping, Proper Lifting.

7:45 Complete Safety Brief, Load final Materials for well pad construction at LFEX-MW01.

8:45 Griffin on Site. Send for Ice.

9:30 Measure DTW = 9.29' @ MW-01

10:00 M. Anderson decon tooling.

10:30 Finish well pad construction

Riley Jonson on Site. Griffin Riley and Patrick Elliot to oversee Air-Knife activities at 2008 Car Fire location.

1100 Complete Set up at LFEX-MW04 Drillers break for Lunch

1130 Drillers back from Lunch.

1140 Begin drilling at LFEX-MW04

1145 Pull Core 3-10' 100% Recovery

1155 Pull Core 10.0-20.0 100% Recovery

1220 Tommy Ta arrives on Site.

1230 Pull core 20.0-30.0' (100%)

1235 Measure DTW = 13.14' Drillers pick up well material. Observe well graded sand ~ 27-30.0' instruct to drill additional footage to determine sand thickness. Discuss with driller if lithologic change in drilling occurs to discontinue drilling. Not to drill too deep into ~~fat~~ clay zone.

1245 Pull core 30-36.0' Sand to 33.0' clay 33-36.0.

1255 Jarod Schmidt departs Site.

1300 Mikey Anderson to check out 2008 Car Fire location in SE corner in rear of Structure ~~(MW03)~~ - MW02 Review APP/SSHP with Tommy Ta

1330 M. Anderson returns. Contact Peter Lawson and Rachel Clennon on extent of wet sand from ~27.0-33.0'. Best Water Bearing Zone.

1340 Drive casing and clean out to 35.0'

1400 Confirm with Peter Lawson well specifications as follows:

Screen 23.0-33.0'

Filter Pack 21.0-35.0' (7)

Chips 2.0'-21.0' (6)

1520 Collect Sample from 26.0-27.0'

NBKK-LFEX-SB04-2627

1600 Complete Setting well. Allow chips to hydrate. Depth of chips 2.0'

1610 M. Anderson Mobilizes rig off hole and checks on Air Knife Crew.

1700 M. Anderson returns for drum to pick up asphalt concrete at Air Knife location. Depth ~ 6.0' bgs.

1730 Bring drum and load on trailer Clean and Secure area. Patrick

Elliot departs Site.
1800 Complete daily field activities
Drillers depart Site.
1810 Jacobs Staff departs Site.

Air Knife Activities/Times:
Per Griffin Riley Notes
1400-1425: Saw Cut Concrete
1425-1545: Use Jackhammer to finish getting through concrete
1545 Concrete 8.0" thick. soil with some asphalt observed
1545-1605: Fix Vac Truck
1610-1630: Hand auger to 3.5' bgs
1620: Collect Sample 1.5-2.5'
NBKK-CFI-SS02-1H2H
1630: Complete air-knife activities
1700: Air knife crew returns with Mikey Anderson.

10-7-2022

10-8-2022

Keyport, WA
NBK-Keyport

Personnel On-Site: I. Dinkelman, P. Elliot, G. Riley and Tommy Ta -> Jacobs; M. Anderson, R. Jonson, E. Clifford, L. Thompson -> Yellow Jacket Drilling.
Weather: Sunny, Clear Skies, Calm 50's-
Objective: Complete well pad at LFEX-MW04 Mobilize and begin drilling B1006-MW01 Complete air knife at 2008 Car Fire.

7:30 Arrive on-Site. Meet with field team
7:40 Lead HSEQ Meeting. Discuss Fatigue, Complacency, Traffic Safety
7:55 Complete Safety Meeting. Begin Mobilization to LFEX-MW04 and Air knife crew to ~~B1006~~ Car Fire
8:10 Begin Mobilization activities to B1006. Eric Clifford constructs well pad at LFEX-MW04.
8:25 Move Rig to B1006
8:30 Calibrate Multi-Rae (see calibration log)
8:40 Begin pad construction at LFEX-MW04.
8:50 Air knife team mobilizes to 2008 Car Fire for ~~air knife~~ utility clearance.

Will cut inside yellow line at location MW-02 in SW corner in parking area.

9:40 Speak to Patrick Elliot. Cultural figures in Monitoring plan have different well nomenclature. Need to update in tablet. Speak to Rachel Clennon RE: Update of Collector vs. Figures.

10:30 Finish well completion activities load and Move Materials and equipment to next location B1006.

11:20 Complete all activities at MW04 and Landfill Extension complete. Mobilize to laydown area.

1130 Move trailer to B1006 to unload Check on Vac Truck team at CF1.

1200 Return to B1006. Drill team to break for Lunch.

1245 Drillers return. Prepare for drilling activities.

1255 Air knife complete at 2008 Car Fire locations. Luke Thompson to join Rig team (3 man crew) Riley Jonson to drop Vac Truck at laydown area and repair Water Truck

1300 Begin drilling activities at B1006-MW01.

1305 Pull core ~3.0-10.0' Previously air knife and hand auger to 6.0' Water observed ~3.0-3.25' bgs.

1320 Pull core 10.0-20.0' 100% Recovery

1355 Pull core 20.0-27.0' 100% Recovery

1410 Pull last ~~10.0~~ 3.0' 100% Recovery

Note: Spoke with Rachel clennon following pulling core samples from 10.0-20.0' Since all clay observed pull additional core to determine the deeper lithology. Generally Clay / Sandy Clay from 10.0-30.0' No subsurface sample collected due to boring all hydrated. Only surface sample collected during air knife.

1430 Patrick Elliot departs Site. No additional intrusive work to occur.

1435 Discuss well specifications with Rachel Clennon. Washington ID # BPK-459

Screen ~~(2) X~~ 4'-14.0'

Filter Pack -3.0-16.0' (7)

Bentonite 1.0-3.0 (11) * Backfill

+ Concrete Pad (3)

1445 Gather well materials. Prepare to set well.
1510 Winch Line for suspending well appears to have "kink". Need to Repair Line, keeps twisting well.
1520 Suspend well to specifications
1530 Well "floats" and comes up ~0.5' due to shallow nature. well cannot be > 4.0' to Screen as required by State.
1600 Stop well installation activities cannot complete today. Clean and secure area
1610 Mobilize to laydown. Discussion with Griffin Riley RE: Ant Knife Tommy Ta departs Site.
1615 Mobilize to 2008 Car Fire(MW-01) Cut concrete and added water entered storm drain ~ 12.0' NW of boring location. Fire Station staff may have placed call to environmental. Contact Rachel clennon. Clean area. Vaccum & Sweep loose dust.
1800 Team departs Site.

10/10/2022

Keyport, WA
NBK-Keyport

Personnel On-Site: Ilka Dinkelman, Patrick Elliot, Tommy Ta > Jacobs; Michael Anderson, Eric Clifford, Luke Thompson > Y.J.
Weather: Partly Cloudy, Cool am, Calm winds, 50's-70's.
Objective: Complete Setting well B1006-MW01 and Mobilize to B1006-MW02.

7:30 Arrive On-Site.
7:40 Perform HSEQ. Discuss traffic safety, Slip-trip-fall, pinch points and PPE.
7:55 Complete daily tailgate. Mobilize to 2008 Car fire location. Check on location (MW-01) and sock laid down by drillers in Morning before Meeting.
8:15 Arrive at B1006.
8:30 Drillers repair hoist cable for Suspending well. Calibrate Multi-Rae.
8:45 Send Tommy Ta to make copies of Waste Tracking log and Scan driller dailies.
9:10 Complete cable repair for hoist. Rig inspection prior to drilling indicates

a small hydraulic fluid leak. Remove hose. No release/spills.

9:30 Drillers will require new hydraulic line. Send Patrick Elliot home. No new intrusive work will occur today. Drillers will need to repair rig, set well and mobilize to new location + set up.

9:35 Drillers depart Site to pick up new hydraulic line.

11:00 Drillers return from picking up new hose line. Tommy Ta to generate proper Waste Logs

11:45 All repairs complete.

12:00 Perform clean-out

12:20 Begin building well to specifications. Add Bentonite chips to 16.0' bags for bottom seal.

12:40 Suspend well Screen 4.0-14.0'

12:45 Begin Sand addition.

~~14:00~~ ~~13:00~~ Complete well construction activities. Begin pad construction.

14:10 Mobilize Rig to B1006-MW02.

14:30 Rig in Place. Mast up. Begin mixing concrete for well pad.

Mikey Anderson take used tooling to decon. (30.0' of casing + rod)

1505 Complete decon.

1545 Finish well pad construction. Fuel all field vehicles. Rig + Skid Steer

1600 Mobilize to Laydown area. Unload IDW drums from LFEX - MW01 & MW04. Stage in secondary containment. Confirm labels.

1715 Complete IDW/ Drum Storage and Labeling. All team members depart Site for day.

Mikey D. Anderson
10-10-2022

Keyport, WA 10/11/2022
NBK - Keyport

Personnel On-Site: Ilka Dinkelman, Matt Steinkamp, Tommy Ta > Jacobs; Michael Anderson, Eric Clifford, Luke Thompson, Tony Fehrenbach > Yellow Jacket
Weather: Sunny, Mild Breeze, Cold am. warming in afternoon 50's - 70's.
Objective: Drill and set well at B1006-MW02
Mobilize to and drill at B1006-MW03

8:00 Arrive on Site. Delay - left tablet at hotel and required for work.
8:05 Perform Safety Meeting. Tony Fehrenbach Safety for Yellow Jacket is on Site. Discuss Heat/Cold Stress (cool mornings - warm afternoon) layer. Traffic safety. Blind corner headed to Drill location. Slip-Trip-Fall and Housekeeping.
8:20 Complete Meeting. Pick up field Supplies at Storage Area.
8:35 Arrive at B1006. Prepare for drilling activities. Set up area
8:55 Begin drilling at B1006-MW02

9:05 Pull core 3.0-10.0' 100% Recovery
9:10 Drum for clean out spoils did not pass inspection. Slight film on inside and slight detect on PID <5 ppm (1.7 ppm). Retrieve new drum from laydown area.
9:20 Resume drilling.
9:35 Pull core 10.0'-20.0' 95% Recovery
9:40 Perform clean-out casing to 20.0'
9:50 Contact Peter Lawson & Rachel Clennon RE: Well. Suggest Same/Similar well completion and specifications as nearby well B1006-MW01.
Screen 4.0-14.0
Sand 3.0-16.0' (9)
Chips 1.0-3.0' (2)
Will place bentonite at bottom for bottom seal.
10:15 Begin Preparations for well. Driller cleaned out
10:45 Add Bentonite Seal 18.5-20.0' as bottom seal. Allow to hydrate
10:55 Add Sand and prepare to suspend well.
11:05 Tommy Ta to ship samples. Continue with well construction.

1235 Tommy Ta returns from shipping samples. E-Mailed COC to team

1245 Finish setting well to specifications. ~~Begin final well completion (build pad).~~ Drillers break for Lunch.

1310 Drillers return. Prepare to finish well at B1006-MWØ2.

1330 Mobilize to decon to clean tooling used. Tommy Ta oversees decon.

1400 Decon complete.

1430 Complete construction of well pad Move Rig onto B1006-MWØ3

1500 Complete set up at B1006-MW03. Place exclusion zone

1515 Begin drilling activities at MW-03

1525 Pull core 6.0-10.0' 100% Recovery

1535 Pull core 10.0-20.0' 75% Recovery Clean out / Drive Casing to 20.0'

1545 Collect Field Blank Sample NBKK-B1006-FBØ1-101122

1555 Measure DTW ~ 11.0' and rising

1600 ~ DTW = 11.0' bgs.

1605 Tony Fehrenbach departs Site.

1615 Secure and clean area Mobilize to laydown area.

1645 Fill water tote.

1700 Unload drums, secure and clean area at laydown

1730 Depart Site.

*Note. Unique Washington Well ID for B1006-MWØ3 = BPK-461. B1006-MW02 = BPK-460.

Will set well 10-12-22.

10-11-2022

Keyport, WA
NBK-Keyport 10/12/22

Personnel OnSite: I. Dinkelman, M. Stenkamp, Tommy Ta (delay due to training) > Jacobs
M. Anderson, E. Clifford, L. Thompson > Y.J.
Weather: Clear skies, Mild Breeze, 50's - 70's
Objective: Set well at B1006-MW03 and mobilize to 2008 Car Fire location

7:35 Arrive on-Site meet with team
7:45 Delivered new Portable Toilet. Lead Health & Safety. Discuss good housekeeping, Lifting, Rig mobilization, Working from heights (getting on Rig for repairs).
810 Prepare for daily field activities Pick up well materials and mobilize to B1006-MW03.
830 Measure DTW ~ 6.9' bgs. Contact Peter Lawson and Rachel Clennon RE: DTW and well specifications.
845 Discuss well design/construction with driller. Well will be set as follows:

Screen 6.0-16.0'
Sand: 4-20.0' (7)
Chips: 1-4.0' (2)

9:00 Problems with heaving sands. Perform Clean out. Will need to add water.
9:35 Add ~ 75 gallons water to borehole to weigh down 'heaving' sand. Will need to be pumped out during well development before sampling.
940 Discuss addition of water with R. Clennon will document in GW Sampling PL's and include on well Completion Diagram.
9:45 Begin well construction per specifications.
10:35 Tommy Ta arrives on Site.
11:30 Move Rig off hole. Fuel Rig
11:40 Finish setting well. Will construct pad for well following Lunch Break.
11:45 Drillers break for Lunch
12:05 Matt Stenkamp returns to B1006. Assisted with utility marking. Two locations require re-mark OU2A2 MW-02 and OU2A2 MW-03.
12:18 Move Rig to 2008 Car Fire location Drillers Helpers construct well pad.
12:55 Driller returns to B1006. Will take tooling to decon and fill water tote.

1305 Tooling to decon and fill tote.
1345 Complete decon. Finish well pad construction. Prepare to mobilize additional materials and equipment to CF location.
1355 Scope Car Fire laydown area at intersection (SW) of B Street. Likely need to expand. Send photos and update request to Rachel Clennon.
1415 Mikey Anderson arrives at location CFI-MW02 outside Gymnasium entryway.
1420 Pull steel plate off boring. Observe utility in hole. Utility was not relayed to field team
1430 Contact R. Clennon about unmarked utility line. Abandonment of hole required.
1445 Set up Rig on MW01
1545 Abandon CF MW02.
1630 Mobilize to laydown area. Tommy Ta and Matt Steinkamp depart
1640 Unload drums and materials
1700 Depart Site.

Ilka Dinkelman
10-12-2022

10-13-2002

Keyport, WA
NBK - Keyport

Personnel On-Site: Ilka Dinkelman, Matt Steinkamp, Tommy Ta (to arrive ~ 10:30). > Jacobs
M. Anderson, Eric Clifford, L. Thompson
Visitor: Aaron Adams > Yellow Jacket
Weather: Clear Skies, Sunny 40's-70's. Calm cool morning warming in afternoon.
Objective: Begin drilling NBKK-CFI-MW01
Set well

7:30 Arrive on Site. Meet with Team
7:40 Aaron Adams on Site. Yellow Jacket Management drop off Materials.
7:45 Safety Meeting. Discuss good housekeeping. Utility identified during air knife, lifting and communication. Objectives.
8:00 Complete safety meeting. Load trailer. Prepare for drilling activities.
8:45 Mobilize to Drill location CFI-MW01. Finalize set up and prepare for drilling
9:35 Begin drilling activities at CFI-MW01
9:48 Pull core 0.0-10.0' 92.5% recovery. Previously hand auger to 6.0'
1010 Pull core 10.0-20.0' 95% recovery

1050 Pull core 20.0-30.0' 90% recovery
1125 Pull core 30.0-40.0' 80% recovery
Will perform clean out
1140 Tommy Ta collects Field Blank Sample NBKK-CFI-FBØ1-101322
1145 Drillers break for lunch.
1230 Return from Lunch DTW=33.6'
1240 Resume drilling. No observable water based on lithology.
1300 Pull core 40.0-50.0' 90% Recovery
1345 Pull core 50.0-60.0' 90% Recovery
1420 Pull core 60-68.0' 100% Recovery
1435 Contact Peter Lawson and Rachel Clennon RE: Well Specifications. Still not ideal WBZ, but best observable "wet" zone is identified at ~56.5-60.0'. Suggest Screen 53.0-63.0'.
1440 Repair air-line on Rig.
1450 Agree on Screen Interval from 53-63.0. Discuss well specs with driller. Unique WA ID# 4162
Screen 53-63
Sand 51.0-65.0 (7)
Seal 46.0-51.0 (2)

Drillers will add grout
1515 Collect Sample 51.0-52.0' bgs NBKK-CFI-SBØ1-5152
Drillers perform clean out and drive casing to 65.0'. Will add 2.0' sand at bottom of boring.
1540 Prepare to suspend well. Will use two centralizers (1) ~ 51.0' (2) ~ 25' bgs.
Clean out complete to 65.0' bgs.
1645 Complete Sand/Filter Pack addition to 51'
Begin addition of Bentonite Chips
1700 Complete addition of chips to 46.0'
Will allow to hydrate overnight.
1705 Clean and secure Site.
1715 Depart Site
Note: 1600 Matt Steinkamp depart Site
No additional intrusive work
1645 Tommy Ta departs. Drillers completing addition of chips.

10-13-2022

Keyport, WA
NBK- Keyport

10-14-22

Personnel On-Site: Ilka Dinkelman, Matt Steinkamp, (To arrive ~9:00), Tommy Ta > Jacobs; Mikey Anderson, Eric Clifford, Luke Thompson > Y.J.
Weather: Hazy due to local fires, Mostly Clear Skies, 40's-70's, Calm Winds
Objective: Complete Setting well at CFI-MW01 and Mobilize to CFI-MW03.

7:30 Arrive on Site. Meet with team
7:40 Health and Safety Meeting. Discuss Decon, housekeeping, Rig Mobilization and heat/cold stress. Daily Objectives.
8:00 Mobilize to drilling location. Warm up Rig. Rig Inspection
8:20 Van Parked in location MW-03 location. Locate driver to be moved.
8:30 Begin Grout at CFI-MW01. 2 50-lb bags in ~ 50 gallons H_2O
9:15 Van Moved from CFI-MW03
9:20 Matt Steinkamp on Site.
9:30 Complete Grout. Top with 2 bags of bentonite chips
9:45 Tower Down Rig.

9:55 Calibrate Multi-Rae (See Cal log)
10:00 Mobilize Rig to CFI-MW03.
10:15 Dennis Ballam on Site
10:20 Drillers mobilize to Decon area
11:45 Drillers return from decon. Helpers break for lunch. T.Ta in training until 1400
12:15 Return from Lunch. Set up well
13:05 Begin Pad Construction. Dennis Ballam departs Site.
1405 Finish Pad construction at CFI-MW01 Complete Mobilization to CFI-MW03.
1420 Begin drilling at CFI-MW03.
1430 Pull core sample 6.0-10.0' 100% Recovery
1445 Pull core sample 10.0-17.0 100% Recovery Back downhole for 17.0-20.0'
1455 Pull core sample 17.0-20.0' 70% Recovery
1520 Pull core sample 20-30.0' 90% Recovery Cleanout and drive casing to 30.0'
1545 Dropped and bent 10' length of casing. Need to get additional casing.
1606 Resume drilling. Tag bottom no water
1630 Pull core 30.0'-40.0' 95% Recovery
1645 Mobilize to laydown area. Drop Trailer
1700 Depart Site.

Ilka D. Dinkelman
10-14-2022

Keyport, WA
NBK-Keyport

10/15/2022

Personnel On-Site: I. Dinkelman, Matt Steinkamp, T. Ta > Jacobs; M. Anderson, E. Clifford, L. Thompson > Yellow Jacket
Weather: Hazy, Smokey Skies, 50's-70's Calm winds, Mostly Sunny.
Objective: Complete drilling CFI-MW03. Mobilize Rig to Staging area for off week. Clean and Secure Site.

7:05 Pick up and load bottleware coolers from lab for IDW Sampling. All Jacobs staff assist
7:20 Mobilize to Site. Final day of Mobilization. Drillers must depart NLT 13:30.
7:35 Arrive on Site. Meet with drillers
7:40 Perform HSEQ. Discuss Fatigue Management. Traffic Safety during demobilization. Staging and securing Rig during off week. Good housekeeping
7:55 Complete HSEQ. Team to Mobilize to CFI-MW03.

Rig staged at hole. Current depth 40.0' bgs.
805 Arrive at CFI-MW03. Warm up Rig and prepare for daily drilling activities.
825 Resume drilling at CFI-MW03
930 Complete drilling to 60.0' bgs.
940 Check DTW ~30.0'. No discernable water bearing zone identified before depth ~53.5-54.0' bgs.
945 Resume drilling to 70.0' bgs. Require sufficient depth to set screen. Also determine if better WBZ is encountered.
1015 Complete drilling to 70.0' bgs. Measure DTW ~31.0' bgs. Cannot complete setting well due to time restrictions for Mobilization. Drillers must be off Site by 13:00 for driving (DOT). Will perform clean out ~~and remove casing. Cannot leave downhole.~~
1045 Complete clean-out. Prepare to move Rig and Materials to approved laydown area at Car Fire location parking area.

1130 Secure area. Complete soil logging during Rig Clean up.
1205 Matt Steinkamp mobilization from Site.
1245 Rig Secure at CFI parking area. Establish exclusion zone for week mobilization. Move drums to IDW Storage area/ laydown.
1330 Complete off-load of drums and clean and secure Site.
1345 Drillers depart Site. Complete check up of area and drop off equipment at Storage area.
1440 Jacobs depart Site.

Ilka D. Dinkelman
10-15-2022

10/24/2022

Keyport, WA
NBK-Keyport

Personnel on-Site: Ilka Dinkelman, Griffin Riley > Jacobs, Michael Anderson, Eric Clifford > Y.J.
Weather: Rain, Cloudy, 40's-50's, cool
Objective: Set well at CFI-MW#2 and Mobilize Rig to Site 7-MW#2.

7:35 Arrive on-Site. Beginning of new 3-week shift. Discuss general shift objectives.
7:45 Perform HSEQ Meeting. Discuss slick conditions due to rain. Cold stress Proper PPE (e.g. rain gear). Traffic Safety, Pedestrian traffic (exclusion zone).
8:05 Complete daily HSEQ. Prepare for daily field activities. Load truck
8:20 Mobilize to location CFI-MW#2 Van parked at drilling location. Belongs to Jacobs Support Group. Will be Moved.
8:30 Warm up Rig and fuel Support equipment.
8:45 Begin Mobilization of equipment and Materials to location from staged area used during off week.
8:55 Move Rig to location and Set up.

9:15 Griffin Riley Measure DTW = 22.72' bgs
9:20 Message Rachel Clemon and Peter Lawson. Still approved to set well in the better WBZ depth observed at ~54-56.0'
9:45 Complete Set up at CFI-MW04
9:55 Begin Clean-out.
10:25 Complete clean-out activities Current TD cased is 63.0' need additional 2.0' to set well. Need to perform additional clean out. Return core barrel down hole to recover final soils.
11:00 Complete second clean-out. Current clean-out to 68.0' bgs.
11:10 Prepare to set well.
11:30 Begin Setting well to specifications
Screen 53.5-63.5'
Sand 51.5-68.0' (9)
Chips 47.0-51.5' (1)
Grout ~4.0-47.0' (2)(1)
1220 Complete addition of sand pack
1230 Add Chips to ~47.0' for seal
1235 Drillers Break for Lunch.
1305 Return from Lunch. Begin
Riley Johnson arrives on Site

preparations for mixing grout.
1355 Complete addition of grout. Will allow to settle and add chips to 2.0'. Use 1 bag (40 gallons)
1400 Begin clean up of area.
1420 Move Rig off location and Mobilize to Site 7- MW04.
1440 Drillers Helpers E.Clifford and R. Jorson Mobilize to laydown area for water and decon. Will return to location CFI-MW03 to finish well completion and clean Site area. Will require power wash to mop up released drill cuttings
1505 Contact Griffin Riley Rig secure at Site 7. Drillers currently at decon when decon complete will load pressure washer to clean asphalt
1540 Drillers return to CFI-MW03 Finish Well pad construction and Pressure wash area of excess ~~cutti~~ purge water from well.
1630 Complete pad construction. Clean area
1815 Drop trailer and materials at laydown
1740 Depart Site.

10-24-2022

Keyport, WA
NBK-Keyport

10/25/22

Personnel On-Site: Ilka Dinkelman, Griffin Riley, Kevin Smallwood > Jacobs; Mikey Anderson, Eric Clifford, Riley Jonson - ~~Guest~~ Visitor: Tony Fehrenbach > Y.J.
Weather: Cloudy, Rain expected, 40s - 50s Breezy, Cool.
Objective: Air Knife location Site 7 MW04. Begin drilling. Set well.

7:30 Meet field team at laydown area. Tony Fehrenbach - Yellow Jacket Safety on Site.
7:40 Perform HSEQ Discuss new location "fill area". Rad Monitoring, Cold Stress, Containing drilling spoils/fluids, PPE - Proper PPE when handing equipment (e.g. gloves worn when handing drums).
8:00 Complete HSEQ. Prepare for daily drilling activities.
8:10 Drillers prepare for air knife activities. Load Materials at laydown. Mobilize to Site 7 with Kevin Smallwood to perform field QA/QC for Radiological Monitoring. Stop at Car Fire to check on MW-03.
8:20 Arrive at Site 7. There is a dump truck and truck/trailer parked blocking work area. Kevin Smallwood to locate owner of work vehicles. Contact Security @ B73.
8:30 Drillers on Site with VAC Truck. Kevin Smallwood contacted owner will be moved.
8:40 Spoke with Ryan of Southwest Operations. Move Dump truck. Can stage at laydown area. Truck Moved
8:45 Move VacTruck to location Site 7-MW04.
8:55 Prepare to cut asphalt for air knife.
9:00 Cut asphalt. ~ 4.0" Thickness.
9:10 Begin Hand Auger. 0.5'-1.0' contained asphalt.
9:20 Collect Sample 1.0-2.0'
NBKK-S7-SS04-0102
9:25 Current depth 2.90' Air knife not starting. Mike Anderson and Tony Fehrenbach depart Site for Materials to start Air knife.

Starter Fluid and Fuse.
Riley Jonsan and Eric Clifford continue to hand auger
1015 M. Anderson and T. Fehrenbach Return.
1020 Cannot Start Air knife. Troubleshoot.
1030 Resume hand auger activities.
1030 Current depth ~4.25' bgs.
Rock at 4.25' cannot get past.
Drillers depart for laydown
1235 Complete Hand Auger to ~5.5'
1245 Prepare for drilling activities.
Move Rig to center on-hole
Drillers helpers pick up tooling and materials from laydown area.
1355 Break for Lunch
1420 Return from lunch. Begin drilling activities at Site 7 MW04.
1425 Pull core sample 5.5-10.0'
Hand Auger to 5.5' ~75% Recovery
1435 Pull core Sample 10.0-19.0'
Drilled 9.0' and recovered ~8.5'
85% Recovery. Core wet.
Shells identified in core Sample

14:40 Perform clean-out.
15:10 Message with SME/PM RE: Well specifications. Request drillers to drill from 19.0-25.0 for lithology and determine final screen placement. Possibly 10.0-20.0'
15:15 G.Riley collect sample 9.0-10.0'
JNBKK-S7-SB04-0910
15:25 Pull core 19.0-25.0', 100% Recovery. Clayey formation from 19.0-20.0 with an organic layer of wood below. Wood is breaking into flat platy sheets from 20.0-21.0'
15:30 Contact Peter Lawson. Do not want hydraulic contact with organic layer from 20.0-21.0' will seal off with Bentonite to 19.5' and place 6.0" Sand above. Will screen from 9.0-19.0' bgs.
15:45 Discuss well specifications with driller. Begin to set well
Screen 9.0-19.0'
Filter Pack 7.0-19.5' bgs
Bentonite 2.0-7.0' bgs
Concrete Pad 2.0'x2.0'x2.0'
Flush Mount Well Completion.

The bottom of borehole seal 19.5-25.0 to prevent hydraolic contact with sandy fat clay and where 'wood' layer observed from 20.0-21.0'

1610 Tony Fehrenbach departs Site.

1650 Finish setting well to chips. Allow for hydration. Will perform and finish well surface completion at S7-MW04 on 10/26/22.

1715 Clean and Secure Site.

1730 Depart Site

D. Dinkelman 10-25-2022

10/26/2022

Keyport, WA
NBK-Keyport

Personnel on-Site: J. Dinkelman G. Riley, K. Smallwood > Jacobs; M. Anderson, E. Clifford, R. Jonson > Yellow Jacket.
Note: Tony Fehrenbach on Site Waiting for Materials to be dropped off no oversight

Weather: Mostly Cloudy, Mild Breeze, 40's-50's.

Objective: Complete well at S7-MW04. Mobilize to S7-MW05.

7:35 Arrive on Site. Meet with field team

7:45 Perform HSEQ Meeting. Discuss Traffic safety, Mobilization PPE. Cold stress. Summarize daily objectives.

8:00 Complete HSEQ. Prepare for daily field activities. Load materials.

8:05 Mobilize to location S7 MW-04

8:25 Measure DTW = 10.50' bgs

8:30 Mobilize Rig off hole to S7 MW05.

8:45 Begin surface completion of well at S7. Use 3 bags concrete.

9:45 Complete pad. Clean and Secure area More tooling and materials to decon. Fill water tote.

10:30 Complete decon. Mobilize remaining equipment and materials to next location S7- MW05.
11:00 Complete drop off of Materials
11:15 Cut concrete at S7 MW05
11:40 Begin Hand auger. Very well graded sand with gravel.
11:45 Collect Sample 1.0-2.0'
NBKK-S7-SS05-0102
12:30 Complete Hand auger. Move Rig into place
12:45 Drillers break for Lunch
13:20 Drillers perform final set up of area at Site 7 MW05
13:40 Begin drilling at S7 MW05.
13:45 Pull core 6.0-10.0' bgs. 100% Recovery. Mostly gravel
14:00 Griffin Riley collects Field Blank
NBKK-S7-FB01-102622
14:05 Pull core 10.0-20.0' repair clamp on Rig. HSE Driller off Rig
14:10 Complete Repair resume drilling
14:35 Pull core 20-25.0' 90% Recovery DTW ~ 10.5' bgs. Contact P. Lawson & R. Clennon RE: Well.
→ 1420 Collect Sample 9.0-10.0'
NBKK-S7-SB05-0910

15:00 Per call drill to 30.0' bgs. Propose 20.0' screen due to possible tidal influence.
15:15 Pull core 25.0-30.0' bgs. Prepare to set well to specifications.
Screen 9.0-29.0'
Filter Pack 7.0-30.0'
Bentonite 2.0-7.0'
Concrete Pad completion 2'x2'
17:25 Complete Setting well. Clean and secure area. Will complete surface completion on 10/27
17:45 Drillers depart Site. Will stop by laydown area to drop off Materials. Kevin Smallwood on Site.
17:50 Cone off areas with Griffin Riley
16:10 Depart Site.

Mia D. Dinkelman
10-26-2022

Keyport, WA
NBK-Keyport
10/27/2022

Personnel On-Site: I. Dinkelman, G. Riley, K. Smallwood > Jacobs; M. Anderson, E. Clifford, R. Jonson > Yellow Jacket
Weather: Mostly Sunny, Cool 40's-50's
Objective: Pad completion at S7-MW05 drill location S7-MW02

7:40 Arrive on Site. Prepare for daily field activities. Perform HSEQ. Discuss drilling safety. No stepping off rig while operating. Good housekeeping. Trip Hazards. Keep area clean. Slip-Trip-Falls.
8:00 Prepare for daily field activities
8:10 Dale with Navy Haz Waste on Site RE: IDW Sampling. Can relocate Aqueous waste to NE Corner of Quonset Hut.
8:15 Mobilize to B1006 with Griffin Riley in preparation to meet with APS for utility locate update.
8:30 Contact R. Clennon APS not on Site. Will check Car Fire Area
8:40 APS on Site. Will meet with G. Riley at B1006. Drillers performing well completion at S7-MW05.
9:00 Mikey complete stamp for well. Will Mobilize to laydown area to pick up trailer to load equipment & Materials.
9:25 Load trailer from S7-MW05 for decon. Finish surface completion.
9:45 Mobilize to decon area. Kevin Smallwood to oversee decon. I. Dinkelman remain to complete logging and clean/secure Site. Speak with G. Riley currently at Car Fire location with APS.
10:00 APS utility locate complete. G. Riley departs Site to Ship Samples
10:30 Activities at S7-MW05 complete Prepare for drilling at S7-MW02
11:10 Arrive at Site 7-MW02 with Vac Truck. Mikey and Kevin to pick up men-at-work signs
11:25 Collect Surface Sample
NBKK-S7-SS02-0001
11:45 Collect Equipment Blank
NBKK-S7-EB01-102722

1150 Complete hand auger to 3.0'
Lithology is a soft to very
soft consistency, Dry. Silty
Sand with ~~little~~ gravel.
Begin air knife activities
1155 Complete air knife to 6.0' bgs.
1200 Prepare to move Rig. Pick
up trailer with materials
(e.g. tooling-drums-water)
1245 Rig Set up. Drillers break
for Lunch. G. Riley to IDW.
1315 Return from Lunch. Prepare
for drilling.
1320 Begin drilling location S7-MW02.
<20' from bay waters.
NE Corner of Site 7.
1330 Pull core 6.0-10.0' 100% Recovery
1340 Pull core 10.0-20.0' 55% Recovery
1345 Perform clean-out. Casing
dropped in hole. Recover.
Lithology soft / very soft.
1420 Retrieve clean-out material
to 20.0' bgs. Measure DTW
=11.3' bgs. Resume drilling
to 30.0' bgs. Material loose.

1430 Left message with PM/SME.
Continue to loose core from
bottom.
1440 Speak with Peter Lawson/SME.
Discuss heaving material. Will
attempt to set 20.0' screen due
to likely tidal influence. If the
"heaving" material cannot be
recovered may need to set 10.0'
1450 Pull core ~~10.0~~ 20.0-30.0'
@1510 75% recovery. Tighter material
observed at bottom of borehole
~28.0-30.0' bgs.
1500 Perform clean-out to 30.0' bgs
1515 Message PM/SME. TD = 30.0'
Will confirm well specifications.
Collect Sample 10.0-11.0'
NBKK-S7-SB02-1011
1530 Clean-out complete. Begin
Setting well to Specifications.
Screen 9.0-29.0'
Filter Pack Sand 7.0-30.0'
Chips 2.0-7.0'
Concrete Pad 2×2×2 Flush
Mount Well Completion.
*Added 100 gallons to stop heaving
Confirm with PM @ 1520.

1610 Griffin Riley returns.
1615 G. Riley & K. Smallwood depart for B1006 where APS damaged door on Transformer (Pad Mounted). Disconnected? Door opened by APS and not closed. Off hinges.
1630 Complete addition of Sand. Add chips to 2.0' bgs and allow to hydrate.
1640 Drillers mobilize to laydown area. K. Smallwood to oversee.
1710 Clean and Secure area.
1720 Drillers depart Site.
1735 Complete end-of-day field activities. Secure canopy.
1745 Depart Site

10-27-2022

Note: IDW Sampling occured today on 10/27/2022. Performed by Griffin Riley with NAVY Oversight. Sampling as follows:

1300 NBKK-IDWØ1-SO-102722
collected from drums SOØ1-SO1Ø
Source from B76. VOC collected from drum SO1Ø

1345 NBKK-IDWØ2-SO-102722
collected from drums SO11-SO13
Source from OU2A5. VOC collected from drum SO13 + VTØ6 VTØ7

1415 NBKK-IDWØ3-SO-102722
collected from drums VTØ1-VTØ5
Source Vac-Truck soils from B76.
VOC collected from drum VTØ5

1500 NBKK-IDWØ4-AQ-102722
collected from drums AQØ1-AQØ2
Combined decon from B76 & OU2A5
VOC sample collected from drum AQØ2.

All drums sampled were generated during drilling by Holt.

Keyport, WA
NBK - Keyport. 10/28/2022

Personnel On-Site: Ilka Dinkelman, Griffin Riley, Kevin Smallwood > Jacobs; Mikey Anderson, Eric Clifford, Riley Jonson > Yellow Jacket.
Weather: Partly Cloudy to Mostly Cloudy, 40's-50's. Mild Breeze. Clearing (p.m)
Objective: Finish Surface completion at S7-MW02. Mobilize to S7-MW01. Set traffic safety area. Drill and Set well at Site 7- MW01.

7:30 Arrive on Site. Prepare for daily drilling activities. Rain overnight flooded areas at laydown.
7:35 Perform HSEQ. Discuss traffic safety. Cone off area 50 feet in front of and behind Rig when mobilizing to S7-MW01. Use signs. One-lane closure. Also discuss cold stress. Keep hydrated. Fatigue mgmt.
7:50 Complete HSEQ. Need to move drums. Currently staged in area flooded w/ 2-4" water. Cannot keep drums submerged. Move to dry area below north bay at Building 1032 in west laydown.
805 Mikey Anderson informs water is shut off at Building 951. Water is being shut off from inside. Need water for drilling. Spoke with B951 personnel. Will make sure water is on.
820 Water access restored. Drums Moved to dry area. Load equipment and tooling for drilling.
835 Mobilize to Site 7.
840 Kevin Smallwood to assist with Traffic control placement. ~~Begin surface completion~~ @
930 Begin cutting asphalt/concrete at Site 7 - MW01.
940 Mikey to fill water totes.
955 Begin for hand auger activities. Asphalt ~ 3.0" Thickness
1000 Collect Sample 0001 Dry
NBKK-S7-SS01-0001
1010 Complete hand auger to 3.0' bgs.

1020 Complete Air-Knife to 6.0' bgs.
1030 Prepare to Mobilize Rig from location S7-MW02 to S7-MW01
Use mud-mats to minimize ground disturbance.
1050 Move Rig to Site 7-MW01.
1100 Begin Surface completion activities at S7-MW02.
1200 Surface completion at S7-MW02 is finished. All Materials and equipment staged at S7-MW01
Drillers break for Lunch.
1230 Return from Lunch. Fuel Rig
Finalize set up and Prepare for drilling activities at S7-MW01.
1300 Begin drilling at S7-MW01
1305 Pull core 6.0-10.0' 75% Recovery
1310 Pull core 10.0-20.0' 80% Recovery
1315 Perform Clean Out
1325 Complete clean out to 20.0'
Measure DTW = ~10.7' Resume drilling to 30.0' bgs.
1330 Collect Sample 8.0-9.0' bgs
NBKK-S7-SB01-0809
1335 Notify PM/SME of Progress
currently drilling to 30.0' bgs
1350 Pull core 20.0-30.0' 80% Recovery
Tighter lithology from 22.0-30.0' bgs. Most of water Bearing Zone from ~10.0-22.0' Discuss with Rachel Clemmon and Peter Lawson. Will continue with 20.0' screen interval given possible tidal influence Some 'stringers' of Sand/Silty sand from 22.0-30.0' can still produce water.
1420 Begin setting well to specifications
Screen 9.0-29.0' bgs
Filter Pack Sand 7.0-30.0'
Bentonite 2.0-7.0'
Concrete Pad 2-2-2
Flush Mount Well Completion.
15:15 Add chips to seal and allow to hydrate. Prepare to Mobilize Rig to OU2AS-MW02.
15:30 Mobilize Rig to next location
15:45 Kevin Smallwood receives call from Bangor Base with request to provide Pad Support.
1550 Kevin Smallwood departs Site

From Keyport to Bangor, Chips hydrated. No additional intrusive work at Site 7 until further notice. Per client work is on-going at MW-03 location at Site 7. Cannot complete until further notice.

1555 Begin surface completion at Site 7- MW01.

1650 Finish Surface completion activities at S7-MW01. Clean area.

1715 Mobilize to laydown area Prior to end of day Mobilization Measured DTW = 8.1. Confirm possible tidal influence. Notify PM/SME of Water Elevation change.

1730 Drop off trailer. Complete daily field activities. Depart Site.

Ilka D. Dinkelman
10-28-2022

10/29/2022

Keyport, WA
NBK-Keyport.

Personnel On-Site: Ilka Dinkelman, Griffin Riley > Jacobs; Mikey Anderson, Eric Clifford, Riley Jonson > Yellow Jacket
Weather: Mostly Cloudy, Cool 50's.
Objective: Commence drilling OUZA5-MW02 Set well, Mobilize to OUZA5-MW01

7:30 Arrive on-Site. Meet with team.
7:40 Perform HSEQ. Discuss fatigue. Last day of week. Cold Stress. Possible inclement weather. Slick conditions.
7:50 Drillers decon tooling from Site 7. Load materials and equipment to trailer to Mobilize to OUZA5 (MW02). Bangor staff relinquished samples at ~1900 10/29 with no COC. Also included Multi-Rae. Notified PM of samples from Bangor. Griffin Riley to ship on Monday from Portland. PM approved drilling at OUZA5.
8:15 Large forklift at laydown area continues to shut down. Loss of power. Jump-Start to run.

0825 Mobilize with team to OU2A5
Griffin Riley will check location at B76 SB05 to collect depth (6.0-7.0' bgs) sample. Encountered "flat" surface at ~6.0' and could not air-knife / hand auger deeper than obstruction.

0830 Begin set up and final staging at location OU2A5-MW02. Air-knife / Vac Truck activities previously performed by HOLT on 9-8-2022. Water observed ~5.5' bgs. May be perched?

855 Team encountered refusal at B76 in attempt to collect the "deeper" sample from B76-SB05. According to G. Riley, feature is flat and continuous. Foundation?

900 G. Riley to depart to purchase "Blue" marking paint for OU2A2.

0920 Begin drilling activities at OU2A5-MW02. Adjacent to pier.

930 Pull core 6.0-10.0 100% recovery

955 Pull core 10.0-20.0 100% recovery. Tight formation. Slow drilling.

1030 Pull core 20.0-30.0' 90% Recovery

1055 Pull core 30.0-40.0' 85% Recovery

1130 Pull core 40.0-50.0' 90% Recovery

1155 Pull core 50.0-60' 825% Recovery
Total drill depth ~61.0' bgs

→1100 Measured DTW ~40.0' currently was cased to 20.0'. Actual 38.85' but appears to be rising.

1125 G. Riley measure DTW at nearby well OU2A5-MW03 = 14.61' drilled previously on 9/8/2022.

1205 Drillers break for lunch @ 12:00
Discussions with PM/SME Regarding well installation at OU2A5-MW02. Encountered "sand" zone from 57.0-60.0' bgs.

1230 Drillers return from lunch. Prepare to set well. Collect well materials. Discussions to possibly drill additional 5.0' to 65.0' drill / clean out depth with "shoe" and top deuce ~61.0'. Per P. Lawson no need to advance. Set well 40.0-60.0' bgs. Due to proximity to bay, may observe tidal influence.

1315 Collect Sample 29.0-30.0'
NBKK-OUZA5-SB02-2930
1345 Begin Setting well per specifications at OUZA5-MW02.
Screen 40.0-60.0'
Filter Pack 38.0-61.0
Bentonite Seal 34.0-38.0'
Will grout 2.0'-34.0'
Complete with cement pad 2.0' x 2.0' x 2.0' Flush.
Use centralizers ~39.0' & 20.0'
15:00 Addition of Bentonite chips. Allow to hydrate. Griffin Riley Mobilize to B76-SB05 to abandon. Chips / Concrete. Area currently under construction.
1535 Prepare to mix grout for location OUZA5-MW02.
1615 Complete Grout to 2.5'bgs (tremmie)
1620 Begin Mobilizing Rig to next location OUZA5-MW01.
1630 Begin Surface completion. Move/load equipment Materials.
1740 Finish Surface completion. Clean and secure site.
1745. Depart Site. ~~Alla D. Quinlan~~
10-29-2022

See Second Logbook for NBK Keyport.
10/31/22 - 11/10/22

Projects (continued)

Printed in China

10/31/2022

Keyport, WA
NBK- Keyport

Personnel On-Site: Ilka Dinkelman, Jordan Peery-Lemon, Charlie Royko (Well Development) > Jacobs; Mikey Anderson, Eric Clifford, Riley Jonson > Yellow Jacket Drilling
Weather: Cloudy, Possible Rain, Mild Breeze 40's am to 50's in afternoon
Objectives: Drill location OU2AS-HW01. Set well. Mobilize to Soil Boring Location.

7:30 Arrive on-Site. Contact drillers. Need to stop at OU2AS to block off area at OU2AS Soil Boring Location. Jordan Peery-Lemon assists.
7:50 Arrive at laydown area. Drillers are filling water tote and performing decon on tooling and well casing.
8:00 Perform HSEQ. Ray Carroll with Yellow Jacket on Site for well development. Charlie Royko is at badging office and will be overseeing well development.
815 Complete HSEQ briefing. Review daily objectives. Pick up materials from Storage unit for drilling

oversight activities. Drillers load field trailer with tools & materials

825 Contact with Charlie Royko. Currently at Badging office. Successfully badged and arriving at laydown area.

835 Begin review of APP/SSHP with Charlie Royko and Raymond Carroll. Site specific Hazards, PPE, Hospital Route, Heat/Cold stress.

840 Jordan Peery-Lemon mobilize with drillers to complete set up at OU2A5-MW01

845 Complete APP/SSHP Review. Show Charlie Royko storage area and location of materials.

900 Mobilize to drilling location. at OU2A5-MW01. Prepare for drilling

910 Begin drilling OU2A5-MW01.

915 Pull Core 6.0-10.0' 100% Recovery. Previous utility clearance on 9/8/2022. using Airknife & Auger

935 Pull core 10.0-20.0' 100% Recovery

1010 Pull core 20.0-30.0' 100% Recovery. Very tight formation.

1030 Pull core 30.0-40.0' 90% Recovery

1055 Pull core 40.0-50.0' 85% Recovery. Measure DTW = 46.65' bgs.

1100 Drillers break for lunch

1105 Water coming up DTW = 45.8' bgs

1120 Check on Development crew staged at B1006 MW01. Bail & Surge are complete. Preparing for pumping.

1130 Jordan Peery-Lemon checks DTW = 42.2' at OU2A5 MW-01.

1140 Resume drilling activities current depth of casing is 30.0' bgs. Perform clean out & Casing to 40.0' bgs.

1205 Pull core from 50.0-60.0' - only recovered to 57.0' driller going back down-hole to collect 57.0-60.0' sample.

1240 Pull core 57.0-~~60.0~~ 61.0' wet material silty sand with gravel & clay (little)

1250 Perform clean out. Lots of water encountered during clean out.

1255 Contact Peter Lawson and Rachel Clemon. Not best lithology for well placement. Very tight formation. Lots of silts and clays. Likely not change if drill to 70.0'

Will set well to same specification as OU2A5-MW02. Using 20.0' Screen.

Screen 40.0-60.0'
Filter Pack 38.0-61.0'
Chips 2.0-38.0'
Centralizers @ ~ 19.0/39.0'

1300 Charlie Royko phoned. Prepared to begin pumping at B1006-MW01. & recording field parameters and no turbidity meter in Pelican Case sent by DWH. Contact DWH and Kevin Mayer (on PTO).

1315 Contact Rachel Clennon RE: No Turbidity Meter (HACH 2100Q).

1325 Call Tom Chalmers to see if a meter available at BNC for use.

1335 Meet with development Rig. Driller has old meter available for use. Confirm calibration. Standard 1 ntu = 1.2 ntu. Will use as temporary.

Pine Environmental has meter available. Will pick up and be available for use on 11/1/22.

1405 Return to drilling location. Setting well. To specifications

1410 Speak with Larry at Pine Environmental in Seattle. Confirm address. Will be picked up by Jordan Peery-Lemon.

1400 Collect sample 36.0-37.0'
NBKK-OU2A5-SB01-3637

1450 Jordan-Peery Lemon departs Site Will pick up equipment from Pine.

1550 Complete Setting well. Chips used from 2.0-38.0' allow to hydrate.

1600 Due to ongoing heavy precipitation well pad cannot be completed will clean and secure area and pad will be set on 11/1. Concrete cannot ~~dure~~ cure in heavy rains. Move Rig off boring location to SB04/SB05 area(s)

1700 Clean area and complete end-of-day activities

1725 Depart Site.

10-31-2022

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Keyport, WA
NBK-Keyport

11/1/2022

Personnel On-Site: Ilka Dinkelman, Jordan Peery-Lemon, Charlie Royka (Well Development) > Jacobs; Mikey Anderson, Eric Clifford, Riley Johnson > Yellow Jacket

Weather: Mostly Cloudy - Partly Sunny. Mild Breeze. 40's-50's.

Objective: Complete activities at OU2A5, Mobilize to complete CF Locations

7:45 Arrive on Site. Perform HSEQ Meeting Prepare for daily drilling activities. Purge Spoils from Site 7 into drums from Air-knife. Place drums from OU2A5 into IDW. Fill water Tote on Rig.

8:45 Mobilize to OU2A5-MW01. Prepare for Surface completion. Make well stamps for S7 & OU2A5 wells.

1015 Finish surface completion at OU2A5-MW1

1025 Mikey to assist at Development Rig.

1045 Jordan Peery-lemon oversee hand auger activities at SB05.

1055 Collect Sample 2.0-3.0'

NBKK-OU2A5-SB05-0203

1120 Set up Rig at OU2A5-SB05. Refusal at 3.0' cannot auger by hand beyond. Also attempted air knife. May be CDF as seen at OU2A5-HWØ3. 3 attempts Made

1130 Begin drilling at SB05.

1135 Pull core sample 0.0-11.0' bgs

1145 Lead Driller Mikey Anderson abandons borehole. Riley Jonson and Eric Clifford cut asphalt at OU2A5-SBØ4.

1210 Collect Sample 10.0-11.0' bgs
NBKK-OU2A5-SBØ5-1011

1215 Begin Hand auger at ~~SBØ5~~ SBØ4

1235 Complete hand auger activities

1245 Collect Sample 2.0-3.0'
NBKK-OU2A5-SBØ4-0203

1255 Complete air knife to 5.0' bgs. Can not advance further (refusal)

1300 Drillers break for Lunch

1330 Drillers return from Lunch. Prepare to Mobilize Rig to OU2A5-SBØ4.

1355 Set up Rig at SBØ4. Mast up

1405 Drill to 10.0'

1415 Pull Core 0.0-10.0'

~~1420~~ 1420 Complete drilling activities at OU2A5

1425 Move Rig to 2008 Car Fire location (CFI-~~HWØ3~~ HWØ2 SW location)

1430 Collect Sample 5.0-6.0' bgs
NBKK-OU2A5-SBØ4-0506

1440 Backfill boring and reset asphalt.

1540 Set up for hand auger and air-knife at Car Fire location CFI-~~HWØ3~~. HWØ2

1615 Complete hand auger to 3.0'. Removed grass/organics to 0.5' Confirm depth interval for collection from Rachel Clennon and Peter Lawson

1655 Collect Sample 0.5-1.0' bgs
NBKK-CFI-SS02-~~0110~~ 0101

1715 Complete air-knife to 6.0' bgs. Stop at B76-HWØ4. Set up exclusion zone for development Rig. Materials and soil Stockpiles from work activites (OWS) trenching being placed in area.

1730 Complete daily field activities

1745 Depart Site.

Mike O. Dinkelman
11-1-2022

Keyport, WA — November 2, 2022
NBK Keyport

Personnel On-Site: Ilka Dinkelman, Jordan Peery-Lemon, Charlie Royko (well development > Jacobs; Mikey Anderson, Eric Clifford, Riley Jonson > Yellow Jacket
Weather: Cloudy. Cool, 30's - 40's Mild Breeze
Objective: Drill location CFI-MW∅2 and Set well.

7:30 Arrive on Site. Prepare for daily drilling activities. Decon augers unload 002A5 drums and mobilize to CFI-MW∅2.
8:05 Arrive at CFI-MW∅2. Fuel Rig and prepare for drilling. Rig set up.
845 Begin drilling at CFI-MW∅2.
850 Pull core 6.0-10.0' 100% Recovery
900 Pull core 10.0-20.0' 100% Recovery
920 Pull core 20.0-30.0' 90% Recovery
Perform clean out and drive casing.
1000 Pull core 30.0-40.0' ~~0%~~ 90% Recovery
1005 Measure DTW = 39.1' water at bottom of borehole. Core barrell appears wet.

1040 Pull core 40.0-50.0 80% Recovery
1110 Pull core 50-60.0' 100% Recovery
1155 Pull core 60.0-70.0' 90% Recovery
1200 Drillers break for Lunch
1245 Drillers picked up additional casing unload from vehicle and prepare to resume drilling activities
1255 Measure DTW = 40.4' bgs
1300 Resume drilling ~~@ CFI-MW∅2~~ CFI-MW∅2
1340 Pull core 70.0-80.0' 85% Recovery
1345 Contact Rachel Clennon and Peter Lawson. Discuss well completion specifications. Current depth of boring 80.0' open to 77.0' and casing @ 80.0'. Based on DTW will chip to 70.5' and add sand.
1400 Jordan Record DTW @ CFI-MW01 : MW∅3
DTW MW∅3 = 23.2' bgs
DTW MW∅1 = 16.0' bgs
Collect Sample 38.0-39.0'
NBKK-CFI-SB02-3839
14:05 Well Specificans are discussed with Driller: Screen: 55.0-65.0'
Filter Pack: 53.0-70.0'
Chips ~~50~~ 48'-53.0
Grout = 1.0-48.0'
Flush Mount 2x2 Pad

1420 Perform clean out, Gather well materials and prepare to set well
1445 Add Bottom Seal 70.5-80.0' allow to hydrate
1500 Begin to hang well as bentonite hydrates
1515 Begin addition of filterpack and 3/8" bentonite chips to seal. Mix grout during hydration of seal (~30 min hydration)
1605 Begin to add grout to ~1.0'
1645 Complete addition of grout. Mast down. Prepare to Mobilize Rig to stage at laydown.
1700 Mobilize Rig to laydown area
1705 Clean and Secure area at CFI-MW∅2.
1725 Mobilize to laydown area.
1730 Depart Site.

11-2-2022

Keyport, WA
NBK Keyport

November 3, 2022

Personnel On-Site: Ilka Dinkelman, Jordan Peery-Lemon, Charlie Reyko > Jacobs; Michael Anderson, Eric Clifford, Riley Jonson > Y.J.
Weather: Mostly Cloudy, Calm, 30's-40's
Objective: Finish Well Completion CFI-MW∅2. Mobilize to B1006-MW∅4

7:35 Arrive on Site. Tony Fehrenbach/Y.J. Safety on Site to monitor drilling crew and assess progress of drilling and well development activities.
7:45 Discuss HSEQ. Hydration, Fatigue and Complacency.
810 Prepare for daily activities. Decon tooling & augers prior to Mobilization to B1006. Unload Drums from CFI-MW∅2 to IDW
855 Mobilize materials to CFI-MW∅2 for well surface completion.
1015 Finish surface completion activities. Mobilize back to laydown area to complete decon and fill water tote.
1100 Load trailer at CFI with final materials. Light rain/precipitation.

1135 Complete all activites at CF1
Mobilize to location B1006-MW04
Helpers clean out Vac Truck
1230 Drillers break for Lunch
1300 Return from Lunch. Spoke with Rachel Clennon RE: Totes for development & Sampling. No new drums available. Currently on back-order. Will have 10 Totes delivered in lieu of drums for IDW.
1305 Begin Hand auger at B1006-MW04
1310 Collect Sample 0.5-1.0' bgs
* NBKK-B1006-SS04-0H01 + FD
1330 Complete hand auger activites to 6.0' Soft Material. Mostly clayey Sand.
1340 Move Rig and set up for drilling at B1006-MW04.
1410 Begin drilling activities.
1415 Pull core 6.0-10.0' 100% Recovery
1425 Pull core 10.0-20.0' 95% Recovery
1435 Perform clean out
1500 Heaving Sands encountered. Drillers may need to add water to boring to keep sands down and from heaving during well placement.
Will set well per specifications as discussed with PM/SME
Screen 5.0-15.0'
Filter Pack 3.5-18.0'
Sands up from 20.0' TD to 18.0'
Bentonite Chips 1.0-3.5'
1545 Begin well installation at B1006-MW04 per specifications. Following Clean out
1635 Complete well installation activities and begin surface completion.
Tony Fehrenbach departs Site.
1645 Driller to decon during well surface completion activities.
1715 Mobilize Rig to area OU2A2 Parking aread. Clean and secure Site.
1800 Depart Site.

Mike D. Dinkel
11-3-2022

Keyport, WA
NBK Keyport

November 4, 2022

Personnel On-Site: Ilka Dinkelman, Jordan Peery-Lemon, Charlie Royko (well development) > Jacks Michael Anderson, Eric Clifford, Riley Jonson > Yellow Jacket
Weather: Light Rain, Mostly Cloudy 40s-50's
Objective: Set up and begin drilling at area OU2A2

7:40 Arrive on Site. Meet with team.
7:45 Safety Briefing. Discuss slick conditions. Slip-Trip-Fall. Handling augers. Proper PPE.
8:00 Prepare for daily drilling activities. Construct Secondary containment for aqueous containing Totes.
8:30 Meet with Dale from Base Hw Management. Confirm location of IDW Tote/Drum Storage in Quonset Hut area.
9:00 Team mobilize to OU2A2 area. Boat blocking access to location Mw01. Team set up at OU2A2-Mw02 until boat relocated.
9:45 Begin hand auger at OU2A2-Mw02. Complete auger to 5.2' bgs. Water encountered in hand auger borehole. Sloughing preventing recovery of soils from 5.2-6.0' bgs.
10:10 Collect sample 0.5-1.0' bgs NBKK-OU2A2-SS02-0101
10:20 Move Rig into place. Note some sheen on asphalt from Rig. Discuss with driller Rig may have small leak. According to driller, rains overnight may pick up oils off Rig. Use sorbent cloths to adsorb sheen.
10:40 Begin drilling at OU2A2-Mw01
10:45 Pull core 5.0-10.0' 100% recovery
11:00 Pull core 10.0-20.0'
11:05 Measure DTW=4.9' bgs.
11:10 Perform clean out. Some heave occurring due to lithology.
11:25 Complete clean out TD=20.0' bgs.
11:30 Prepare to set well. Pick up materials (monument, bollards, etc...) No deeper sample collected due to very shallow water table.
11:40 Have Jordan Peery-Lemon Measure

DTW in nearby wells

2MW6 (no access)

2MW9	#615	=	3.81'
2MW10	#616	=	4.9'
2MW13	#618	=	5.7'
2MW14	#617	=	5.77'
2MW15	#619	=	3.95'
2MW16	#620	=	3.30'

Well specifications as discussed:
Screen 4.0 - 14.0'
Filter pack 3.0 - 20.0'
Bentonite 1.0 - 3.0'
Monument Completion w/ 3 Bollards

1230 Complete setting well per specifications Drillers break for lunch. Allow chips to hydrate.

1300 Drillers return from Lunch and begin surface completion for OU2A2-MW03. During surface completion, drillers begin activities at OU2A2-MW03

1315 Begin Hand Auger at OU2A2-MW03.

1330 Collect Sample 2.0-3.0' bgs. MS/MSD

NBKK-OU2A2-SS03-0203
NBKK-OU2A2-SS03-0203-MS
NBKK-OU2A2-SS03-0203-MSD

Sample collected deeper due to ponding water in drilling area and samples from 0-2.0' were supersaturated from heavy rains and run-off observed in area.

1430 Move Rig and set up at OU2A2-MW03

1455 Finish Surface (Monument and bollards) Completion at OU2A2-MW02.

1510 Begin drilling activities at MW03.

1515 Pull core 6.0-10.0' 100% recovery

1525 Pull core 10.0-20.0' 95% recovery

1530 Measure DTW = 4.8' bgs

1545 Walk over and speak with Steve at DRMO area. May not be able to access OU2A2 wells in fenced/secure area until Monday/Tuesday.

1555 Set well to specifications at OU2A2-MW03 (same as MW02).

1640 Complete addition of Bentonite Chips Allow to hydrate. Will finish surface completion on 11/5

1695 Drillers mobilize to decon

1700 Fill water Tote for decon water Clean & Secure area

1745 Depart Site.

Mark D. Dickson
11-4-2022

NBK Keyport
Keyport, WA

November 5, 2022

Personnel On-Site: Ilka Dinkelman, Jordan Peery-Leavon, Charlie Royko (Well Development) > Jacobs
Mikey Anderson, Eric Clifford, Riley Jonson > YJT
Weather: Cloudy, Some Rain expected, Calm Winds, Cool an warming slightly in pm (40s-50s)
Objective: Continue drilling activities at OU2A2. Finish pad at MW03 and begin drilling at OU2A2-MW01.

7:30 Arrive on-Site. Aaron Adams from Yellow Jacket delivering totes and picking up excess materials to return to Oregon not using at Keyport. Some materials returning from Bangor.
7:45 Discuss HSEQ. PPE. Spotting when backing heavy equipment. S-T-F.
805 Complete HSEQ. Improve Secondary Containment for IDW. Select few drums for QA/QC check to see if any "free" water in drums and decant if required. No free water in drums of soil and soil needs to be <6.0" from top or too heavy.

850 Mobilize to OU2A2 area. Assess area at MW01 behind structure.
905 Cut asphalt ~2.5" thickness
920 Begin Hand Auger at MW01.
930 Collect Sample 0.5-1.0' bgs
NBKK-OU2A2-SS01-0101
945 Complete hand auger to 6.0' bgs. Prepare to mobilize Rig to location. Aaron Adams departs Site.
1005 Rig set up at OU2A2-MW01. Begin surface completion at OU2A2-MW03.
1120 Finish surface completion at MW03. Complete Mobilization of equipment & Materials to OU2A2-MW01.
1200 Begin drilling.
1205 Pull core 6.0-10.0' 100% Recovery
1215 Pull core 10.0-20.0' 85% Recovery
1225 Measure DTW = 9.4' bgs
1230 Perform clean-out
1245 Call from Charlie Royko on Development Rig. Turbidity remaining >999 ntu.
1250 Specify well completion to driller
Screen 4.0-14.0'
Filter Pack 3.0-20.0'
Chips 1.0-3.0'
Complete 2'-2' Pad w/ housing Flush-Mount

Meet up with Charlie Reyko at the Development Rig Troubleshoot w/ Developer. Draw-down water to ~~force~~ force inflow of fresh formation water.

1305 Turbidity down to 338 ntu. Return to Rig.

1315 Still adding sand to 3.0'. Confirmed 1.0' sand above screen in shallow wells is minimum required DEQ.

1330 Complete addition of sand. Add chips and allow hydration

1345 Mobilize Rig off-hole.

1405 Begin Surface completion

1450 Finish Surface completion at OU2A2-MW04. Clean and secure area.

1515 Depart Site.

Ilka D. Dinkelman 11-5-2022

NBK Keyport
Keyport, WA

November 7, 2022

Personnel On-Site: Ilka Dinkelman, Jordan Peery-Lemon, Tommy Ta, Tim Anderson and Patrick Elliot > Jacobs; Michael Anderson, Eric Clifford, Riley Jonson > Yellow Jacket

Weather: Cool, Breezy, Light Rain 30's-40's.

Objective: Begin drilling activities inside gate area at DEMO (OU2A2-MW04).

7:40 Arrive on Site.

7:45 Begin HSEQ Meeting. Discuss traffic safety. Proper lifting. PPE.

8:00 Complete Briefing. Decon pipe and tooling. Shore up and secure Secondary containment for IDW.

930 Load trailer with tooling, equipment and materials.

1000 Fuel Rig from Support truck.

1020 Access granted at DEMO area. Notify Yellow Jacket at laydown Gate open.

1030 Mark out locations OU2A2-MW04 and OU2A2 MW05. Relocate some cones around MW04 for better access.

1040 Begin cutting asphalt. ~0.5' thickness

1050 Begin Hand Auger. Very rocky Material. Some cobbles.
1055 Collect EB from Auger
NBKK-OU2A2-EB01-110722
1100 Patrick Elliot on Site for Cultural Monitoring
1125 Very large rock/cobble at 2.0' May be asphalt or concrete (fill?)
1130 ~~Collect~~ Pull Sample from auger at 2.0-3.0' (below cobble) strong hydrocarbon odor. Contact PM RE: Soils, hydrocarbon-like odor and well installation at DRMO.
1145 Collect Sample below asphalt/rock from 2.0-3.0' bgs
NBKK-OU2A2-SS04-0203
1210 Complete air-knife to 6.0' bgs
1215 Drillers break for Lunch.
1245 Return from Lunch. Set up Rig and prepare for drilling.
1300 Begin drilling at OU2A2-MW04
1305 Pull core 6.0-10.0' ~ 50% Recovery
1315 Pull core 10.0-20.0' ~95% recovery
1320 Measure DTW = 8.65' bgs Perform clean-out
1325 Amanda Rohrbaugh on Site to check in on drilling progress. Still looking for final confirmation of drilling at Site 7 - MW03.
1330 Clean-out complete DTW = 9.2' bgs
1335 Client departs Site. ~~Contact PM~~
PM/SME to discuss well specifications.
1350 Perform second clean-out. Gather well materials and prepare to set well.
1400 Call with SME (Peter Lawson). Set well to following specifications:
Screen: 7.0-17.0'
Filter Pack: 5-20.0'
Chips: 1.0-5.0'
Pad Completion 2'x2' Flush Mount.
1405 Collect ~~Sample from 9.0-10.0'~~
~~NBKK-OU2A2-SB04-0910~~ Not Shipped
1410 Begin setting well to specifications
1925 Complete setting well. Begin cutting asphalt/concrete at OU2A2-MW05.
1615 Finish surface completion at MW04.
1635 Depart DRMO. Clean and Secure Area.
1700 Depart Site.

Alka D. Quinlan
11-7-2022

Keyport, WA — November 8, 2022
NBK-Keyport

Personnel On Site: Ilke Dikteman, Jordan Peery-Lemon, Patrick Elliot, John Toulme, Tommy Ta, Tim Anderson > Jacobs; Michael Anderson, Eric Clifford, Riley Jonson > Y.J.
Weather: Cold Temps, 30's, Partly Cloudy, Mild Breeze. Freezing in a.m. ~ 20's.
Objective: Set up and drill location OU2A2-MW05. Scope area and Mobilize to MW06.

730 Arrive on Site. Very cold morning <20°F
740 Perform HSE. Discuss cold stress/hypothermia. Mobilizing to wooded area (OU2A2-MW06). Slip-Trip-Falls. Spot equipment during Mobilization.
800 Complete HSEQ. Prepare for daily drilling activities.
815 Call with Rachel Clennon RE: Sample Collected 9.0-10.0' likely in saturated zone. Will remove and not ship for analysis.
820 Cut asphalt. Require Jackhammer and digging bar to break up large asphalt/concrete debris from boring.
840 Patrick Elliot on Site for Monitoring.
845 Complete call with PM. Confirm with Jordan Peery-Lemon to remove sample SB04-0910 from sample cooler and COC prior to shipping samples.
900 Begin Hand auger at OU2A2-MW05
910 Collect Sample (below asphalt) 1.0-2.0'
NBKK-OU2A2-SS05-0102
925 Complete air knife to 6.0' bgs
945 Mobilize Rig to OU2A2-MW05 and Set up equipment & Materials.
1005 Prepare for drilling
1015 Pull core 6.0-10.0' 100% Recovery
1020 Drillers to move skid-steer and Materials blocking access to DRMO for truck deliveries.
1025 Patrick Elliot, Jordan Peery-Lemon and Riley Jonson to hand auger at MW06 in area behind fence.
1030 Collect EB sample. (Field Blank)
NBKK-OU2A2-EB01-110822
1040 Pull Core 10.0-20.0'
1115 Drillers break for Lunch
1145 Collect Sample 6.0-7.0'
NBKK-OU2A2-SS05-0607

1210 Samples to FedEx for shipping

1215 Drillers prepare to set well OU2AZ-MW05. John Toulme on Site. Review APP/SS HP.

1245 Prepare to set well to following specifications as discussed with PM/SMW.

Screen: 7.0-17.0'

Filter Pack: 5.0-20.0

Chips: 1.0-5.0'

Flush Mount 2' x 2' x 1.0' depth.

1250 Begin setting well. John Toulme departs area to Development Rig. To meet up with Tommy Ta

1315 Complete setting well. Prepare for surface completion.

1350 Call from Tim Anderson. Cannot get bailer from Development Rig down-hole at CFI-MW03. Contact Rachel Clennon with update. May have bend in well.

1415 Driller to meet up with development Rig. Check to see if well bent.

1430 Used shorter bailer. Pump down hole. Can develop CFI-MW03.

1440 Finish Surface completion at OU2AZ-MW05. Mobilize Rig to location OU2AZ-MW06 in wooded area. May require clearance of some vegetation with skid-steer

1600 All materials and equipment out of DRMO Fenced area

1610 Check on development crew.

1640 Rig Staged at OU2AZ-MW06.

Note: Sample collected during hand auger activities at OU2AZ-MW06

From Intervals 0.5-1.0' bgs and 3.0-4.0' bgs (at capillary fringe)

Groundwater observed ~ 4.5' bgs.

NBKK-OU2AZ-SS06-0101	@ 10:40
NBKK-OU2AZ-SB06-0304	@ 10:55

1655 Complete daily field activities

1700 Depart Site.

Mike D. Quinlan 11-8-2022

NBK Keyport
Keyport, WA

January 9, 2022

Personnel On-Site: Ilka Dinkelman, Jordan Peery-Lemon, Patrick Elliot, John Toulme, Tommy Ta, Tim Anderson > Jacobs; Mikey Anderson, Eric Clifford, Riley Jonson > Yellow Jacket
Weather: Mostly Clear, Sunny, Cool Temps
Temperature < 32°F up to low 40s. Calm
Objective: Complete drilling at OU2A2 and prepare for demobilization.

7:25 Arrive on Site. Prepare for daily field activities.
7:40 Begin HSEQ. Discuss Complacency, Travel Hazards, Lifting & PPE.
8:00 Mobilize to OU2A2-MW06
Warm up Rig. Bring tooling to drill area with Skid-Steer.
8:55 Begin drilling activities @ MW06
9:00 Pull core 6.0-10.0' 100% Recovery
9:10 Pull core 10.0-20.0' 100% Recovery
9:45 Perform clean out. Discuss well Specifications: Screen 4.0-14.0
Filter Pack 3.0-20.0'
Chips: 1.0-3.0
Set monument w/ 3 Bollards.
10:00 Begin Setting well to specifications.
10:15 Oscillator on Rig not operating. Need to add lubricant to rotator.
10:35 Resume setting well.
11:00 Complete addition of chips. Allow to hydrate. Prepare to Mobilize Rig from area. All members of field team spot Rig during Mobilization
11:35 Rig moved from Area. Prepare to Move to laydown / IDW Staging Area
1140 Drillers break for Lunch
1200 Contact Development Team for Status. Currently staged at CFI-MW01. Bailing activities indicate possible presence of Filter Pack Sand in well. Team tagging bottom at 54.0' bgs. Screen Interval 55-65.0' bgs TD = 68.0'
1205 Meet with Mikey Anderson / Driller. He is checking in with Developer Ray Carroll to check on well
1210 Driller Helpers Eric and Riley begin well completion activities including pad construction and setting monument and installation of bollards at OU2A2-MW06.

1230 Call from driller confirms well not viable under current conditions. Filter Pack in well casing. Will require re-drill. Has contacted Yellow Jacket Management. (Aaron Adams).

1235 Contact Rachel Clennon RE: Field Update. Discuss drilling completion at OU2A2-MW06. No drilling at Site 7-MW03 (No access) and likely re-drill at CFI-MW01.

1255 Rachel confirms discussion with Yellow Jacket to redrill boring Permit Still in place at CFI locations. When all activities complete at OU2A2 will Mobilize to CFI-MW01 to begin overdrill activities and reset well.

1310 ~~Bit~~ Check on available tooling.

1430 Complete activities at OU2A2.

1500 Mobilize Rig to CFI-MW01. Organize tooling (equipment and materials) for redrill activities. Use 7.0" casing and 6.0" core barrell for overdrilling.

1540 Update Tablet Waste Tracking Logs and have Tommy Ta QA/QC drums and totes to confirm aqueous waste and soil waste labels.

1700 Rig Staging complete at CFI-MW01 Clean and Secure Site.

1720 Depart Site.

11-09-2022

NBK-Keyport
Keyport, WA

January 10, 2022

Personnel On-Site: Ilka Dinkelman, Jordan Peery-Lemon, Patrick Elliot, John Toulme, Tommy Ta, Tim Anderson > Jacobs; Michael Anderson, Eric Clifford, Riley Jonson > Y.J.
Weather: Mostly Sunny 30's-40's Mild breeze
Objective: Check CFI-MW01. Confirm re-drill. Mobilize Rig. Remove installed well and install replacement well.

7:30 Arrive on-Site. Mikey Confirms with well developer Ray Carroll > Y.J. Filter Pack in bottom of well. Will require re-drill. Prepare for Mobilization to CFI.
7:45 Perform HSEQ. Discuss ergonomics, fatigue, traffic safety and PPE.
815 Mobilize to CFI location. Stop at LFEX to cone off Sample locations for GW Sampling Team (Tommy Ta and Tim Anderson)
830 Arrive at CFI location. Drillers set up area and prepare for re-drill activities. Remove well pad and flush Mount Housing.
940 Begin over drill activities and poll hardware from boring. Using 7.0" casing for over drill to ensure removal of all well materials before setting replacement well.
1130 Well and materials all removed from borehole. Perform final clean-out before setting well
1200 Drillers break for lunch
1230 Clean out and add sand.
1320 Need drillers to back down-hole. Too much Filter pack added to bottom of well and replacement well will sit too high. Screen should be 53.0-63.0' (see log-book 10-13-2022)
1330 Perform additional clean-out. Jordan Peery-Lemon to oversee efforts. Will mobilize with Patrick Elliot to collect Sediment Samples
1400 Prepare to collect Sample at the outlet area to Keyport Lagoon along Westfall Road. Sample location ~ 30' north of Road.

1405 Collect Sediment Sample
NBKK-OUZA2-SDØ3-0000
Sample collected from surface just below leaf litter. Silt/Sandy Silt. Few organics. Wet. 10 YR 2/2 Very Dark Brown.

1455 Collect Sediment Sample
NBKK-OUZA2-SDØ1-0000
Sample collected ~20-25 feet from culvert on west side of road and south bank. There was no access closer to culvert on west side due to thick vegetation and steep side slopes.

1515 Collect Sediment Sample
NBKK-OUZA2-SDØ2-0000
Sample collected at south outfall of culvert. Small embankment.

1520 Receive call from Rachel Clennon. Notified by Yellow Jacket second well is observed to contain Filter Pack Material. (Location OUZA5-MWØ1). Will also require overdrill and replacement. Patrick Elliot departs Site.

1545 Return to CFI-MWØ1 location.

1600 Mikey Anderson informed of second well with filter pack material. Will Mobilize Rig to OUZA5-MWØ1 location once new well has been installed at CFI-MWØ1.

1700 Complete setting well. All casing from hole. Well appears to have "lifted" slightly, but based on discussions with driller, <0.75' rise. Screen likely ~52.5-62.5'?. Surface completion will be finished on 11/11 prior to Mobilization to OUZA5.

1740 Clean and secure Site.

1745 Staff departs for day.

11-10-2022

NBK-Keyport
Keyport, WA

November 11, 2022

Personnel On-Site: Ilka Dinkelman, Jordan Peery Lemon, John Toulme, Tim Anderson, Tommy Ta > Jacobs; Mikey Anderson, Eric Clifford, Riley Jonson > Yellow Jacket
Weather: Mostly Sunny 30's-40's. Cool. Mild Breeze. Up to 10 mph winds.
Objective: Complete activities at CFI-MW01 Mobilize Rig to OU2A5-MW01

735 Arrive on Site. Meet with Team
745 Perform HSEQ. Discuss daily objectives. Complacency. Fatigue Mgmt. Rushing. Stay Focused. PPE. S-T-F.
815 Mobilize to CFI-MW01. Driller still had 20' casing in hole. Not all removed. Need to pull final casing and chip to surface.
910 Tagged well at CFI-MW01. TD = 59.4' bgs. Was supposed to TD at 63.5. Up ~4.0'. Contact Peter Lawson and Rachel Clennon. The bottom is soft and "sticky" Will confirm TD during well development once sediment removed. IF development indicates anything other than silt in well, will be redrilled second time.
940 Complete surface completion activities at ~~CFI~~ CFI-MW01 begin mobilization to OU2A5-MW01 for redrill.
945 Speak with SME Peter Lawson. If well can be developed and sampled no need for re-drill. Will record new well screen interval. Keep as is.
1010 Will have Ray Carroll bail at CFI-MW01 to confirm no Filter Pack in well.
1025 Speak with Rachel Clennon RE: CFI and previous discussion w/ SME. She is in agreement with approach if well can be sampled / developed no need for redrill even if screen interval is different (higher).
1040 Ray Carroll bails CFI-MW01. No change in TD still measuring at 59.4'. Some silt removed.
1135 Begin overdrill activities at OU2A5-MW01.

1455 Overdrill activities complete. All material removed from well. Based on removed hardware, Bottom cap of well damaged.

1505 Measure Total Depth ~56.0'
Perform Clean-Out. Original Screen 40-60.0' bgs.

1600 Begin Setting well to original specifications. TD = 63.0'

1800 Complete addition of Seal. Allow to hydrate overnight. Will complete well installation and surface pad 11/12.

1815 Clean and Secure Site. Move trailer to laydown area

1825 Depart Site.

Ilka D. Dinkelman
11-11-2022

NBK Keyport
Keyport, WA

November 12, 2022

Personnel On-Site: Ilka Dinkelman, Jordan Peery-Lemon, John Toulme, Tommy Ta > Jacobs
Michael Anderson, Eric Clifford, Riley Johnson > Yellow Jacket.

Weather: Cool a.m. 30's increasing in p.m. to low 50's. Calm Winds <10mph

Objective: Complete well installation at OU2A5. Will begin well development at CFI-MW01 to confirm good re-drill / installation before Mobilization. Load Materials and Rig for Site departure.

7:30 Arrive on-Site. Prepare for final Site activities. GW Sampling to resume 11/14. Well development at CFI-MW01 Preparation.

7:45 HSEQ Meeting. Complacency. Traffic Safety. Use spotters. Pinch Points.

8:05 Mobilize to OU2A5-MW01.

8:15 Complete Setting well / chips.

9:15 Finish Setting replacemet well begin surface pad completion.

940 Development Rig is down. Occurred early in development activities. (Surge & Bail) Cannot lift bailer from hole. No power at Rig. Ray Carroll troubleshooting

1030 Surface completion at OU2A5 finished. Begin load-up.

1045 Team from Yellow Jacket to OU2A5-MW03 to repair poor completion from Holt. Create Pad and reset Concrete. Replace Flush-Mount Monument.

1145 Mobilize to B76-MW04. Repair poor surface completion. Cannot remove Flush-Mount Monument. Stuck in concrete. Will expand pad to 2'x2' and add concrete.

1310 Break for Lunch

1330 Load water tote. Mobilize to OU2A2 to install Bollards at MW06.

1500 Ray Carroll Still repairing development Rig. Will require Mechanic to troubleshoot. Will be on Site 11/14/22?

1515 Decon all remaining tooling. Begin breakdown of laydown area. Load Materials

1600 Load Rig onto truck for Mobilization. Yellow Jacket to pick up Rig on 11/13 off Site.

1715 Depart Site. Team Mobilize.

11-12-2022

Clennon, Rachel

From: Anderson, Tim
Sent: Tuesday, November 15, 2022 8:35 PM
To: Clennon, Rachel
Cc: Ballam, Dennis; Lawson, Peter; Radford, Maggie; Borchert, Susanne; Cutler, Eric; Leu, Nathan; Dinkelman, Ilka
Subject: Daily Report for Tuesday 11-15-22

Tuesday November 15, 2022

Good evening everyone,

Below is the daily report for field activities that occurred at NBK Keyport on Tuesday November 15, 2022:

Jacobs Staff	*Yellow Jacket Staff*
Ilka Dinkelman	Michael Anderson
Tim Anderson	Eric Clifford
Nathan Leu	Riley Jonson
	Raymond Carroll (All day)

General:

Two teams composed of Ilka with the client, IDW sampling, and Tim with Nathan continuing to develop CF1-MW01 with Raymond. Michael and Riley came back on site around 1100 to grab the rest of their trucks and take them back to the shop. Ilka conducted IDW sampling with the client today. Nathan joined Ilka around lunch time.

Well GW Sampling Activities:

None were sampled today as the plan has shifted to focus on the development of wells on site. This is the current bottleneck and has been communicated.

As mentioned above, IDW samples were collected by Ilka with assistance from Nathan. They managed to gather all of the samples required.

Well Development Activities:

One well was developed today; CF1-MW01. While bail and surge and pumping on the previous day, the parameters were not stable prior to end of the previous day's activities and pumping was resumed. Yellow Jacket continues to have electrical issues with their development truck, slowing down development. Turbidity was continually high at this location despite different methods to clean up the water. The lowest NTU reading was 386

The final stabilization readings were as follows:

CF1-MW01 were as follows:

DTW: *56.69*
Temperature: *13.5°C*
Specific Conductivity: *0.379 mS/cm*
DO: *3.86 mg/L*
pH: *7.67*
ORP: *-204 mV*
Turbidity did not record below 50 ntu. Lowest turbidity reading was 386 ntu.

Site Visitors:

No Site Visitors today

Planned activities for 11/16/22: Mobilize development rig trailer to OU2A5-MW01 and begin purging well. This well was bailed and surged earlier today (11/15) and will be set up on first thing tomorrow (11/16) morning.

Just a quick reminder, too: I will be sending out the daily reports 11/15 – 11/17.

Thanks and I hope you enjoy your evening.

Sincerely,

Tim

Tim Anderson | **Jacobs** | Geologist
+1.702.686.7448 (M) | Tim.Anderson1@jacobs.com
999 West Main Street, Suite 1200 | Boise, ID 83702 | USA

Clennon, Rachel

From: Anderson, Tim
Sent: Wednesday, November 16, 2022 9:37 PM
To: Clennon, Rachel
Cc: Ballam, Dennis; Lawson, Peter; Radford, Maggie; Borchert, Susanne; Cutler, Eric; Leu, Nathan; Dinkelman, Ilka
Subject: Daily Report for Wednesday 11-16-22

Wednesday November 16, 2022

Good evening everyone,

Below is the daily report for field activities that occurred at NBK Keyport on Wednesday November 16, 2022:

Jacobs Staff	*Yellow Jacket Staff*
Tim Anderson Nathan Leu	Raymond Carroll

General:

Well development continued on OU2A5-MW01. Nathan shipped all remaining IDW samples. Multiple wells were surged ahead of us continuing to corral the parameters at MW-01

Well GW Sampling Activities:

None were sampled today as the plan has shifted to focus on the development of wells on site. This is the current bottleneck and has been communicated.

Well Development Activities:

One well was developed today; B1006-MW04. Raymond went ahead and swabbed and bailed MW-04; as well as OUA2A-MW04 and OUA2A-MW05 before returning to help out with OU2A5-MW01. OU2A5-MW01 was very slow to recharge during the day and we only were able to get about 60 gallons purged with parameters not looking like they would stabilize today despite letting the well recharge, purged dry, and recharge four times over in the day. The 20' screen on this well didn't seem to want to clean up very well. Turbidity on this well never got to a recordable level so we followed guidance and purged the well dry and will allow it to recharge overnight. This will be tackled first thing tomorrow (11/17) morning.

Yellow Jacket fixed their truck to ensure we can complete all well development activities.

The final stabilization readings for B1006-MW04 were as follows:

DTW: *4.48*
Temperature: *15.1°C*
Specific Conductivity: *0.169 mS/cm*

DO: *0.99 mg/L*
pH: *7.17*
ORP: *-10.0 mV*
Turbidity: *8.99*

Site Visitors:

No Site Visitors today

Planned activities for 11/17/22: Mobilize development rig trailer to OU2A5-MW01 and finalize well development. Wells OUA2A-MW04 and OUA2A-MW05 will be next on the list to do after.

Thanks and I hope you enjoy your evening.

Sincerely,

Tim

Clennon, Rachel

From: Anderson, Tim
Sent: Friday, November 18, 2022 11:53 PM
To: Clennon, Rachel
Cc: Ballam, Dennis; Lawson, Peter; Radford, Maggie; Borchert, Susanne; Cutler, Eric; Leu, Nathan
Subject: RE: Daily Report for Thursday 11-18-22

Thursday November 17, 2022

Good evening everyone,

Below is the daily report for field activities that occurred at NBK Keyport on Thursday November 17, 2022:

Jacobs Staff	*Yellow Jacket Staff*
Tim Anderson Nathan Leu	Raymond Carroll

General:

Well development was completed on OU2A5-MW01. Multiple wells were surged ahead of us continuing with the given game plan of sending Ray ahead to speed up production.

Well GW Sampling Activities:

None were sampled today as the plan has shifted to focus on the development of wells on site. This is the current bottleneck and has been communicated.

Well Development Activities:

Two wells were developed today; OU2A5-MW01 and OU2A2-MW04. OU2A5-MW01 had a low turbidity reading of 46 NTU as well as an abundance of well volumes purged. Gallons exceeded 75 on this well, citing earlier drawbacks with this well. We packed up on this site and headed over to Area 2 to handle those wells. OU2A2-MW04 was a very cooperative well and we got that to give 3 consecutive readings under 10 NTUs in under an hour. While Nathan and I were handling this well, Raymond went ahead and surged and bailed MW-3 in the same area.

After MW-04, we moved onto OU2A2-MW05. This well gave us a ton of problems recharging. The strange part of this well is that it is approximately 40 feet from MW-04 and the exact screen depth of 7-17’ BGS. The recharge rate on MW-05 was extremely low and this was communicated with management. We purged it dry in the first 5-10 minutes with minimal recharge time. Due to the slow recharge time, we moved over to OU2A2-MW-06. This well, too, was purged dry the first time. After surging techniques, the well was a bit quicker to recharge but the end of the day was drawing near so we decided to leave everything there and pack up. While on the way out, we purged MW-05 once more and purged it dry again to help clean it for tomorrow (11/18).

The final stabilization readings for OU2A5-MW01 were as follows:

DTW:	*12.59*
Temperature:	*13.7°C*
Specific Conductivity:	*0.624 mS/cm*
DO:	*3.28 mg/L*
pH:	*7.33*
ORP:	*-106.9 mV*
Turbidity:	*46*

Site Visitors:

No Site Visitors today

Planned activities for 11/18/22: Mobilize development rig trailer to OU2A2-MW05 and MW-06 to finish those wells. The continue to develop those wells in Area 2.

Thanks and I hope you enjoy your evening.

Sincerely,

Tim

Tim Anderson | **Jacobs** | Geologist
+1.702.686.7448 (M) | Tim.Anderson1@jacobs.com
999 West Main Street, Suite 1200 | Boise, ID 83702 | USA

Clennon, Rachel

From: Anderson, Tim
Sent: Saturday, November 19, 2022 12:26 AM
To: Clennon, Rachel
Cc: Ballam, Dennis; Lawson, Peter; Radford, Maggie; Borchert, Susanne; Cutler, Eric; Leu, Nathan
Subject: RE: Daily Report for Friday 11-18-22

Friday November 18, 2022

Good evening everyone,

Below is the daily report for field activities that occurred at NBK Keyport on Friday November 18, 2022:

Jacobs Staff	*Yellow Jacket Staff*
Tim Anderson Nathan Leu	Raymond Carroll

General:

Well development was completed on OU2A2-MW05, OU2A2-MW06, OU2A2-MW03, and OU2A2-MW02. Multiple wells were surged ahead of us continuing with the given game plan of sending Ray ahead to speed up production.

Well GW Sampling Activities:

None were sampled today as the plan has shifted to focus on the development of wells on site. This is the current bottleneck and has been communicated.

Well Development Activities:

Four wells were developed today; OU2A2-MW05, OU2A2-MW06, OU2A2-MW03, and OU2A2-MW02. Despite the very cold day, about 27 degrees in the morning, we were very productive. We handled MW-06 first. This well developed in a timely manner after setting up on the well the day before. 3 NTU readings came in under 50 for this well

The final stabilization readings for OU2A5-MW06 were as follows:

DTW: *12.37*
Temperature: *9.7°C*
Specific Conductivity: *0.390 mS/cm*
DO: *3.97 mg/L*
pH: *5.61*
ORP: *39.9 mV*
Turbidity: *24*

OU2A2-MW05: This well was a bit uncooperative as described in the last daily update. I had Ray resurge the well again to see if there was a bunch of built up finer and heavier silt blocking the screen or other inhibiting sediments. It is hypothesized that this well was not drilled to the water bearing zone after re-surging did nothing to improve well recharge. Per instruction given by Rachel, we called the well developed after over 3 well volumes were removed and the NTUs started becoming readable at 500NTUs at the lowest point.

DTW: *13.69*
Temperature: *13.9°C*
Specific Conductivity: *0.367 mS/cm*
DO: *4.34 mg/L*
pH: *6.29*
ORP: *69 mV*
Turbidity: *683*

OU2A2-MW03: This well was cooperative as well. A shallow well at 4-14' screen, this well recharged quickly and NTUs reflected that. This well was completed with very low NTUs. NOTE: This well head contains a cracked PVC well head as communicated to Rachel.

DTW: *10.46*
Temperature: *10.9°C*
Specific Conductivity: *0.326 mS/cm*
DO: *5.2 mg/L*
pH: *6.01*
ORP: *-18.1 mV*
Turbidity: *13.5*

OU2A2-MW02: This well was cooperative as trending with other wells in the area. A shallow well at 4-14' screen, this well recharged quickly and NTUs reflected that. This well was identical to its counterparts and completed with very low NTUs as well.

DTW: *7.85*
Temperature: *10.9°C*
Specific Conductivity: *0.175 mS/cm*
DO: *0.93 mg/L*
pH: *5.22*
ORP: *-44.8 mV*
Turbidity: *26.5*

OU2A2-MW01: This well was being surged and bailed by Raymond and Yellow Jacket when it was communicated by him that the bailer was bringing up lots of casing screen sand, indicative of a well that has broken PVC somewhere. He is certain the bottom is still intact and perhaps there is a compromise in the screen somewhere. I concur with the idea that the PVC is of low quality due to MW-03 cracking at the surface.

It was also communicated to me by on site Navy personnel that the site in which OU2A2-MW01 is built on will be demolished for a series of brand new buildings for the Navy in the next few years. Further investigation is suggested.

Site Visitors:

No Site Visitors today

Planned activities for 11/19/22: Mobilize development rig trailer to S7-MW04 and S7-MW01 to finish those wells. Those wells both need to surged and bailed as well as gather water quality parameters.
NOTE: We had a bit of free time this afternoon to mobilize to S7-MW04. During the initial tagging of that well, Ray's tag line broke in the well, sending the tag line down. He went to Home Depot to gather more supplies to fish that out of the well.

All Development activities should be done tomorrow by COB. An update will come from Nathan regarding that.

Thanks and I hope you enjoy your weekend. It has been a pleasure working with you guys and I hope to come back soon

Sincerely,

Tim

Tim Anderson | **Jacobs** | Geologist
+1.702.686.7448 (M) | Tim.Anderson1@jacobs.com
999 West Main Street, Suite 1200 | Boise, ID 83702 | USA

Clennon, Rachel

From: Leu, Nathan
Sent: Saturday, November 19, 2022 11:51 PM
To: Anderson, Tim; Clennon, Rachel
Cc: Ballam, Dennis; Lawson, Peter; Radford, Maggie; Borchert, Susanne; Cutler, Eric
Subject: Daily Report for Friday 11-19-22

Saturday November 19, 2022

Good evening everyone,

Below is the daily report for field activities that occurred at NBK Keyport on Saturday November 19, 2022:

Jacobs Staff	***Yellow Jacket Staff***
Nathan Leu	Raymond Carroll Dillon Cenarrusa

General:

Well development was completed on S7-MW02 and S7-MW04. Yellow Jacket demobilized most of their equipment and equipment was shipped back to the warehouse. Jacobs personnel also mobilized back to Portland.

Well GW Sampling Activities:

No wells were sampled today.

Well Development Activities:

Two wells were developed today; S7-MW02 and S7-MW04:

The final stabilization readings for S7-MW02 were as follows:

S7-MW02: Despite the well's pipe being bent, which obstructed bailing, the well was surged with the pump and the water ran clear very quickly. Screen interval: 9-19.

DTW: *12.70'*
Temperature: *12.50°C*
Specific Conductivity: *44.11 mS/cm*
DO: *5.82 mg/L*
pH: *8.07*
ORP: *80.3 mV*
Turbidity: *7.22 NTU*

S7-MW04: This well also developed nicely. Murky water turned clear very quickly. Screen interval: 9-19.

DTW: *17.69'*
Temperature: *17.2°C*
Specific Conductivity: *2.772 mS/cm*
DO: *NA*
pH: *8.38*
ORP: *-210.9 mV*
Turbidity: *2.82 NTU*

Site Visitors:

No Site Visitors today.

Planned activities for 11/12/22:
Continue GW sampling activities.

Thanks,

Nate

Nathan Work Leu | Jacobs | Environmental Engineer
M:+1.541.817.5777 | Nathan.Leu@jacobs.com
2020 SW 4th Ave, Suite 300 | Portland, OR 97201 | USA

From: Anderson, Tim <Tim.Anderson1@jacobs.com>
Sent: Friday, November 18, 2022 9:26 PM
To: Clennon, Rachel <Rachel.Clennon@jacobs.com>
Cc: Ballam, Dennis <Dennis.Ballam@jacobs.com>; Lawson, Peter <Peter.Lawson@jacobs.com>; Radford, Maggie <Maggie.Radford@jacobs.com>; Borchert, Susanne <Susanne.Borchert@jacobs.com>; Cutler, Eric <Eric.Cutler@jacobs.com>; Leu, Nathan <Nathan.Leu@jacobs.com>
Subject: RE: Daily Report for Friday 11-18-22

Friday November 18, 2022

Good evening everyone,

Below is the daily report for field activities that occurred at NBK Keyport on Friday November 18, 2022:

Jacobs Staff	***Yellow Jacket Staff***
Tim Anderson Nathan Leu	Raymond Carroll

General:

Well development was completed on OU2A2-MW05, OU2A2-MW06, OU2A2-MW03, and OU2A2-MW02. Multiple wells were surged ahead of us continuing with the given game plan of sending Ray ahead to speed up production.

Well GW Sampling Activities:

None were sampled today as the plan has shifted to focus on the development of wells on site. This is the current bottleneck and has been communicated.

Well Development Activities:

Four wells were developed today; OU2A2-MW05, OU2A2-MW06, OU2A2-MW03, and OU2A2-MW02. Despite the very cold day, about 27 degrees in the morning, we were very productive. We handled MW-06 first. This well developed in a timely manner after setting up on the well the day before. 3 NTU readings came in under 50 for this well

The final stabilization readings for OU2A5-MW06 were as follows:

DTW: *12.37*
Temperature: *9.7°C*
Specific Conductivity: *0.390 mS/cm*
DO: *3.97 mg/L*
pH: *5.61*
ORP: *39.9 mV*
Turbidity: *24*

OU2A2-MW05: This well was a bit uncooperative as described in the last daily update. I had Ray resurge the well again to see if there was a bunch of built up finer and heavier silt blocking the screen or other inhibiting sediments. It is hypothesized that this well was not drilled to the water bearing zone after re-surging did nothing to improve well recharge. Per instruction given by Rachel, we called the well developed after over 3 well volumes were removed and the NTUs started becoming readable at 500NTUs at the lowest point.

DTW: *13.69*
Temperature: *13.9°C*
Specific Conductivity: *0.367 mS/cm*
DO: *4.34 mg/L*
pH: *6.29*
ORP: *69 mV*
Turbidity: *683*

OU2A2-MW03: This well was cooperative as well. A shallow well at 4-14’ screen, this well recharged quickly and NTUs reflected that. This well was completed with very low NTUs. NOTE: This well head contains a cracked PVC well head as communicated to Rachel.

DTW: *10.46*
Temperature: *10.9°C*
Specific Conductivity: *0.326 mS/cm*
DO: *5.2 mg/L*

pH: *6.01*
ORP: *-18.1 mV*
Turbidity: *13.5*

OU2A2-MW02: This well was cooperative as trending with other wells in the area. A shallow well at 4-14' screen, this well recharged quickly and NTUs reflected that. This well was identical to its counterparts and completed with very low NTUs as well.

DTW: *7.85*
Temperature: *10.9°C*
Specific Conductivity: *0.175 mS/cm*
DO: *0.93 mg/L*
pH: *5.22*
ORP: *-44.8 mV*
Turbidity: *26.5*

OU2A2-MW01: This well was being surged and bailed by Raymond and Yellow Jacket when it was communicated by him that the bailer was bringing up lots of casing screen sand, indicative of a well that has broken PVC somewhere. He is certain the bottom is still intact and perhaps there is a compromise in the screen somewhere. I concur with the idea that the PVC is of low quality due to MW-03 cracking at the surface.

It was also communicated to me by on site Navy personnel that the site in which OU2A2-MW01 is built on will be demolished for a series of brand new buildings for the Navy in the next few years. Further investigation is suggested.

Site Visitors:

No Site Visitors today

Planned activities for 11/19/22: Mobilize development rig trailer to S7-MW04 and S7-MW01 to finish those wells. Those wells both need to surged and bailed as well as gather water quality parameters.
NOTE: We had a bit of free time this afternoon to mobilize to S7-MW04. During the initial tagging of that well, Ray's tag line broke in the well, sending the tag line down. He went to Home Depot to gather more supplies to fish that out of the well.

All Development activities should be done tomorrow by COB. An update will come from Nathan regarding that.

Thanks and I hope you enjoy your weekend. It has been a pleasure working with you guys and I hope to come back soon

Sincerely,

Tim

Tim Anderson | **Jacobs** | Geologist
+1.702.686.7448 (M) | Tim.Anderson1@jacobs.com
999 West Main Street, Suite 1200 | Boise, ID 83702 | USA

Wed, Dec 7

0930: TA on site. Met up with JPL to begin sampling. Loaded up field supplies and coolers and mobed to OU2A5-MW02.

1020: Used peristaltic pump after WL determined to be less than 30'. Begin purging

1230: Sample and demobe

1240: Mobe to CF1-MW02

1250: Set up on CF1-MW02. Used bladder pump

1400: Sample CF1-MW02

1420: Grab ice for samples

1515: Begin COC then head off site

1530: JPL and TA off site

Thurs, Dec 8

0700: Mobe to site

0730: JPL and TA on site. Conduct morning brief and safety meeting

0745: gather field supplies and Mobe to B1006-MW04

0750: WL less than 10', used peristaltic pump.

0845: Sample, collected a duplicate sample marked 0850

0850: Mobe to OU2A2-MW06

0855: Set up on OU2A2-MW06. WL less than 10', used peristaltic pump

0945: Sample OU2A2-MW06

0950: Mobe to OU2A2-MW04

0955: Set up on OU2A2-MW04. WL less than 10', used peristaltic pump

1045: Sample OU2A2-MW04

1050: Mobe to OU2A2-MW2-8

1055: Set up on OU2A2-MW2-8. WL less than 10', used peristaltic pump

1130: Sample OU2A2-MW2-8. Duplicate sample taken here at 1135 and marked incorrectly as EB01. Was a duplicate sample, not an EB.

1140: Mobe to OU2A5-MW05

1145: Set up on OU2A5-MW05. WL more than 30', used bladder pump

1240: Sample OU2A5-MW05

1245: Mobe to OU2A2-MW03

1250: Set up on OU2A2-MW03. WL more than 30', used bladder pump

1330: Sample OU2A2-MW03. Collected MS/MSD as well as a duplicate sample here. MS: 1340, MSD: 1345, DUP: 1335

1345: Mobe to OU2A2-MW02

1350: Set up on OU2A2-MW02. WL less than 10', used Peristaltic pump

1445: Sample OU2A2-MW02

1500: Grabbed ice for samples. Update COC

1550: TA and JPL off site

Friday, Dec 9

0700: Mobe to site

0730: JPL and TA on site. Conduct morning brief and safety meeting

0740: Mobe to storage shed for sample prep and ship coolers

0950: Went to Home Depot for a supply run

1050: Head to FedEx to ship samples

1100: return to Keyport

1500: TA and JPL off site

Clennon, Rachel

From: Anderson, Tim
Sent: Thursday, December 8, 2022 7:17 PM
To: Clennon, Rachel
Cc: Ballam, Dennis; Lawson, Peter; Radford, Maggie; Borchert, Susanne; Cutler, Eric; Leu, Nathan; Peery Lemon, Jordan
Subject: RE: Daily Report for Wednesday 12-7-22 and Thursday 12-8-22

Wednesday December 7, 2022

Good evening everyone,

Below is the daily report for groundwater sampling activities that occurred at NBK Keyport on Wednesday December 7, 2022:

Jacobs Staff	No other staff
Tim Anderson Jordan Peery Lemon	

General:

Tim Anderson and Jordan Peery Lemon arrived on site. Well sampling was completed on OU2A5-MW02 and CF1-MW01.

Well GW Sampling Activities:

As stated above, sampling was completed on OU2A5-MW02 and CF1-MW01. Nothing of significance to be reported while sampling

Site Visitors:

No Site Visitors today

Planned activities for 11/19/22: Continue to sample wells. Primary focus: OU2A2 wells inside the fenced off area.

Thursday December 8, 2022

Good evening everyone,

Below is the daily report for groundwater sampling activities that occurred at NBK Keyport on Thursday December 8, 2022:

Jacobs Staff	No other staff
Tim Anderson Jordan Peery Lemon	

General:

Well sampling was completed on OU2A2-MW05, OU2A2-MW06, OU2A2-MW03, OU2A2-MW02, OU2A2-MW2-8 and B1006-MW04.

Well GW Sampling Activities:

As stated above, sampling was completed on OU2A2-MW05, OU2A2-MW06, OU2A2-MW03, OU2A2-MW02, OU2A2-MW2-8 and B1006-MW04.

The only object worth noting about today was that OU2A2-MW05 was incredibly slow to recharge (as was noted with well development). Slow enough, that even at a 300 mL/min flow rate, the well was not able to recharge fast enough.

Site Visitors:

No Site Visitors today

Planned activities for 11/19/22: OU2A2-MW2-2 is the only well left to sample. Navy personnel will be notified in order to conduct IDW sampling. Once OU2A2-MW2-2 is sampled, samples will be shipped off and a Saturday delivery date will be relayed to the lab.

Thanks and I hope you enjoy your evening!

Sincerely,

Tim

Tim Anderson | **Jacobs** | Geologist
+1.702.686.7448 (M) | Tim.Anderson1@jacobs.com
999 West Main Street, Suite 1200 | Boise, ID 83702 | USA

Clennon, Rachel

From: Anderson, Tim
Sent: Friday, December 9, 2022 7:38 PM
To: Clennon, Rachel
Cc: Ballam, Dennis; Lawson, Peter; Radford, Maggie; Borchert, Susanne; Cutler, Eric; Leu, Nathan
Subject: RE: Daily Report for Friday December 9, 2022

Friday December 9, 2022

Good evening everyone,

Below is the daily report for groundwater sampling activities that occurred at NBK Keyport on Friday December 9, 2022:

Jacobs Staff	No other staff
Tim Anderson Nathan Leu	

General:

Site location for wells MW2-2 and 2MW-1. Shipped samples and shipped back un-needed groundwater sampling supplies. Installed transducers

Well GW Sampling Activities:

Wells MW2-2 and 2MW-1 were determined to be not able to be sampled. MW2-2 is in the exact same location as the newly installed OU2A2-MW2. It was determined that MW2-2 is no longer in service and no longer visible. 2MW-1 was also slated to be sampled but we were unable to locate it due to thick vegetation. It's last location is unknown so we did not sample this well either.

Once all wells were determined to be sampled, samples were shipped off via FedEx today. All groundwater sampling supplies were sent off to their respective suppliers by Nathan.

Well Transducer Installation Activities:

Today, it was determined that a previous crew installed the wrong transducers. Time was spend today removing this wrongly installed equipment. Some wells were installed with correct transducers (OU2A5-MW02, S7-MW02, S7-MW04). The remaining wells (all Car Fire wells, remaining OU2A5, and S7 wells) will have transducers installed tomorrow, 12-10.

Site Visitors:

No Site Visitors today

Planned activities for 12/10/22: Activates include install the rest of the transducers and ensure all of them are online and working. We will do a second run through of the storage building to make sure all unnecessary equipment is sent back.

Thanks and I hope you enjoy your weekend!

Sincerely,

Tim

Tim Anderson | **Jacobs** | Geologist
+1.702.686.7448 (M) | Tim.Anderson1@jacobs.com
999 West Main Street, Suite 1200 | Boise, ID 83702 | USA

Clennon, Rachel

From: Anderson, Tim
Sent: Monday, December 12, 2022 12:49 PM
To: Clennon, Rachel
Cc: Ballam, Dennis; Lawson, Peter; Radford, Maggie; Borchert, Susanne; Cutler, Eric; Leu, Nathan
Subject: RE: Daily Report for Saturday December 10, 2022

Friday December 9, 2022

Good evening everyone,

Below is the daily report for well transducer installation activities that occurred at NBK Keyport on Saturday December 10, 2022:

Jacobs Staff	No other staff
Tim Anderson Nathan Leu	

General:

Installed transducers, removed incorrect transducers in wells

Well Transducer Installation Activities:

As mentioned in the previous daily report, it was determined that a previous crew installed the wrong transducers. Time was spend today removing this wrongly installed equipment. All remaining wells were installed with correct transducers and the transducers were turned on to record water level data. All Car Fire site wells, prescribed OU2A5 wells, and Site 7 wells were installed and activated.

Site Visitors:

No Site Visitors today

Thanks and I hope you enjoy your weekend!

Sincerely,

Tim

Tim Anderson | **Jacobs** | Geologist
+1.702.686.7448 (M) | Tim.Anderson1@jacobs.com
999 West Main Street, Suite 1200 | Boise, ID 83702 | USA

3/29/23

NBK Report

Task: Repair of well OU2 A2_ MW01

9[45] onsite
9[50] I left site to retrieve the Horiba. JJ remained to hand bail the well & insert plug.
10[40] Back onsite. 10-15 gallons removed. 1 plug at the bottom of well. JJ reported no sand pack observed in the bailer.
10[45] Setting up pump.
11[03] Started pumping

DTW	Time	Pump rate	Total vol removed	pH	Cond	Temp	ORP	DO	Turb	Clarity
4.50	11[03]	2 gpm								
6.02	11[10]	2 gpm	14 gal	7.20	.314	10.67	-62	4.78	102	cloudy
6.37	11[17]	2 gpm	28 gal	7.05	.310	10.34	-45	2.90	56.4	Cloudy
4.98	11[24]	2 gpm	42 ~~50~~ gal	5.~~22~~	.295	10.55	-41	3.65	78.4	clearing up
6.48	11[31]	2 gpm	56 ~~70~~ gal	6.65	.297	10.69	-40	4.00	41.4	~~clear~~ slightly turbid
6.59	11[41]	2 gpm	76 gal	6.49	.296	10.63	-26	~~4~~.3.64	25.3	~~clear~~ clear
6.~~5~~1	11[51]	2 gpm	~~9~~6 gal	6.48	.288	10.57	-29	4.52	30.7	~~clear~~ ~~slightly turbid~~ clear

11[54] Stopped pumping to empty drums. Emptied into tote AQ28.
12[45] Reset back over well.
12[49] Restarted Pump

4.48	12[48]	2 gpm								clear
6.10	12[58]	2 gpm	~~10~~6 gal	6.92	.293	11.85	-70	4.23	27.2	~~clear~~
6.85	13[08]	2 gpm	13~~0~~ gal	6.~~8~~0	.283	11.18	-47	2.58	25.8	clear
7.18	13[18]	2 gpm	156 gal	6.74	.285	10.82	-45	2.69	23.5	clear

13[20] Site cleanup & emptied drum into tote AQ28. 45 gallons went into AQ26
13[50] offsite

KEYPORT PFAS SI 7047SBCH 8/7/23

PERSONNEL: LYNDSEY KLEPPIN, JILL SEHRLAU, TOMMY TA (JACOBS)

MIKE ANDERSEN, AARON ADAMS, BRANDON AYERS, BLAKE DAVIS (YELLOWJACKET)

WEATHER: CLOUDY, 58°F, CALM → SUNNY 6

PPE: MOD. LEVEL D

OBJECTIVE: SITE ORIENTATION, RIG STAGING, BOREHOLE CLEARANCE

0700 MEET YELLOWJACKET @ BADGING OFFICE

0715 CONDUCT SITE SAFETY ORIENTATION/APP REVIEW/ HIRA REVIEW AT BADGE OFFICE LINE. BRANDON AYERS OFFSITE.

1005 BADGING COMPLETE, STAGE EQUIPMENT @ IDW YARD. IDENTIFY AREA IN WASTE TENT FOR STAGING WITH DALE.

1030 SITE WALK - IDENTIFY THAT MW07 AND MW08 HAVE INSUFFICIENT CLEARANCE FOR RIG. CONTACT R. LENNON VIA PHONE ABOUT ~12' OFFSET FOR EACH FOR RIG ACCESS. BOTH STILL WITHIN LOCATE/GPR SURVEY EXTENT. NOTIFY FIRE STATION OF ADJACENT WORK.

1215 CRANE INSPECTION WITH HANSEN + AMANDA ROHRBAUGH (RPM)

P2 FORM REVIEW FOR JIG HOIST, DECON CASING @ IDW YARD

1230 LUNCH

1300 MOBILIZE EQUIPMENT TO MW16 (NBKK-876-MW06)

AIR KNIFE TO 5' BGS - VERY HARD MATERIAL

STAGE RIG ON LINER, WARM UP, RIG INSPECTION + EMERGENCY SHUT OFF DEMONSTRATION.

1530 BEGIN DRILLING (SEE SOIL BORING LOG)

VERY STIFF/HARD SILT – SAND @ 24-25' BGS, 26 PPM PID (REST 0.0 to 0.1 PPM)

8/7/23 AIR KNIFE B76-MW09 to 3.5' BGS, HARD GOING

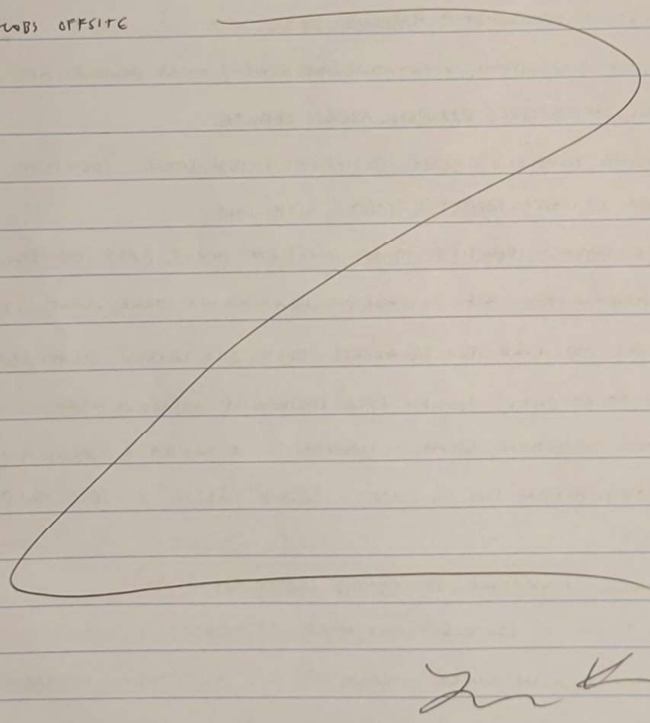
GENERATE DRUM J-2023-01 ~40 GAL SOIL CUTTINGS (DRY) + LABEL

TD @ 29' BGS – OUTER CASING TO 21' BGS.

COLLECT PROVISIONAL SAND SAMPLE FOR POTENTIAL CAPILLARY FRINGE SUBMITTAL

YELLOWJACKET OFFSITE @ 1700

1730 JACOBS OFFSITE



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8/8/23

PERSONNEL: LYNDSEY KLEPPIN, JILL SCHRLAU, TOMMY TA (JACOBS)

AARON ADAMS, MIKE ANDERSEN, BLAKE DAVIS (YELLOWJACKET)

WEATHER: 60°F, CALM, PARTLY CLOUDY

PPE: MOD LEVEL D

OBJECTIVE: DRILL + INSTALL B76-MW06,

0630 EMAIL COMMUNICATION RE: INTERVAL HHS TRAINING

0710 TOMMY TA, LYNDSEY KLEPPIN + YELLOWJACKET ON SITE SAFETY TAILGATE: WORK GLOVES, ~~TRAINING~~ RECORDS

0730 VACTRUCK AIR KNIFE @ MW09 to 5' BGS, MW08 to 5' BGS @1050, MW04 to 5' BGS

0800 PROVISIONAL CAPILLARY SAMPLE FROM MW06 24-25' BGS COLLECTED 8/7 CONTAMINATED W/ MELTED ICE, SAMPLE DISCARDED.

0850 CONTINUE DRILLING @ MW06. TD @ 50' BGS. FREE WATER IN CORES INTERVALS 29-39', 39-49' BGS. PREDOMINANTLY STIFF TO VERY STIFF SILT (MOIST), SAND LENS (SW) 38'-41' BGS.

DRILLERS COLLECT WELL CONSTRUCTION MATERIAL FROM LAYDOWN YARD.

CONSULT TM/HYDRO SMES FOR WELL SCREEN DETERMINATION.

- UPPER SAND INTERVAL WILL BE TARGETED
- 10' SCREEN (NOT 20') TO PREVENT CREATING PREFERENTIAL PATHWAY BETWEEN SAND LENSES
- DESPITE MOIST SOIL IN CORE, LOCAL DTW ~ 8-11' BGS IN SEPT/OCT. (@1100 8/8 DTW 30' BGS AND SLOWLY RISING WITH CASING SET @ 50' BGS) AND (@ 0800 DTW 23' CASING @ 30' BGS)

E. CUTLER, P. LAWSON, R. CLENNON, L. KLEPPIN CONCUR ON 23-33' BGS SCREEN INTERVAL @ MW06

PAGE 3

KEYPORT PFAS S1

8/8/23 1000 J. SCHRALAU ON SITE. NOTIFIED OF NOISE COMPLAINT BY RPM.

BENTONITE CHIPS TO 34.5' BGS : SEAL HYDRATED @ 1330

SAND TO 20.5' BGS ; WELL TD @ 33.14' BGS WL @ 11.6' BGS

1230 BEGIN INSTALL / HYDRATE SEAL @ 1330 / COMPLETE @ 1400

3 GAL WATER ADDED TO HYDRATE 0-11' BGS, NO DRILLING WATER ADDED

8 BAGS 3/4" HOLEPLUG / 6 BAGS SAND. DECON HAND AUGER RPM ONSITE.

1400 NBKK-B76-SS11-0001 COLLECTED (0-1' HOMOGENIZED, COLLECTED WITH HAND AUGER, VEGETATION REMOVED ~2" GRASS/ROOTS)

1420 NBKK-B76-SB11-0203 (01'-03' HOMOGENIZED COLLECTED W/ HAND AUGER

EQUIPMENT BLANK COLLECTED W/ DECON'ED HAND AUGER ; LAB SUPPLIED WATER

1550 NBKK-EB91-080823 RPM OFFSITE.

1634 SURFACE SOIL @ B76-MW06 COLLECTED: HOMOGENIZE 0-1' BGS

INTERVAL COLLECTED W/ FRESH SS. SPOON FROM BORING SIDEWALL (FRESH)

DRY, BROWN SILT, GLASS SHARD + COARSE GRAVEL

1634 NBKK-B76-MW06-0001

DRILLERS DECON CASING @ LAYDOWN YARD, GENERATE

2 DRUMS AQUEOUS IDW (J-2023-03, J-2023-04)

VAC TRUCK DEGN - REFILL PFAS FREE WATER TOTE.

1640 STAGE RIG AT MW09.

1810 YELLOW JACKET OFFSITE. STAGE IDW LINER @ LAYDOWN YARD

1545 JACOBS OFFSITE.

4

KEYPORT PFAS S1

8/9/23

PERSONNEL: LYNDSEY KLEPPIN, JILL SCHRALAU, TOMMY TA (JACOBS)

MIKE ANDERSEN, AARON ADAMS, BLAKE DAVIS

WEATHER: LIGHT RAIN, 60°F, CALM

PPE: LEVEL D

OBJECTIVE: DRILLING B76-MW09, INSTALL WELL, HAND AUGERING

0730 SAFETY TAILGATE / POWRA SLIPS/TRIPS/FALLS PPE

0800 BEGIN DRILLING B76-MW09 (SEE SOIL BORING LOG)

CALIBRATE PID W/ 100PPM ISOBUTYLENE (BUMP-SEE CAL LOG)

1002 AT 39' BGS. SEND BORING LOG TO TECHNICAL TEAM VIA TEXT.

WET SOIL @ ~12' BGS, NO FREE WATER IN CASING, WL IN HOLE

STABLE @ 20.4' BGS. RELIEVE OK TO SCREEN 19-29' BGS

1040 BEGIN INSTALL. 2' SAND BELOW PVC CASING, UP TO 17' BGS, REST

BENTONITE HOLEPLUG 3/4" SEAL HYDRATED @ 1125. CHIP TO 2' BGS.

1200 DRILLERS LUNCH. (NO WATER ADDED DURING DRILLING)

1230 DRILLERS DECON RODS @ IDW YARD, GET PFAS FREE WATER

TOMMY TA AND JILL SCHRALAU TO B76-SS12 W/ HAND AUGER

1100 NBKK-B76-SS12-0001 0-1' HOMOGENIZED INTERVAL (LIGHT BROWN SILTY GRAVEL, DENSE MOIST)

1115 NBKK-B76-SS12-0103 1-3' HOMOGENIZED INTERVAL MS/MSD

COLLECT CAPILLARY SAMPLE AT MW09 - WL IN PVC @ 16.01' BGS

TWO "CAPILLARY" SAMPLES COLLECTED - ONE FROM TOP OF SCREENED INTERVAL / DRILLING WATER LEVEL 19-20' BGS, ONE FROM WL MEASURED IN INSTALLED WELL 14-15' BGS.

~~1150 NBKK-B76-SB09-1720~~

1200 NBKK-B76-SB09-1415

COLLECTED MW09 0-1' BGS SAMPLE FROM FRESH SCRAPED SURFACE OF OPEN BOREHOLE WITH DISPOSABLE SS. SPOON.

5

8/9/23

AARON FLUSH-MOUNT SURFACE COMPLETION @ B76-MW09

DRILLERS DEGON RODS @ IDW YARD

MOBILIZE RIG TO B76-MW08. ADJACENT TREE TRIMMED TO ACCOMODATE TOWER. ADVANCED TO 40' BGS - CAPILLARY SAMPLE COLLECTED FROM 15'-16' BGS BASED ON DTW @ MW09. SCREEN INTERVAL

1713 NBKK-B76-SB08-1516 CAPILLARY FRINGE ABOVE 16' DTW

1714 NBKK-B76-SB08P-1516 DUPLICATE

J. SCHRAUT + TOMMY TA @ SS13 WITH HAND AUGER. DEGON + ADVANCE

1500 NBKK-B76-SS13-0001 0-1' HOMOGENIZED INTERVAL

1505 NBKK-B76-SS13P-0001 DUPLICATE

1515 NBKK-B76-SB13-0103 1'-3' HOMOGENIZED INTERVAL

B76-MW09 SAMPLES: NBKK-B76-SS09-0001 @ 1145

SS13 0-2' BGS NBKK-B76-SB09-1415 @ 1200 CAPILLARY FRINGE BASED ON DTW IN WELL

LIGHT BROWN SILTY GRAVEL, DENSE, MOIST

2-3' BGS DARK BROWN SILTY GRAVEL, BLACK GRAVEL, ANGULAR SHELL FRAGMENTS

[FORMER BURN AREA W/CHAR? NO ASPHALT]

DEGON AUGER, MOVE TO SS10

1710 NBKK-B76-SS10-0001 SILTY GRAVEL WITH FINE SAND LIGHT BROWN, MOIST, DENSE

1715 NBKK-B76-SB10-0103

1630 YELLOWJACKET OFFSITE

COLLECT EQUIPMENT BLANKS W/ LAB PFAS-FREE WATER

1600 NBKK-EB01-080923 FROM CUTTING SHOE OF CASING

1700 NBKK-EB02-080923 FROM HAND AUGER

1800 JACOBS OFFSITE

6

7

KEYPORT PFAS SI

8/10/23

PERSONNEL: LYNDSEY KLEPPIN, JILL SCHRAUT, TOMMY TA (JACOBS)

MIKE ANDERSEN, AARON ADAMS, BLAKE DAVIS (YELLOWJACKET)

WEATHER: CALM, 60°F, PARTLY CLOUDY

PPE: LEVEL D

OBJECTIVE: DRILLING AND INSTALL, WELL DEVELOPMENT + SAMPLE SHIPPING

0700 SAFETY TAILGATE @ SITE HOUSEKEEPING, BRAMBLES

MOBILIZE WELL MATERIALS TO B76-MW08

0800 BEGIN WELL INSTALL - SCREEN 25-35' PER HYDRO SMG/TM

CALIBRATE PID/YSI/TURBIDIMETER (SEE CAL FORMS)

0900 BENTONITE SEAL HYDRATED (SAND 12/20), 39-33' BGS CHIPS

6 BAGS CHIPS, 9 BAGS SAND → 33-22' BGS 1120 NBKK-B76-SB08-2425 COLLECTED FROM TOP OF SCREEN

YELLOWJACKET TO IDW YARD TO DEGON RODS

SET UP AT B76-MW07 - TD @ 40' BGS DTW IN CASED HOLE: 14.5' BGS

FREE WATER IN RODS/LOKE @ ~25' LITTLE PID HIT (1.1 PPM) @ 24-25' BGS (NO ODOR). TM/HYDRO SMG DISCUSSION VIA TEXT. SCREEN @ MW07 23-33' BGS

CHIP FROM TD TO 35', SAND 35-20' BGS, CHIP REST (6 BAGS CHIPS, 6 SAND)

1500 HYDRATE BENTONITE SEAL @ B76-MW07

SURFACE COMPLETION @ MW08, COLLECT SURFACE SAMPLE FROM FRESH BORING SIDEWALL 0-1' BGS 1107 NBKK-B76-SS08-0001

J. SCHRAUT TO SILVERDALE FOR SOIL SAMPLE/EQUIPMENT BLANK SHIPMENT, COC PREPARED BY CHEMIST (JUAN ACARON)

TOMMY + JILL DEVELOP MW06: 3 WELL CASING VOLUMES = 93 GAL

SURGE 1FT/MIN OF 10 FT SATURATED SCREEN, PUMP @ 2 GAL/MIN SURGED W/ PUMP

TO DTW @ TOP OF PUMP, ALLOW TO RECHARGE TO TOP OF SCREEN

8/10/23

12V PROACTIVE PUMP - VOLTAGE REGULAR NOT SENT - CONTACT KEVIN

FOR RHEOSTAT. PRESSURE TOO HIGH TO DOWNREGULATE FLOW W/ VALVE.

WELL TURBIDITY OVERRANGE TO 110 NTU @ 2 GAL/MIN

~100 GAL TOTAL PURGE, ~ 10 MIN TO RECHARGE FROM 24' TO 19'

COLLECT 2 PROVISIONAL CAPILLARY FRINGE SAMPLES @ MW07:

ONE @ 15'-16' (DTW IN COMPLETED WELL @ 16.5' BGS) ONE @ PID HIT

ABOVE SCREEN INTERVAL (24'-25') BGS.

COLLECT SURFACE SAMPLE 0-1' BGS, VEGETATION REMOVED GRASS/ROOTS

IDW DRUM MANAGEMENT. SOIL SAMPLES COLLECTED @ MW07:

1705	NBKK-B76-SS07-0001	MS/MSD
1715	NBKK-B76-SB07-0910	(CAP FRINGE, 9.5-10.5' BGS)
1720	NBKK-B76-SB07-2223	(PID HIT ABOVE SCREEN)

YELLOWJACKET OFFSITE @ 1630. PM/RPM CONCUR MW06 REDRILL FOR CAP FRINGE SAMPLE

1740 JACOBS OFFSITE.

8

8/11/23

PERSONNEL: CYNDEY KLEEFISH, JILL SCHELAV, TIMMY TA (JACOBS)

MIKE ANDERSEN, AARON ADAMS, BLAKE DAVIS (YELLOWJACKET)

WEATHER: CLEAR, CALM, 65° F

PPE: LEVEL D

OBJECTIVE: ADVANCE MW06 REDRILL (SB-14) FOR SOIL COLLECTION,

DEVELOP MW09 AND MW08, YELLOWJACKET FOB OFFSITE

0700 SAFETY TAILGATE - DERMA PRECAUTIONS, UTILITY CLEARANCE

SET UP RIG ON MW06. (2" CASING - DRILL TO 30' TO AID SAMPLE

RECOVERY) AIR KNIFE TO 5' BGS.

2 GAL/MIN OFFS @ 28' BGS RECHARGE TO 23.0' BGS @ 1000 HR

1004	NBKK-B76-SB06-0910	CAPILLARY FRINGE
1009	NBKK-B76-SB06-2325	TOP OF SCREEN (PID HIT)

YELLOWJACKET MOBILIZE OFFSITE - DECON RIG + TOOLING/VACTRUCK

J. SCHELAV + T. TA TO MW09 FOR DEVELOPMENT.

SURGE SCREEN INTERVAL 1 MIN/FT WITH PROACTIVE TYPHOON PUMP,

PURGE @ 2 GAL/MIN. 12V PUMP BATT NO RHEOSTAT - UNABLE TO CONTROL

FLOW RATE. ATTEMPT TO CONNECT OUTLET VALVE TO REGULATE FLOW -

CAUSES MASTERFLEX TUBING CONNECTION TO TEAR OR POP OFF. TEAR

IN MASTERFLEX CAUSES FLOW RATE TO RAISE TO ~600 mL/MIN.

STABILITY AND <10 NTU ACHIEVED AFTER ~30 GALLONS PURGED.

MOVE TO MW08 FOR DEVELOPMENT. SURGE SCREEN INTERVAL

WITH PUMP FOR 10 MIN (1 FT/MIN) PURGE AT LOWER RATE - 1500 mL/MIN

PUMP SLOWING TO ~600 mL/MIN. INITIALLY VERY TURBID, TOTAL

31 GALLONS PURGED, STABILITY < 4.6 NTU.

9

8/11/23

YELLOWJACKET STAGING DRUMS / TOTE IN 2° CONTAINMENT AT IDW,

CONTAINERS ARGUS DECON IDW IN DRUMS.

COLLECT EQUIPMENT BLANK OFF OF CUTTING STAGE:

1325 NBKK-B76-EB01-081123

DEVELOPMENT IDW TRANSFERRED FROM BULLETS TO IBC TOTE.

1351 NBKK-B76-FB01-081123 FIELD ~~EQUIPMENT~~ BLANK COLLECTED

AT SITE WITH LABORATORY PFAS WATER

SITE HOUSEKEEPING FOR WEEKEND

1400 YELLOWJACKET OFFSITE

JACOBS OFFSITE

10

8/14/23

PERSONNEL: LYNDSEY KLEPPIN, TOMMY TA (JACOBS)

WEATHER: SUNNY, 65°F, CALM

PPE: MODIFIED LEVEL D

OBJECTIVE: WELL DEVELOPMENT @ B76-MW07, GROUNDWATER SAMPLING

0800 SAFETY TAILGATE - SPLASHING / ERGONOMICS.

SET UP FOR DEVELOPMENT AT B76-MW07. BEGIN SURGE WITH

1500 ML/MIN STABLE PURGE ~~PURGING TORNADO~~ PUMP IN 2' INTERVALS 10 MV/10 FT

@ 2 GAL/MIN DRAWDOWN TO TOP OF PUMP (28.8 BGS) RECHARGE 28.8' BGS

TO 23.0' BGS 0955-1000. GREY, TURBID, PURGE ~ 25 GAL @ 2 GAL

MW W/ DRAWDOWN + RECHARGE. PUMP RATE SLOWED TO STEADY

WL @ 28.8 BGS @ ~ 0.4 GAL/MIN. GROUNDWATER SAMPLING @ MW06:

1110 stability @ 52 GALLONS PURGED, 7.69 NTU.

1512 NBKK-B76-MW06P-0823 DUPLICATE

1517 NBKK-B76-MW06-0823 PRIMARY

PURGED UNTIL STABILITY (300 NTU → 8 NTU, 8.5 GALLONS PURGED)

BEGIN PURGING MW 09. VERY CLEAR AT START (< 10 NTU)

~ 3.5 GALLONS PURGED @ ~ 380 ML/MIN

1613 NBKK-B76-MW09 PRIMARY

1613 NBKK-B76-MW09-MS

1613 NBKK-B76-MW09-MSD

CALL IN ADDITIONAL BOTTLEWARE ORDER FOR IDW SAMPLING

1621 FIELD BLANK COLLECTED

11

8/15/23

PERSONNEL: LYNDSEY KLEPPIN, TOMMY TA (JACOBS)

WEATHER: 75°F, SUNNY, SLIGHT BREEZE

PPE: MODIFIED LEVEL D

OBJECTIVE: GROUNDWATER SAMPLING / IDW MANAGEMENT

0800 SAFETY TAILGATE @ B76 : HEAT / HYDRATION

SET UP AT B76-MW08, BEGIN PURGE. CLEAR, GOOD RECHARGE @ ~200 mL/MIN. ~2.5 GAL PURGED BEFORE STABILITY CRITERIA MET (<5 NTU) PERISTALTIC PUMP W/ DISPOSABLE TUBING USED

0949 NBKK-B76-MW08-0823 PRIMARY COLLECTED

MOVE TO IDW YARD FOR WASTE MANAGEMENT - SOIL DRUMS

COMPOSITE SAMPLE NBKK-B76-IDW01-SO-081523 @ 1142 COLLECTED

DISCRETE VOC SAMPLE COLLECTED FROM HIGHEST PID OF 10-DRUM GROUP (J-2023-13 PID = 3.9 ppm) REST FROM HOMO GEM 2GD

COMPOSITE OF THE FOLLOWING DRUMS: J-2023-01, 05, 06, 07 08, 09, 11, 12, 13, 14.

SET UP AT B76-MW07. CLEAR, GOOD RECHARGE @ 200 mL/MIN

1351 NBKK-B76-MW07-0823

COLLECT EQUIPMENT BLANK FROM PERISTALTIC DISPOSABLE TUBING WITH LABORATORY PFAS-FREE WATER.

1356 NBKK-B76-EB01-081523

1430 DEPART SITE FOR SAMPLE SHIPPING, SAMPLE MANAGEMENT

1600 QC COC, CONFIRM ALTERNATE PFAS JAR SIZES W/CHEMIST, SHIP 2 COOLERS VIA FEDEX. EMAIL COC + TRACKING. COLLECT IDW SUPPLIES.

1700 END

8/16/23

PERSONNEL: LYNDSEY KLEPPIN, TOMMY TA (JACOBS)

WEATHER: SUNNY, 70°F, CALM → 95°F AFTERNOON

PPE: MOD. LEVEL D

OBJECTIVE: SYNOPTIC WATER LEVEL MEASUREMENT, DEMOBILIZATION

0800 JACOBS ON-SITE, SAFETY TAILGATE - HEAT

IDW BOTTLENECK MANAGEMENT

0907	MW04	22.54' BTOC	68.99' TD
0917	MW09	16.52' BTOC	29.21' TD
0924	MW08	20.40' BTOC	35.02' TD
0927	MW07	15.51' BTOC	33.40' TD
0931	MW06	11.15' BTOC	32.72' TD
0940	MW01	10.88' BTOC	39.68' TD
0957	MW02	12.74' BTOC	57.55' TD
1011	MW03	7.54' BTOC	42.95' TD

ONE COMPOSITE AQUEOUS IDW SAMPLE COLLECTED FROM 2 DRUMS (J-2023-15 AND J-2023-16) AND ONE AQUEOUS ANALYTICAL COLLECTED FROM THE 275 GAL TOTE (J-2023-18) FOR PFAS ANALYSIS. ~35 LBS KITTY LITTER USED IN SOIL DRUMS W/FREE WATER ON TOP

1120 NBKK-B76-IDW01-AQ-081623

1157 NBKK-B76-IDW02-AQ-081623

ONE 3-DRUM SOIL COMPOSITE COLLECTED FROM DRUMS J-2023-02, 03 AND 04

1102 NBKK-B76-IDW02-SO-081623 FOR PFAS

1400 IDW PFAS SAMPLES SHIPPED, TOMMY TA OFFSITE.

NBK KEYPORT ADDITIONAL SI WASTE MANAGEMENT LOG

DRUM ID	CONTENTS	LOCATION	DATE
Ø6 (66% Full)	SOIL	MWØ9	08/9/2023
Ø5 (66% Full)	SOIL	MWØ7, MWØ8, MWØ9	08/7/2023
Ø7 (~~66%~~ 100% Full)	SOIL	MWØ8, MWØ9, SS12	08/09/2023
Ø8 (100% Full)	SOIL	MWØ8, SS1Ø	08/09/2023
14 (75% Full)	SOIL	MWØ6R	08/11/2023
13 (75% Full)	SOIL	MWØ7	08/10/2023
12 (75% Full)	SOIL	AIR KNIFE MWØ6, MWØ7, MWØ8, MWØ9	08/09/2023
Ø9 (75% Full)	SOIL	AIR KNIFE MWØ6, MWØ7, MWØ8, MWØ9	08/08/2023
11 (100% Full)	SOIL	MW-Ø7	08/11/2023
Ø1 (75% Full)	SOIL	MWØ6	08/07/2023
Ø2 (100% Full)	SOIL	MWØ6	08/08/2023
Ø3 (100% Full)	SOIL	AIR KNIFE MWØ7, MWØ8, MWØ9	08/08/2023
Ø4 (100% Full)	SOIL	AIR KNIFE MWØ7, MWØ8, MWØ9	08/07/2023
1Ø (90% Full)	WATER	DEVELOPMENT WATER MWØ6, MWØ7, MWØ8, MWØ9	08/10/2023
15 (100% Full)	WATER	DECON WATER MWØ6, MWØ7, MWØ8, MWØ9	08/07/2023
16 (100% Full)	WATER	DECON WATER MWØ6, MWØ7, MWØ8, MWØ9	08/07/2023

NBK KEYPORT PFAS SI DRUM INVENTORY

DRUM IDs
SØ29
SØ4Ø
SØ39
SØ33
SØ36
SO11
SO13
SO37
SO12
SO28
SO3Ø
VTØ7
VTØ6
SOØ4
SOØ8
SOØ2
SOØ3
SO51
SO31
SO38
VT12
SO5Ø
SO27
SO26
SO23
SOØ6
SOØ1
SOØ7
SOØ5
VT11
SO46
SO49
SO48
SO47
SOØ9
SO34
SO1Ø
SO32
SO24
SO35
SO17
SO22
SO2Ø
SO19
VTØ2
SO41
SO44
SO43
SO14
VTØ9
SO18
SO21
VT1Ø
SO15
VTØ8
SO16
VTØ4
VTØ5
VTØ3
VTØ1

61 DRUMS TOTAL

8/17/23

PERSONNEL: LYNDSEY KLEPPIN

WEATHER: SUNNY, 75°F, CALM

PPE: MODIFIED LEVEL D

OBJECTIVE: IDW SAMPLING

1300 RECIEVE GLASSWARE FROM HOTEL/FEDEX

COLLECT SOIL + AQUEOUS IDW COMPOSITE SAMPLES PER 8/15 + 8/16 GROWING

VERIFY GLASSWARE W/ LINDATA - ADD BOTTLES FOR BREAKAGE + MEOH VOAS

1710 NBKK-B76-IDW01-SO-081723 (10 DRUM COMPOSITE)

1713 NBKK-B76-IDW02-SO-081723 (3 DRUM COMPOSITE)

1 16-oz JAR, 1 8-oz, 4 4-oz, 1 40mL MEOH VOA

1647 NBKK-B76-IDW01-AQ-081723 (2 DRUM COMPOSITE)

1702 NBKK-B76-IDW02-AQ-081723 (IBC TOTE)

SAMPLES LABELED, COCS PREPARED, RENTAL EQUIPMENT SHIPPED

1800 JARS OFFSITE, SAMPLE SHIPPING 8/18 AM VIA FEDEX.

Appendix B
Field Change Requests

Sampling Analysis Plan Field Change Request (FCR)

(9000-4117-FCR-01 NBK Keyport SI)

Date of Change: 11/17/2022

FCR No. (assigned by PM): 1

Applicable Sampling Analysis Plan Title:
Per- and Polyfluoroalkyl Substances Site Inspection, Naval Base Kitsap Keyport

Project Number:	704758CH	**Project Location:**	Keyport, WA
Contract Number:	N62470-16-D-9000, Contract Task Order 4117		

Subject of Change:

1. Removal of well NBKK-S7-MW03 from current scope of Site Inspection (SI).

Recommended Changes:

Sampling and Analysis Plan, Worksheet #14 – Summary of Project Tasks

Recommend removing well NBKK-S7-MW03 from scope of PFAS Site Inspection field work due to inaccessibility of the area during the duration of the drilling field events. Four wells were installed at Site 7: NBKK-S7-MW01, NBKK-S7-MW02, NBKK-S7-MW04, and NBKK-S7-MW05.

Reason for Change:

1. The location of well NBKK-S7-MW03 (Figure 1, attached) was inaccessible to the field team and drilling equipment for the duration of the Site Inspection drilling field work (*August through November 2022*) due to equipment staged at the well location, including pallets, torpedo casings, and other equipment, obstructing access for utility locating. Once correct point of contact was established and equipment could be moved (week of September 12, 2023), the location was cleared for utilities (September 20, 2022).
2. On October 6, 2022, an outage request was submitted to the NBK Keyport outage coordinator by another contractor for pipeline work to be completed in the alleyway where the monitoring well location was located, to be conducted from October 10, 2022, through at least November 4, 2022. As of the date of rig demobilization (November 12, 2022), Jacobs and the NAVFAC RPM were unable to confirm that the pipeline work was complete, and it appeared that pipeline field activity in the vicinity would continue with a second stage of work.

Submitted by:	Rachel Clennon	**Company**:	CH2M	**Date**:	11/28/2022

Review & Acceptance:

Activity Manager/ Project Manager:	**Dennis Ballam**	**Date:**	Dennis Ballam Digitally signed by Dennis Ballam DN: cn=Dennis Ballam , c=US, o=CH2M , ou=Jacobs CH2M , email=dennis.ballam@jacobs.com Date: 2023.07.13 10:39:10 -04'00'
Senior Technical Consultant:	**Susanne Borchert**	**Date:**	Susanne Borchert Digitally signed by Susanne Borchert Date: 2023.08.23 17:23:36 +02'00'

Navy RPM/NTR:	**Date:** ROHRBAUGH.AMANDA.LYNN.1400915292 Digitally signed by ROHRBAUGH.AMANDA.LYNN.1400915292 Date: 2023.12.15 12:59:59 -08'00'		
Distribution:			
1. Approvers above	2. FTL	3. Field Staff	4.
5.	6.	7.	8.

File Copies: Project File

Site Inspection Report
for Per- and Polyfluoroalkyl Substances
Naval Base Kitsap-Keyport
Keyport, Washington

NOTIFICATION: FIGURE 1 CONTAINS SENSITIVE BUT UNCLASSIFIED INFORMATION WHICH IS PROTECTED BY THE FREEDOM OF INFORMATION ACT

FOIA Exemption 3 (5 USC 552(b)(3))
Information Exempted by other Federal Statues

TO REQUEST A COPY OF THE DOCUMENT

PLEASE CONTACT

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Freedom of Information Act Office

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	FIELD CHANGE REQUEST 02 **Contract No. N62470-16-D-9000 CTO N4425518F4117** **Naval Base Kitsap Keyport, Washington**		**NIRIS SAP DOC ID:** 5789
Tables, Figures, or Text Section	**Rev No.**	**Itemized Changes**	**Prepared By/Date**
Worksheet #10, 11, 15, 17, 18, 20, and 21	1	Update the objectives and project quality objectives	CH2M HILL, Inc. (CH2M) August 2023

REFERENCE DOCUMENTS

CH2M. 2022. *Sampling and Analysis Plan, Basewide Per- and Polyfluoroalkyl Substances (PFAS), Site Inspection, Naval Base Kitsap Keyport, Washington.* September.

EXISTING CONDITION

The initial field activities for the Site Inspection (SI) for per- and polyfluoroalkyl substances (PFAS) at Naval Base Kitsap (NBK) Keyport in Keyport, Washington were conducted from August 2022 through June 2023 in accordance with the Sampling and Analysis Plan (SAP) (CH2M, 2022). The objectives of the SI were:

- Determine potential presence of PFAS in groundwater and soil at concentrations warranting further investigation.
- Refine the understanding of hydrogeologic characteristics at potential PFAS areas, and evaluate the potential for on- and off-Base migration of PFAS, if present.

Groundwater samples were collected during the SI from monitoring wells screened within the upper aquifer at Building 76. Perfluorooctanoic acid (PFOA), perfluorooctanesulfonic acid (PFOS), perfluorohexanoic acid (PFHxA), hexafluoropropylene oxide-dimer acid (HFPO-DA), and perfluorononanoic acid (PFNA) were not detected. Perfluorobutanesulfonic acid (PFBS) and perfluorohexanesulfonic acid (PFHxS) were detected in groundwater, but less than the May 2022 regional screening levels (RSLs).

Soil samples were collected between 1 and 3 feet below ground surface (bgs) at five locations. PFOS was detected above the May 2022 RSL of 13 micrograms per kilogram [µg/kg]), based on a hazard quotient of 0.1 (USEPA, 2022) at two soil boring locations (NBKK-B76-SB03 and NBKK-B76-SB04). Concentrations at NBKK-B76-SB03 and NBKK-B76-SB04 were 25.9 and 40.3 µg/kg, respectively (**Figure 1**). PFOA, PFBS, PFHxA, HFPO-DA, and PFNA were not detected. PFHxS was detected in soil, but less than the May 2022 RSL.

Soil samples were collected from the unsaturated soil above the capillary fringe at four locations ranging from 24 to 59 ft bgs. The seven PFAS with screening levels were not detected in the subsurface soil samples.

Due to the variable lithologic conditions observed during the SI, the four monitoring wells installed at Building 76 were constructed with variable screen intervals ranging from 25 to 26 feet bgs to 58 to 59 feet bgs. As a result, the groundwater elevation data collected during the SI is incomplete to fully assess the groundwater flow regime and potential migration pathways.

During SI data review, it was identified that the eastern most soil sample location (NBKK-B76-SB04) is believed to be located at the northern end of what appears to be a former stockpile of unknown material. This was identified during review of historical aerial photos from 2010 through present which indicate potential staging of unknown material from August through November 2011 (Google Earth, 2011) (**Figure 1**). Following apparent removal of the stockpile after the August 2011 photo, the ground surface to the southeast of Building 76 is visibly impacted, as indicated through lack of grass/vegetation. The impact to the ground surface is diminished in 2023, but still present.

REASON FOR CHANGE

Based on the soil results exceeding the SLs, the presence of a former stockpile southeast of Building 76, and incomplete groundwater elevation data from the monitoring wells installed during the SI, additional sampling of soil and groundwater is recommended in order to meet the SI objectives at Building 76.

DESCRIPTION OF CHANGE

This Field Change Request (FCR) proposes collection of additional surface (0 to 1 foot bgs) and shallow subsurface (1 to 3 feet bgs) soil samples at four soil borings southeast of Building 76, and installation of four additional monitoring wells from which surface (0 to 1 foot bgs) and subsurface (unsaturated soil above the capillary fringe) soil and groundwater samples will be collected. Analytical and groundwater flow data will be utilized to further evaluate whether PFAS is present in soil or groundwater at concentrations warranting further investigation at or near Building 76 and to refine the upper aquifer groundwater flow direction to evaluate the potential for on- and off-Base migration of PFAS.

Figure 1 presents analytical results from the initial SI activities as well as the additional monitoring well locations that are proposed in this FCR.

Appendix A includes the field sampling standard operating procedures (SOPs). **Appendix B** includes the laboratory SOPs and Environmental Laboratory Accreditation Program (ELAP) letter. **Appendix C** includes the decision logic trees for the site inspection and the drinking water evaluation from the SAP (CH2M, 2022). This FCR is intended to be used in conjunction with the 2022 SAP, where appropriate. Field activities associated with the FCR are anticipated to start in August 2023.

	FIELD CHANGE REQUEST 02 **Contract No. N62470-16-D-9000 CTO N4425518F4117** **Naval Base Kitsap Keyport, Washington**	**NIRIS SAP DOC ID:** 5789

APPROVALS

(Signature) Dennis Ballam — Digitally signed by Dennis Ballam DN: cn=Dennis Ballam , c=US, o=CH2M , ou=Jacobs CH2M , email=dennis.ballam@jacobs.com Date: 2023.07.13 10:39:10 -04'00'

CH2M Project Manager
Name: Dennis Ballam **Date:**

(Signature) Digitally signed by Susanne Borchert Date: 2023.08.23 17:15:55 +02'00'

CH2M Senior Technical Consultant
Name: Susanne Borchert **Date:**

(Signature) [Not Reviewed]

CH2M PFAS Subject Matter Expert
Name: Maggie Radford, P.E. **Date:**

(Signature) ROHRBAUGH.AMANDA.LYN N.1400915292 — Digitally signed by ROHRBAUGH.AMANDA.LYNN.1400915292 Date: 2023.12.15 13:01:29 -08'00'

Naval Facilities Engineering Systems Command (NAVFAC) Mid-Atlantic Remedial Project Manager
Name: Amanda Rohrbaugh **Date:**

REMARKS/IMPACT OF CHANGE

If this change results in a contract cost or schedule change, is the NAVFAC Remedial Project Manager (RPM) aware of it?
X Yes ☐ No ☐ Not Applicable (N/A)
If this change does not result in a contract cost or schedule change, is the NAVFAC RPM aware of the FCR content?
☐ Yes ☐ No X N/A

Appendices

A Field Standard Operating Procedures
B Laboratory Department of Defense Environmental Laboratory Accreditation Program Accreditation Letter and Standard Operating Procedures
C Decision Logic Trees

Table

10-1 Conceptual Site Model for Building 76

11-1 Problem Definitions/Objectives, Environmental Questions, and Project Quality Objectives

17-1 Sampling Design and Rationale for NBK Keyport – Groundwater and Soil

Figure

1 Building 76 Proposed Sample Locations

Distribution

Project File
Project Manager
NAVFAC Atlantic Quality Assurance Officer
NAVFAC Northwest RPM

SAP Worksheet #10—Conceptual Site Model

The updated conceptual site model for potential PFAS release areas at Building 76, NBK Keyport, is included in **Table 10-1**.

Table 10-1. Conceptual Site Model for Building 76

Site Name	Associated Figures	Description and Operational History	Potential for PFAS Release	Area Conditions	Potential Human Receptors	Drinking Water Exposure Assessment
Building 76	Figure 1	Building 76 is located in the northwestern portion of the installation, southeast of the intersection of Strom Avenue and A Street and bordered by Strom Avenue to the north, A Street to the west, the fire truck access ramp and parking area to the south, and a grass-covered area to the east. The western Base perimeter fence lies just west of A Street, with several offsite residential parcels beyond. Building 76 was constructed in 1937 and operated as a chapel until 1972 before being converted into the sole fire station for NBK Keyport. As such, the Keyport Fire Department responds to fire or other on-Base emergency incidents.	No aqueous film-forming foam (AFFF) has been knowingly used or released at Building 76, with the exceptions of transfer and storage of AFFF prior to 2010. Transfer of 5-gallon buckets of AFFF into the fire trucks was conducted on the truck ramp south of Building 76. During transfer of AFFF, minor spills and splashes have reportedly occurred. Building 76 houses two fire trucks equipped with tanks carrying approximately 30 gallons of AFFF concentrate each. During SI data review, it was identified that the eastern most soil sample location (NBKK-B76-SB04) with a PFOS concentration above the May 2022 RSL (USEPA, 2022) in shallow subsurface soil is believed to be located at the northern end of what appears to be a former stockpile of unknown material. This stockpile was identified during review of historical aerial photos from 2010 through present that indicate potential staging of unknown material from August through November 2011 (Google Earth, 2011) (**Figure 1**). Following apparent removal of the stockpile after the August 2011 photo, the ground surface to the southeast of Building 76 is visibly impacted, as indicated through lack of grass/vegetation. The impact to the ground surface is diminished in 2023, but still present. Soil samples collected in this area during initial SI activities contained PFOS at concentrations exceeding the applicable screening level (SL). PFOS was detected in a soil sample from NBKK-B76-MW03 at a concentration of 25.9 micrograms per kilogram (µg/kg) and from NBKK-B76-MW04 at a concentration of 40.3 µg/kg. In groundwater samples collected at the four wells installed during the SI, PFBS and PFHxS were detected at concentrations less than the applicable SLs (**Figure 1**).	**Ground cover:** Currently, the area around Building 76 is paved with asphalt and concrete. There is a grass-covered area to the east of the building. Historical aerial photos indicate a stockpile of unknown material was potentially staged southeast of Building 76 between August and November 2011 (Google Earth, 2011). **Surface water:** The fire truck ramp south of Building 76 is designed to direct stormwater and/or other liquids toward a trench drain and sump that runs parallel to the western edge of the ramp. Surface water that flows into the trench drain is held in a sump and eventually transferred via pump truck to the treatment, storage, and disposal facility for storage prior to transportation and disposal off-Base. The depth of the trench drain is not known but is assumed to be above the water table. During the SI, a retaining wall was observed running north-south along the Base boundary to the west of Building 76; its depth belowground and construction details are unknown, but its presence may affect surface water and/or shallow (perched) groundwater flow in the vicinity of the Base boundary. **Groundwater flow direction:** Due to the variable lithologic conditions observed during the SI, the four monitoring wells installed at Building 76 were constructed with screen intervals ranging from 25 to 26 feet bgs to 58 to 59 feet bgs. The water table in the northernmost well, NBKK-B76-MW01, and the southernmost well, NBKK-B76-MW03, were higher than at the monitoring wells in the middle of the site (NBKK-B76-MW02 and -MW04) (**Figure 1**). While the difference in screen depths among the four wells precludes contouring them as a single aquifer, the location of the site in proximity to the coastline to the north and its position on the north slope of the topographic high located to the south suggest that the prominent groundwater flow direction at Building 76 is to the north. Groundwater levels from the additional proposed monitoring wells will be used to confirm the groundwater flow direction.	Workers, visitors, and potential trespassers are present at Building 76; residents, workers, visitors, potential trespassers, local tribal subsistence fishermen, and recreators are present within a 1 mile-radius.	The Kitsap County Public Utility District (PUD) emergency water supply well is approximately 0.3 mile southwest of Building 76, while the primary water supply well is approximately 1.3 miles to the southwest. The on-Base supply well (Well 5) is approximately 0.4 mile to the south. Based on the assumed shallow groundwater flow direction (northwest) and the location in the northwestern portion of the installation, no public water supply wells were identified within 1 mile downgradient of Building 76. Additionally, the Kitsap County PUD wells and Well 5 are screened in the lower confined aquifer at depths ranging from 745 to 1,030 feet bgs, and PFAS have not been detected during previous sampling efforts. Private drinking water wells may exist within 1 mile northwest and downgradient of Building 76, in the town of Keyport; however, the exact number and location, current operational status, depth, and usage have not been confirmed. Some of these wells are suspected to be abandoned or used as monitoring wells, given that residents were mandated to convert to municipal water in 1975. In addition, the groundwater flow direction at Building 76 is not yet known, though it is assumed to be to the north, consistent with regional flow and topography.

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SAP Worksheet #11—Project/Data Quality Objectives

The objectives and project quality objectives (PQOs) were updated based on the FCR form. Only the changes from the original **Worksheet #11** are shown in **Table 11-1**.

Table 11-1. Problem Definitions/Objectives, Environmental Questions, and Project Quality Objectives

Problem Definition/ Objective	Environmental Question	General Investigation Approach and Rationale	Project Quality Objectives
Based on the CSMs for the potential release area (Building 76), the media most likely to be impacted by potential PFAS releases are groundwater and soil. Determine whether PFAS are present in groundwater and soil at concentrations warranting further investigation.	Are PFAS[a] present in onsite groundwater at concentrations that warrant further investigation?	Four new shallow groundwater monitoring wells will be installed north and east of Building 76 (**Figure 1**). Groundwater samples will be collected from the shallow, upper aquifer at the newly installed monitoring wells. Samples will be analyzed for 18 PFAS listed by Liquid Chromatography/Mass Spectrometry/Mass Spectrometry (LC/MS/MS) compliant with Table B-15 of Quality Systems Manual (QSM) version 5.3 (or most current) in accordance with **Worksheet #18**. **Figure 1** presents the sample locations. The samples and rationale are outlined in **Worksheet #17** and sample details are provided in **Worksheet #18**.	The soil and groundwater data will be evaluated to determine whether further investigation is warranted (Figure 11-1 of **Appendix C**). Additionally, the groundwater data will be evaluated with respect to potential drinking water exposure based on the 2016 USEPA Lifetime Health Advisory of 70 nanograms per liter (ng/L).
	Are PFAS[a] present in onsite soil at concentrations that warrant further investigation?	Surface (0 to 1 foot bgs) and shallow subsurface soil (1 to 3 feet bgs) samples will be collected from four soil borings southeast of Building 76 where historical aerial photos indicate a stockpile of unknown material was potentially staged from August to November 2011 (Google Earth, 2011). The surface and shallow subsurface soil samples will be collected via hand auger, without soil boring advancement, as specified in surface soil sampling SOP presented in **Worksheet #21**. Surface (0 to 1 foot bgs) and subsurface (unsaturated soil above the capillary fringe) soil samples will be collected during soil boring advancement for the four newly installed groundwater monitoring wells. Surface and/or subsurface soil samples will be collected to evaluate PFAS impact to soil east of the truck ramp south of Building 76. Samples will be analyzed for 18 PFAS by Liquid Chromatography/Mass Spectrometry/Mass Spectrometry (LC/MS/MS) compliant with Table B-15 of Quality Systems Manual (QSM) version 5.3 (or most current) in accordance with **Worksheet #18**. **Figure 1** presents the sample locations. The samples and rationale are outlined in **Worksheet #17** and **Worksheet #18**.	

SAP Worksheet #11—Project Quality Objectives/ Systematic Planning Process Statements (continued)

Table 11-1. Problem Definitions/Objectives, Environmental Questions, and Project Quality Objectives

Problem Definition/ Objective	Environmental Question	General Investigation Approach and Rationale	Project Quality Objectives
The hydrogeologic characteristics remain poorly understood at Building 76 due to the lithologic variability observed during the SI. Therefore, the potential for off-Base migration in the shallow aquifer from release areas, if identified, is uncertain. Evaluate if PFAS could potentially migrate to off-Base drinking water receptors beyond the initial off-Base sampling area.	What is the shallow groundwater flow direction at potential PFAS release areas and is there a potential for on- and off-Base migration of PFAS?	Prior to groundwater sampling, the four new and four existing monitoring wells will be gauged to determine depth to groundwater at each location, these measurements will be converted to groundwater elevations, and these data will be used to estimate local groundwater flow directions in the areas where monitoring wells were installed. The same vertical datum (or appropriate correction factor, as applicable) will be used for survey of old and new wells.	This information will be used to assess the potential for on- and off-Base migration of PFAS and refine the CSM for shallow groundwater flow at Building 76 (**Figure 1**). If the refined understanding of hydrogeologic characteristics indicates that drinking water wells are within 1 mile downgradient of Building 76, groundwater data will be evaluated with respect to potential drinking water exposure if groundwater concentrations exceed the 2016 USEPA Lifetime Health Advisory of 70 ng/L. If appropriate, off-Base drinking water will be further evaluated under a separate investigation.

[a] The focus of the SI is PFAS with DoD-endorsed, vetted toxicity values (that is, Tier 1, 2, or 3 toxicity values) at this time (for PFOS, PFOA, PFBS, PFHxS, PFNA, and HFPO-DA, per current USEPA guidance and Navy policy). Data for the remaining constituents will be reported in an appendix to the SI report for future use, if/as appropriate toxicity values become available.

SAP Worksheet #11—Project Quality Objectives/ Systematic Planning Process Statements (continued)

What are the Project Action Limits?

The determination of whether further investigation is warranted will be made using the PALs describe below and listed in **Worksheet #15**, which are based on human health exposure scenarios. Risk to ecological receptors will be evaluated using currently available, approved, state-of-the-science toxicological information; an ecological risk screening will not be conducted as part of the SI.

PFAS that are detected, but do not have an RSL, will be retained for future use, as applicable, and will be included in the SI report appendices. Those data will be qualitatively evaluated in the SI report by stating which compounds were detected and indicating that there is uncertainty with the conclusions of the SI since those data do not have screening levels available to allow quantitative evaluation.

Groundwater

Groundwater data will be screened against residential scenario risk RSLs for PFOA, PFOS, PFBS, PFHxS, PFNA, and HFPO-DA presented in the May 2022 RSL Table (USEPA, 2022).

Groundwater may also be screened against the USEPA Lifetime Health Advisory concentrations for PFOA and PFOS, which is 70 ng/L individually; however, if both chemicals are detected, then 70 ng/L is the Lifetime Health Advisory for the cumulative concentration of the two chemicals. Although not a PAL, the USEPA Lifetime Health Advisory is taken into consideration to ensure maximum usability of the data.

Soil

Soil data will be screened against residential scenario risk RSLs for PFOA, PFOS, PFBS, PFHxS, PFNA, and HFPO-DA presented in the May 2022 RSL Table (USEPA, 2022).

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SAP Worksheet #15-1—Reference Limits and Evaluation Table

Matrix: Surface Soil (SS) and Shallow Subsurface Soil (SB)
Analytical Group: PFAS (LC-MS/MS Compliant with QSM v5.4[a] Table B-15)

Analyte[b]	CAS Number	PAL (ng/g)[c]	PAL Reference	Laboratory Limits (ng/g)			LCS and MS/MSD Recovery Limits and RPD (%)[d]		
				LOQ	LOD	DL	LCL	UCL	RPD
Perfluorooctanoic acid (PFOA)	335-67-1	19	RSL	1	0.5	0.214	69	133	30
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	13	RSL	1	0.5	0.175	68	136	30
Perfluorobutanesulfonic acid (PFBS)	375-73-5	1,900	RSL	1	0.5	0.171	72	128	30
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	130	RSL	1	0.5	0.173	67	130	30
Perfluorononanoic acid (PFNA)	375-95-1	19	RSL	1	0.5	0.157	72	129	30
Hexafluoropropylene oxide dimer acid (HFPO-DA)	13252-13-6	23	RSL	2	0.5	0.159	71[e]	153[e]	30
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OudS)	763051-92-9	NC[f]	NA	2	0.5	0.15	40[e]	160[e]	30
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	919005-14-4	NC[f]	NA	2	0.5	0.16	61[e]	139[e]	30
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)	756426-58-1	NC[f]	NA	2	0.5	0.154	60[e]	140[e]	30
N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA)	2991-50-6	NC[f]	NA	2	0.5	0.165	61	139	30
N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA)	2355-31-9	NC[f]	NA	2	0.5	0.159	63	144	30
Perfluorodecanoic acid (PFDA)	335-76-2	NC[f]	NA	1	0.5	0.158	69	133	30
Perfluorododecanoic acid (PFDoA)	307-55-1	NC[f]	NA	1	0.5	0.16	69	135	30
Perfluoroheptanoic acid (PFHpA)	375-85-9	NC[f]	NA	1	0.5	0.168	71	131	30
Perfluorohexanoic acid (PFHxA)	307-24-4	NC[f]	NA	1	0.5	0.178	70	132	30

SAP Worksheet #15-1—Reference Limits and Evaluation Table

Analyte[b]	CAS Number	PAL (ng/g)[c]	PAL Reference	Laboratory Limits (ng/g)			LCS and MS/MSD Recovery Limits and RPD (%)[d]		
				LOQ	LOD	DL	LCL	UCL	RPD
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	NC[f]	NA	2	0.5	0.162	69	133	30
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	NC[f]	NA	1	0.5	0.161	66	139	30
Perfluoroundecanoic acid (PFUnA)	2058-94-8	NC[f]	NA	1	0.5	0.156	64	136	30

[a] Compliant with Quality Systems Manual (QSM) v.5.4 Table B-24 (DoD/DOE, 2021).

[b] The analyte list is based on 18 PFAS referenced in EPA Method 537.1 (USEPA, 2020). All isomers are reported for each analyte as a sum.

[c] RSLs listed are based on an HQ of 0.1 and the May 2022 RSL Table (USEPA, 2022).

[d] QSM v.5.4 (DoD/DOE, 2021) is the basis for LCS and MS/MSD limits.

[e] DoD QSM v5.4 does not provide limits for this compound. In-house limits used.

[f] NC: No Criteria (no screening level for this compound at time of original SAP development).

CAS = Chemical Abstract Service
DL = detection limit
LCL = lower control limit
LCS = laboratory control sample
LOD = limit of detection
LOQ = limit of quantitation
MS = matrix spike
MSD = matrix spike duplicate
NA = not applicable
ng/g = nanogram(s) per liter
PAL = project action limit
RPD = relative percent difference
UCL = upper control limit

SAP Worksheet #15-2—Reference Limits and Evaluation Table

Matrix: Groundwater (GW)

Analytical Group: PFAS (LC-MS/MS Compliant with QSM v5.4[a] Table B-15)

Analyte[b]	CAS Number	PAL (ng/L)[c]	PAL Reference	Laboratory Limits (ng/L)			LCS and MS/MSD Recovery Limits and RPD (%)[d]		
				LOQ	LOD	DL	LCL	UCL	RPD
Perfluorooctanoic acid (PFOA)	335-67-1	6	RSL	5	2.5	1.01	71	133	30
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	4	RSL	5	2.5	1.07	65	140	30
Perfluorobutanesulfonic acid (PFBS)	375-73-5	600	RSL	5	2.5	0.866	72	130	30
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	39	RSL	5	2.5	0.997	68	131	30
Perfluorononanoic acid (PFNA)	375-95-1	5.9	RSL	5	2.5	0.833	69	130	30
Hexafluoropropylene oxide dimer acid (HFPO-DA)	13252-13-6	6	RSL	5	2.5	0.865	60[e]	126[e]	30
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OudS)	763051-92-9	NC[f]	NA	5	2.5	0.901	56[e]	125[e]	30
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	919005-14-4	NC[f]	NA	5	2.5	0.869	61[e]	130[e]	30
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)	756426-58-1	NC[f]	NA	5	2.5	1.03	60[e]	126[e]	30
N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA)	2991-50-6	NC[f]	NA	5	2.5	0.99	61	135	30
N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA)	2355-31-9	NC[f]	NA	5	2.5	1.03	65	136	30
Perfluorodecanoic acid (PFDA)	335-76-2	NC[f]	NA	5	2.5	0.784	71	129	30
Perfluorododecanoic acid (PFDoA)	307-55-1	NC[f]	NA	5	2.5	0.76	72	134	30
Perfluoroheptanoic acid (PFHpA)	375-85-9	NC[f]	NA	5	2.5	0.941	72	130	30
Perfluorohexanoic acid (PFHxA)	307-24-4	NC[f]	NA	5	2.5	0.913	72	129	30

SAP Worksheet #15-2—Reference Limits and Evaluation Table (continued)

Analyte[b]	CAS #	PAL (ng/L)[c]	PAL Reference	Laboratory Limits (ng/L)			LCS and MS/MSD Recovery Limits and RPD (%)[d]		
				LOQ	LOD	DL	LCL	UCL	RPD
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	NC[f]	NA	5	2.5	0.791	71	132	30
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	NC[f]	NA	5	2.5	0.742	65	144	30
Perfluoroundecanoic acid (PFUnA)	2058-94-8	NC[f]	NA	5	2.5	0.752	69	133	30

[a] Compliant with QSM v.5.4 Table B-24 (DoD/DOE, 2021).

[b] The analyte list is based on 18 PFAS referenced in 18 PFAS listed in EPA Method 537.1 (USEPA, 2020). All isomers are reported for each analyte as a sum.

[c] RSLs listed are based on an HQ of 0.1 and the May 2022 RSL Table (USEPA, 2022).

[d] The QSM v.5.4 (DoD/DOE, 2021) is the basis for LCS and MS/MSD limits.

[e] DoD QSM v5.4 does not provide limits for this compound. In-house limits used.

[f] NC: No Criteria (no screening level for this compound at time of original SAP development).

SAP Worksheet #17—Sampling Design and Rationale

Table 17-1 presents the sampling strategy and rationale.

Table 17-1. Sampling Design and Rationale for NBK Keyport – Groundwater and Soil

Area Name	Matrix	Number of Samples	Sampling Locations	Sampling Strategy and Rationale
Building 76	Groundwater Soil	Groundwater: 4 Soil: 16	Refer to **Figure 1**	Four groundwater monitoring wells will be installed up to approximately 70 feet bgs, an estimated maximum depth based on generalized local hydrogeologic and topographic conditions. Wells will be located downgradient and crossgradient of Building 76 (**Figure 1**) to refine shallow groundwater flow directions in the area and further evaluate PFAS impacts in groundwater. Soil samples will be collected from the borings of the four new wells to be installed. Soil samples will be collected from two depths (at the surface [0 to 1 feet bgs] and the top of the capillary fringe in the unsaturated soil) within each boring. Additional surface (0 to 1 feet bgs) soil samples will be collected at four soil borings east of the truck ramp south of Building 76, and south of NBKK-B76-MW04, where historical aerial photos indicate a stockpile of unknown material was potentially staged from August to November 2011 (Google Earth, 2011) to evaluate PFAS impacts in soil. Due to detections in surface soil samples, shallow subsurface soil samples (1 to 3 feet bgs) will be collected.

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SAP Worksheet #18—Sampling Locations and Methods/SOP Requirements Table

(UFP-QAPP Manual Section 3.1.1)

Sampling Location	Sample Identification	Matrix	Depth (feet bgs)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
NBKK-B76-MW06	NBKK-B76-SS06-0001	SS	0 - 1	PFAS	1	See **Worksheet #21**
NBKK-B76-MW06	NBKK-B76-SB06-TDBD[a]	SB	TBD[b]	PFAS	1	See **Worksheet #21**
NBKK-B76-MW06	NBKK-B76-MW06-MMYY	GW	TBD[c]	PFAS	1	See **Worksheet #21**
NBKK-B76-MW06	NBKK-B76-MW06P-MMYY	GW	TBD[c]	PFAS	1 (FD)	See **Worksheet #21**
NBKK-B76-MW07	NBKK-B76-SS07-0001	SS	0 - 1	PFAS	1	See **Worksheet #21**
NBKK-B76-MW07	NBKK-B76-SS07-0001-MS	SS	0 - 1	PFAS	1 (MS)	See **Worksheet #21**
NBKK-B76-MW07	NBKK-B76-SS07-0001-MSD	SS	0 - 1	PFAS	1 (MSD)	See **Worksheet #21**
NBKK-B76-MW07	NBKK-B76-SB07-TDBD[a]	SB	TBD[b]	PFAS	1	See **Worksheet #21**
NBKK-B76-MW07	NBKK-B76-MW07-MMYY	GW	TBD[c]	PFAS	1	See **Worksheet #21**
NBKK-B76-MW08	NBKK-B76-SS08-0001	SS	0 - 1	PFAS	1	See **Worksheet #21**
NBKK-B76-MW08	NBKK-B76-SB08-TDBD[a]	SB	TBD[b]	PFAS	1	See **Worksheet #21**
NBKK-B76-MW08	NBKK-B76-SB08P-TDBD[a]	SB	TBD[b]	PFAS	1 (FD)	See **Worksheet #21**
NBKK-B76-MW08	NBKK-B76-MW08-MMYY	GW	TBD[c]	PFAS	1	See **Worksheet #21**
NBKK-B76-MW09	NBKK-B76-SS09-0001	SS	0 - 1	PFAS	1	See **Worksheet #21**
NBKK-B76-MW09	NBKK-B76-SB09-TDBD[a]	SB	TBD[b]	PFAS	1	See **Worksheet #21**
NBKK-B76-MW09	NBKK-B76-MW09-MMYY	GW	TBD[c]	PFAS	1	See **Worksheet #21**
NBKK-B76-MW09	NBKK-B76-MW09-MMYY-MS	GW	TBD[c]	PFAS	1 (MS)	See **Worksheet #21**
NBKK-B76-MW09	NBKK-B76-MW09-MMYY-MSD	GW	TBD[c]	PFAS	1 (MSD)	See **Worksheet #21**
NBKK-B76-SS10	NBKK-B76-SS10-0001	SS	0 - 1	PFAS	1	See **Worksheet #21**
NBKK-B76-SS10	NBKK-B76-SB10-0203	SB	1 - 3	PFAS	1	See **Worksheet #21**
NBKK-B76-SS11	NBKK-B76-SS11-0001	SS	0 - 1	PFAS	1	See **Worksheet #21**
NBKK-B76-SS11	NBKK-B76-SB11-0203	SB	1 - 3	PFAS	1	See **Worksheet #21**
NBKK-B76-SS12	NBKK-B76-SS12-0001	SS	0 - 1	PFAS	1	See **Worksheet #21**

SAP Worksheet #18—Sampling Locations and Methods/SOP Requirements Table (continued)

Sampling Location	Sample Identification	Matrix	Depth (feet bgs)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
NBKK-B76-SS12	NBKK-B76-SB12-0203	SB	1 - 3	PFAS	1	See **Worksheet #21**
NBKK-B76-SS12	NBKK-B76-SB12-0203-MS	SB	1 - 3	PFAS	1 (MS)	See **Worksheet #21**
NBKK-B76-SS12	NBKK-B76-SB12-0203-MSD	SB	1 - 3	PFAS	1 (MSD)	See **Worksheet #21**
NBKK-B76-SS13	NBKK-B76-SS13-0001	SS	0 - 1	PFAS	1	See **Worksheet #21**
NBKK-B76-SS13	NBKK-B76-SS13P-0001	SS	0 - 1	PFAS	1 (FD)	See **Worksheet #21**
NBKK-B76-SS13	NBKK-B76-SB13-0203	SB	1 - 3	PFAS	1	See **Worksheet #21**
Field QC samples						
NBKK-QC	NBKK-FB01-MMDDYY	QC	N/A	PFAS	1	See **Worksheet #21**
NBKK-QC	NBKK-FB02-MMDDYY	QC	N/A	PFAS	1	See **Worksheet #21**
NBKK-QC	NBKK-EB01-MMDDYY	QC	N/A	PFAS	1 per day	See **Worksheet #21**
NBKK-QC	NBKK-EB02-MMDDYY	QC	N/A	PFAS	1 per day	See **Worksheet #21**
NBKK-QC	NBKK-EB03-MMDDYY	QC	N/A	PFAS	1 per day	See **Worksheet #21**

[a] TDBD in the sample IDs by the top depth and bottom depth of the sampled interval.

[b] Subsurface soil samples will be collected at the at the top of the capillary fringe as identified in the field, unless otherwise specified in the table above.

[c] Monitoring well sample depth will depend on the final screen length and depth of the installed monitoring well, as determined in the field based on observed lithologic and hydraulic conditions. Samples will be collected from the mid-point of the screen interval. If a tidal lag study from a nearby site indicates the timing of samples during a tidal cycle impacts the presence of fresh water in wells, wells at the same or similar proximity to the shoreline will be sampled using the lag times suggested by the study.

Notes:

Field duplicates and matrix spikes/spike duplicates will be collected per **Worksheet #12** with the following template nomenclature.

- For field duplicates, a "P" will be added after the station ID. (ex. NBK-OU2A2-MW02-MMYY would be NBK-OU2A2-MW02P-MMYY)
- For matrix spikes and duplicates, -MS and -MSD will be appended to the end of the ID.

Field blanks will be collected as described in **Worksheet #12**.

GW = groundwater

MW = monitoring well

SB = soil

SS = surface soil

TBD = to be determined

TDBD = top depth bottom depth

SAP Worksheet #20—Field Quality Control Sample Summary Table

Matrix	Analytical Group	No. of Sampling Locations[1]	No. of Field Duplicates	No. of MS/MSDs[2]	No. of Field Blanks	No. of Equip. Blanks[3]	Total No. of Samples to Lab
GW	PFAS	4	1	1/1	1	1	9
SS	PFAS	8	1	1/1	1	2	14
SB	PFAS	8	1	1/1	1	2	14

Notes:

[1] Samples to be collected at different depths at the same location are counted as separate sampling locations or stations.

[2] Although the matrix spike (MS)/matrix spike duplicate (MSD) is not typically considered a field QC, it is included here because location determination is often established in the field. MS/MSD are designated by total samples collected in the soil matrix and the groundwater matrix; for the purpose of this project, the soil in surface and subsurface sections are comparable enough to constitute as one soil matrix.

[3] The number of equipment blanks is based on a fundamental assumption of the number of sampling days each site will require. It was assumed that the soil and groundwater sampling will occupy a total of up to 2 days.

GW = groundwater

SB = soil

SS = surface soil

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SAP Worksheet #21—Project Sampling SOP References Table

Reference Number (CH2M/NAVFAC Northwest)	Title, Revision Date and/or Number	Originating Organization of Sampling SOP	Equipment Type	Modified for Project Work? (Yes/No)	Comments
SOP-001	Preparing Field Log Books, rev. 03/2023	CH2M	Loose leaf paper or tablet for electronic data capture	No	Loose leaf paper substituted for standard field log books.
SOP-002	General Considerations for PFAS Investigations, rev. 04/2023	CH2M	PFAS-free materials	No	
SOP-003 / III-I	Decontamination of Personnel and Equipment, rev. 02/2023	CH2M	For cleansing reusable samplers	No	
SOP-004 / NA	Decontamination of Drill Rigs and Equipment, rev. 02/2023	CH2M	Steam cleaner, potable water, phosphate-free, detergent, brushes, personal protective equipment	No	
SOP-005 / NA	Disposal of Waste Fluids and Solids, rev. 02/2023	CH2M	United States Department of Transportation 55-gallon drums or tank	No	
SOP-017 / I-D-07	Field Measurement of pH, Specific Conductance, DO, ORP, and Temperature Using a WQP Meter with Flow-through Cell, rev. 02/2023	CH2M	Water quality meter with flow-through cell	No	
SOP I-C-5	Low-Flow Groundwater Purging and Sampling, rev. 03/2015	CH2M	Pump, HDPE tubing	Yes	Reflects most recent Base and USEPA Region 4 low-flow sampling guidance
SOP-040 / NA	MultiRAE Photoionization Detector (PID), rev. 03/2023	CH2M	PID	No	
SOP-051 / NA	Installation of Monitoring wells by Sonic Drilling, rev. 03/2023	NAVFAC Northwest	PFAS-free Pumps, sampling equipment, monitoring equipment	No	WQPs will be considered stable based on the criteria provided in SOP-017.

SAP Worksheet #21—Project Sampling SOP References Table (continued)

Reference Number (CH2M/NAVFAC Northwest)	Title, Revision Date and/or Number	Originating Organization of Sampling SOP	Equipment Type	Modified for Project Work? (Yes/No)	Comments
SOP-056 / I-D-05	Water Level Measurements, rev. 03/2023	CH2M	Electronic water-level meter, Interface probe	No	
SOP-059 / I-G-01	Civil Surveying, rev. 03/2023	CH2M		No	
SOP-060 / N/A	Sampling Contents of Tanks and Drums, rev. 03/2023	CH2M	Rubber mallet, socket wrench, laboratory-supplied sample bottles	No	
SOP-061 / N/A	Global Positioning System, rev. 03/2023	CH2M	Hand-held global positioning system unit	No	
SOP-066 / N/A	Equipment Blank and Field Blank Preparation, rev. 03/2023	CH2M	Laboratory provided blank liquid and sample bottles	No	
SOP-067 / N/A	Chain-of-Custody, rev. 03/2023	CH2M	Chain-of-custody form	No	
SOP-069 / N/A	Packaging and Shipping Procedures for Low-Concentration Samples, rev. 03/2023	CH2M	Laboratory-supplied coolers, plastic bags, ice, tape	No	No Teflon supplies, Samples will be kept on ice and shipped to laboratory via FedEx.
SOP-074	Logging of Soil Borings, rev. 02/2023	CH2M	Indelible pen, ruler, logbook, spatula, soil color chart, grain size chart, hand lens, USCS index charts	No	
SOP-075 / N/A	Shallow Soil Sampling, rev. 02/2023	CH2M	Stainless steel trowel, sample jars, pin flags	No	
SOP-087 / N/A	Locating and Clearing Underground Utilities, rev. 02/2022	CH2M	EM-31, Ground Penetrating Radar systems, Magnetic and Optical field methods	No	

SAP Worksheet #21—Project Sampling SOP References Table (continued)

Reference Number (CH2M/NAVFAC Northwest)	Title, Revision Date and/or Number	Originating Organization of Sampling SOP	Equipment Type	Modified for Project Work? (Yes/No)	Comments
SOP-090 / N/A	Groundwater Sampling for Per- and Polyfluoroalkyl Substances, rev. 3/2023	CH2M	Teflon-free tubing, Teflon-free bailer (if using bailer), PFAS-free pump, sample bottles (HDPE bottle with HDPE screw cap), laboratory prepared deionized, certified PFAS-free water for field blank collection, loose leaf paper without waterproof coating or tablet, metal clip board, pen (not Sharpie), nitrile or latex gloves	No	No Teflon components, PFAS-free shipping materials
SOP-094 / N/A	Soil Sampling for Per- and Polyfluoroalkyl Substances, rev. 3/2023	CH2M	Sample jars (HDPE bottle with HDPE screw cap), laboratory prepared deionized, certified PFAS-free water for field blank collection, loose leaf paper without waterproof coating or tablet, clip board, pen (not Sharpie), nitrile or latex gloves	No	No Teflon components, PFAS-free shipping materials

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References

CH2M HILL, Inc. (CH2M). 2022. *Sampling and Analysis Plan, Site Inspection for Per- and Polyfluoroalkyl Substances for Naval Base Kitsap Keyport, Keyport, Washington*. September.

Department of Defense (DoD). Assistant Secretary of Defense (Sustainment). 2019. Investigating Per- and Polyfluoroalkyl Substances within Department of Defense Cleanup Program. October.

Department of Defense and Department of Energy (DoD/DOE). 2021. *Department of Defense (DoD) Department of Energy (DOE) Consolidated Quality Systems Manual (QSM) for Environmental Laboratories*. Based on ISO/IEC 17025:2005(E) ISO/IEC 17025:2017(E) and The NELAC Institute (TNI) Standards, Volume 1, (September 2009). DoD Quality Systems Manual Version 5.4.

Google Earth. 2011. *NBK Keyport Building 76*. earth.google.com/web.

United States Environmental Protection Agency (USEPA). 2020. *Method 537.1 Determination of Selected Per- and Polyfluorinated Alkyl Substances in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry*. Version 2. March.

USEPA. 2022. *Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites*. May. http://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables.

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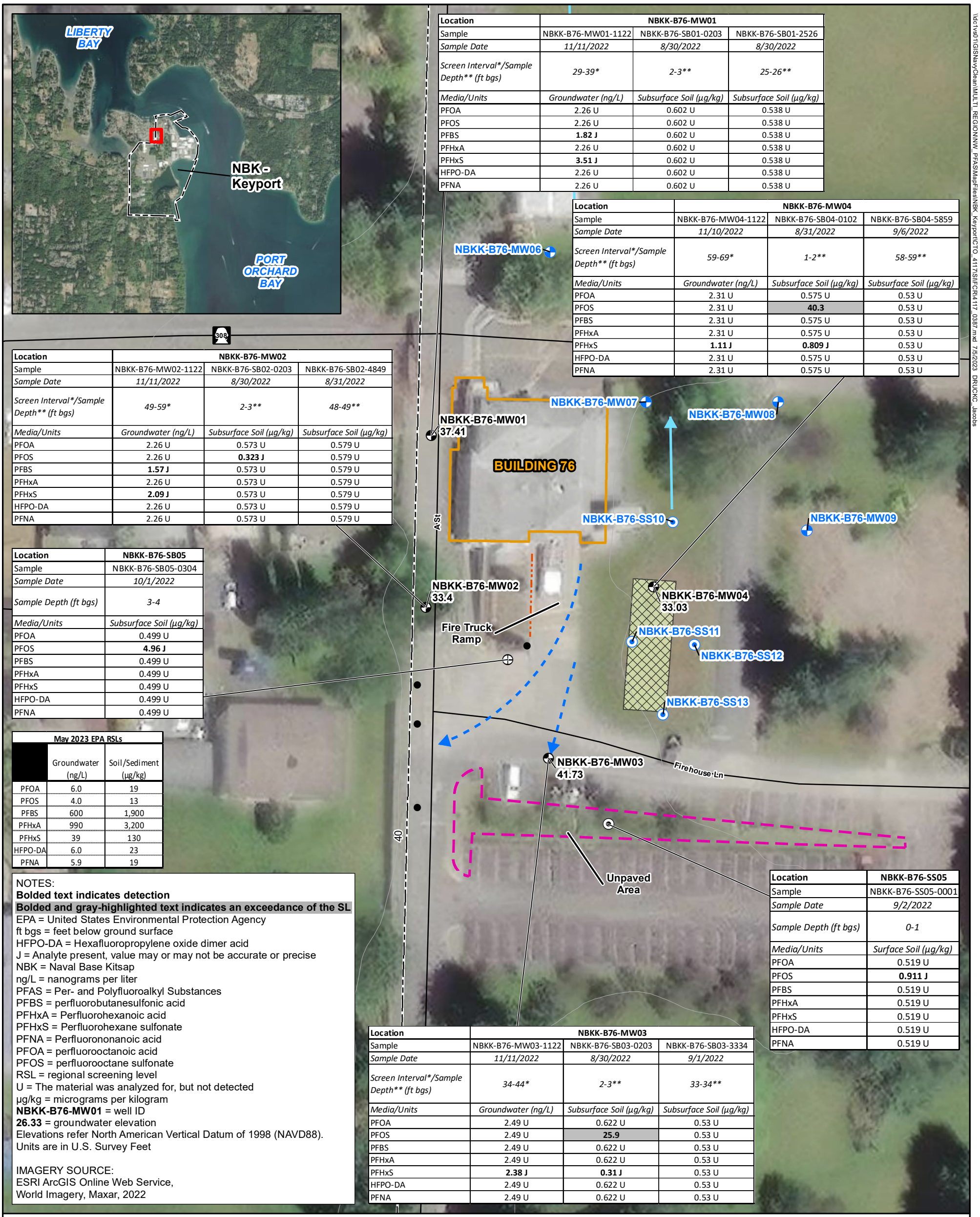
Figure



Location	NBKK-B76-MW01		
Sample	NBKK-B76-MW01-1122	NBKK-B76-SB01-0203	NBKK-B76-SB01-2526
Sample Date	*11/11/2022*	*8/30/2022*	*8/30/2022*
Screen Interval/Sample Depth** (ft bgs)*	*29-39**	*2-3***	*25-26***
Media/Units	*Groundwater (ng/L)*	*Subsurface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*
PFOA	2.26 U	0.602 U	0.538 U
PFOS	2.26 U	0.602 U	0.538 U
PFBS	**1.82 J**	0.602 U	0.538 U
PFHxA	2.26 U	0.602 U	0.538 U
PFHxS	**3.51 J**	0.602 U	0.538 U
HFPO-DA	2.26 U	0.602 U	0.538 U
PFNA	2.26 U	0.602 U	0.538 U

Location	NBKK-B76-MW04		
Sample	NBKK-B76-MW04-1122	NBKK-B76-SB04-0102	NBKK-B76-SB04-5859
Sample Date	*11/10/2022*	*8/31/2022*	*9/6/2022*
Screen Interval/Sample Depth** (ft bgs)*	*59-69**	*1-2***	*58-59***
Media/Units	*Groundwater (ng/L)*	*Subsurface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*
PFOA	2.31 U	0.575 U	0.53 U
PFOS	2.31 U	**40.3**	0.53 U
PFBS	2.31 U	0.575 U	0.53 U
PFHxA	2.31 U	0.575 U	0.53 U
PFHxS	**1.11 J**	**0.809 J**	0.53 U
HFPO-DA	2.31 U	0.575 U	0.53 U
PFNA	2.31 U	0.575 U	0.53 U

Location	NBKK-B76-MW02		
Sample	NBKK-B76-MW02-1122	NBKK-B76-SB02-0203	NBKK-B76-SB02-4849
Sample Date	*11/11/2022*	*8/30/2022*	*8/31/2022*
Screen Interval/Sample Depth** (ft bgs)*	*49-59**	*2-3***	*48-49***
Media/Units	*Groundwater (ng/L)*	*Subsurface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*
PFOA	2.26 U	0.573 U	0.579 U
PFOS	2.26 U	**0.323 J**	0.579 U
PFBS	**1.57 J**	0.573 U	0.579 U
PFHxA	2.26 U	0.573 U	0.579 U
PFHxS	**2.09 J**	0.573 U	0.579 U
HFPO-DA	2.26 U	0.573 U	0.579 U
PFNA	2.26 U	0.573 U	0.579 U

Location	NBKK-B76-SB05
Sample	NBKK-B76-SB05-0304
Sample Date	*10/1/2022*
Sample Depth (ft bgs)	*3-4*
Media/Units	*Subsurface Soil (µg/kg)*
PFOA	0.499 U
PFOS	**4.96 J**
PFBS	0.499 U
PFHxA	0.499 U
PFHxS	0.499 U
HFPO-DA	0.499 U
PFNA	0.499 U

May 2023 EPA RSLs	Groundwater (ng/L)	Soil/Sediment (µg/kg)
PFOA	6.0	19
PFOS	4.0	13
PFBS	600	1,900
PFHxA	990	3,200
PFHxS	39	130
HFPO-DA	6.0	23
PFNA	5.9	19

Location	NBKK-B76-SS05
Sample	NBKK-B76-SS05-0001
Sample Date	*9/2/2022*
Sample Depth (ft bgs)	*0-1*
Media/Units	*Surface Soil (µg/kg)*
PFOA	0.519 U
PFOS	**0.911 J**
PFBS	0.519 U
PFHxA	0.519 U
PFHxS	0.519 U
HFPO-DA	0.519 U
PFNA	0.519 U

Location	NBKK-B76-MW03		
Sample	NBKK-B76-MW03-1122	NBKK-B76-SB03-0203	NBKK-B76-SB03-3334
Sample Date	*11/11/2022*	*8/30/2022*	*9/1/2022*
Screen Interval/Sample Depth** (ft bgs)*	*34-44**	*2-3***	*33-34***
Media/Units	*Groundwater (ng/L)*	*Subsurface Soil (µg/kg)*	*Subsurface Soil (µg/kg)*
PFOA	2.49 U	0.622 U	0.53 U
PFOS	2.49 U	**25.9**	0.53 U
PFBS	2.49 U	0.622 U	0.53 U
PFHxA	2.49 U	0.622 U	0.53 U
PFHxS	**2.38 J**	**0.31 J**	0.53 U
HFPO-DA	2.49 U	0.622 U	0.53 U
PFNA	2.49 U	0.622 U	0.53 U

NOTES:
Bolded text indicates detection
Bolded and gray-highlighted text indicates an exceedance of the SL
EPA = United States Environmental Protection Agency
ft bgs = feet below ground surface
HFPO-DA = Hexafluoropropylene oxide dimer acid
J = Analyte present, value may or may not be accurate or precise
NBK = Naval Base Kitsap
ng/L = nanograms per liter
PFAS = Per- and Polyfluoroalkyl Substances
PFBS = perfluorobutanesulfonic acid
PFHxA = Perfluorohexanoic acid
PFHxS = Perfluorohexane sulfonate
PFNA = Perfluorononanoic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
RSL = regional screening level
U = The material was analyzed for, but not detected
µg/kg = micrograms per kilogram
NBKK-B76-MW01 = well ID
26.33 = groundwater elevation
Elevations refer North American Vertical Datum of 1998 (NAVD88).
Units are in U.S. Survey Feet

IMAGERY SOURCE:
ESRI ArcGIS Online Web Service,
World Imagery, Maxar, 2022

LEGEND

- Proposed Monitoring Well Location
- Proposed Shallow Subsurface Soil Sample Location
- Monitoring Well Installation/Groundwater Sampling/Soil Sampling Location
- Shallow Subsurface Soil Sampling Location
- Surface Soil Sampling Location
- Stormwater Catch Basin
- Surface Water Drainage Direction (Estimated)
- Upper Aquifer Groundwater Flow Direction
- Unpaved Area
- Trench Drain
- 10' Topographic Contour
- Road
- Potential PFAS Release Area
- Installation Boundary
- Approximate extent of potential stockpiled material based on 8/19/2011 Google imagery

Figure 1
PFAS Results: Building 76
Site Inspection for PFAS
NBK Keyport, Keyport, Washington

0 25 50
1 inch = 50 feet
N

Appendix A
Standard Operating Procedures

Preparing Field Logbooks

I. Purpose

This SOP provides general guidelines for entering field data into logbooks (hard copy and electronic) during site investigation and remediation activities.

II. Scope

This is a general description of data requirements and format for field logbooks. Logbooks are needed to properly document all field activities in support of data evaluation and possible legal activities. Field notes may be recorded in field logbooks or electronically on computer tablets.

III. Equipment and Materials

- Logbook
- Indelible pen
- Jacobs supplied electronic tablet or laptop with notebook software

IV. Procedures and Guidelines

Properly completed field logbooks are a requirement for all of the work we perform under the Navy CLEAN contract. Logbooks are legal documents and, as such, must be prepared following specific procedures and must contain required information to ensure their integrity and legitimacy. This SOP describes the basic requirements for field logbook entries.

A. Procedures for Completing Field Logbooks

1. Field notes commonly are kept in bound, hard-cover logbooks used by surveyors and produced, for example, by Peninsular Publishing Company and Sesco, Inc. Pages should be water resistant and notes should be taken only with water-proof, non-erasable permanent ink, such as that provided in Rite in the Rain or Sanford Sharpie permanent markers. Note: for sites where PFC is being analyzed for, Rite-in-the-Rain, Sanford Sharpie, or anything water-resistant or with Teflon cannot be used in the field. All field book materials must be “fluorine free”. Acceptable substitutes would be a sewn notebook without a plastic cover, or loose-leaf notebook paper.
2. Alternatively, field notes may be recorded electronically in Jacobs provided field tablets or laptop computers. Notes are recorded in appropriate note collection software; e.g., Microsoft One Note. At the end of each day, the electronic notes must be digitally signed by the author and downloaded for electronic file storage. The notes may be converted to an Adobe pdf file prior to storage. It is important that the field notes be downloaded daily to ensure the electronic time stamp of the notes is the same as the day the notes were recorded.

3. On the inside cover of the logbook the following information should be included:
   - Company name and address
   - Log-holders name if logbook was assigned specifically to that person
   - Activity or location
   - Project name
   - Project manager's name
   - Phone numbers of the company, supervisors, emergency response, etc.
4. All lines of all pages should be used to prevent later additions of text, which could later be questioned. Any line not used should be marked through with a line and initialed and dated. Any pages not used should be marked through with a line, the author's initials, the date, and the note "Intentionally Left Blank."
5. If field notes are recorded electronically, the author will not have any spaces between entries.
6. If errors are made in the logbook, cross a single line through the error and enter the correct information. All corrections shall be initialed and dated by the personnel performing the correction. If possible, all corrections should be made by the individual who made the error.
7. Daily entries will be made chronologically.
8. Information will be recorded directly in the field logbook during the work activity. Information will not be written on a separate sheet and then later transcribed into the logbook.
9. Each page of the logbook will have the date of the work and the note takers initials.
10. The final page of each day's notes will include the note-takers signature as well as the date.
11. Only information relevant to the subject project will be added to the logbook.
12. The field notes will be copied and the copies sent to the Project Manager or designee in a timely manner (at least by the end of each week of work being performed).

B. Information to be Included in Field Logbooks

1. Entries into the logbook should be as detailed and descriptive as possible so that a particular situation can be recalled without reliance on the collector's memory. Entries must be legible and complete.
2. General project information will be recorded at the beginning of each field project. This will include the project title, the project number, and project staff.
3. Scope: Describe the general scope of work to be performed each day.
4. Weather: Record the weather conditions and any significant changes in the weather during the day.

5. Tail Gate Safety Meetings: Record time and location of meeting, who was present, topics discussed, issues/problems/concerns identified, and corrective actions or adjustments made to address concerns/ problems, and other pertinent information.
6. Standard Health and Safety Procedures: Record level of personal protection being used (e.g., level D PPE), record air monitoring data on a regular basis and note where data were recording (e.g., reading in borehole, reading in breathing zone, etc). Also record other required health and safety procedures as specified in the project specific health and safety plan.
7. Instrument Calibration; Record calibration information for each piece of health and safety and field equipment.
8. Personnel: Record names of all personnel present during field activities and list their roles and their affiliation. Record when personnel and visitors enter and leave a project site and their level of personal protection.
9. Communications: Record communications with project manager, subcontractors, regulators, facility personnel, and others that impact performance of the project.
10. Time: Keep a running time log explaining field activities as they occur chronologically throughout the day.
11. Deviations from the Work Plan: Record any deviations from the work plan and document why these were required and any communications authorizing these deviations.
12. Health and Safety Incidents: Record any health and safety incidents and immediately report any incidents to the Project Manager.
13. Subcontractor Information: Record name of company, record names and roles of subcontractor personnel, list type of equipment being used and general scope of work. List times of starting and stopping work and quantities of consumable equipment used if it is to be billed to the project.
14. Problems and Corrective Actions: Clearly describe any problems encountered during the field work and the corrective actions taken to address these problems.
15. Technical and Project Information: Describe the details of the work being performed. The technical information recorded will vary significantly between projects. The project work plan will describe the specific activities to be performed and may also list requirements for note taking. Discuss note-taking expectations with the Project Manager prior to beginning the field work.
16. Any conditions that might adversely affect the work or any data obtained (e.g., nearby construction that might have introduced excessive amounts of dust into the air).
17. Sampling Information: Specific information that will be relevant to most sampling jobs includes the following:
    - Description of the general sampling area – site name, buildings and streets in the area, etc.
    - Station/Location identifier

- Description of the sample location – estimate location in comparison to two fixed points – draw a diagram in the field logbook indicating sample location relative to these fixed points – include distances in feet.
- Sample matrix and type
- Sample date and time
- Sample identifier
- Draw a box around the sample ID so that it stands out in the field notes
- Information on how the sample was collected – distinguish between "grab," "composite," and "discrete" samples
- Number and type of sample containers collected
- Record of any field measurements taken (i.e., pH, turbidity, dissolved oxygen, and temperature, and conductivity)
- Parameters to be analyzed for, if appropriate
- Descriptions of soil samples and drilling cuttings can be entered in depth sequence, along with PID readings and other observations. Include any unusual appearances of the samples.

C. Suggested Format for Recording Field Data

1. Use the left side border to record times and the remainder of the page to record information (see attached example).
2. Use tables to record sampling information and field data from multiple samples.
3. Sketch sampling locations and other pertinent information.
4. Sketch well construction diagrams.

V. Attachments

- Example field notes.

(47) MAY 12, 2003 EXAMPLE

0715 ARRIVE ON SITE AT XYZ SITE.
CH2M HILL STAFF:
John Smith: FIELD TEAM LEADER
Bob Builder: SITE SAFETY COORD.
WEATHER: OVERCAST + COOL, 45°F
CHANCE OF LATE SHOWERS
SCOPE: • COLLECT GROUNDWATER SAMPLES FOR LTM WORK AT SITE 14
• SUPERVISE SURVEY CREW
AT SITE 17
0725 BB ~~CALIBRATES~~ (JS) CALIBRATES
PID: 101 ppm/100 ppm OK
PID Model #, SERIAL #
0730 BB CALIBRATES HORIBA METER
Model #, SERIAL #
→ LIST CALIBRATION RESULTS
0738 SURVEY CREW ARRIVES ON SITE
→ LIST NAMES
0745 BB HOLDS H+S TALK ON SLIPS, TRIPS, FALLS, TICKS + AIR MONITORING
JS + SURVEY CREW ATTEND
NO H+S ISSUES IDENTIFIED AS CONCERNS. ALL WORK IS IN "LEVEL D."
0755 JS CONDUCTS SITE-WIDE AIR MONITORING
ALL READINGS = 0.0 ppm IN

JS 5-12-03

MAY 12, 2003 EXAMPLE (48)

SITE 14 LTM
BREATHING ZONE (BZ)
0805 MOBILIZE TO WELL MW-22 TO SAMPLE, SURVEYORS SETTING UP AT SITE 17
0815 PM (PAUL PAPER PUSHER) CALLS AND INFORMS JS TO COLLECT GW SAMPLE AT WELL MW-44 TODAY FOR 24 hour TAT ANALYSIS OF VOCS
0820 PURGING MW-22
→ RECORD WATER QUALITY DATA

JS 5-12-03

0843 COLLECT SAMPLE AT MW-22 FOR total TAL Metals AND VOCs. No Dissolved Metals collected per PM
0905 JS + BB MOBILIZE TO SITE 17 TO SHOW SURVEYORS WELLS TO SURVEY
0942 MOBILIZE TO WELL MW-22 TO COLLECT SAMPLE
0950 CAN NOT ACCESS WELL MW-22 due to BASE OPERATIONS; CONTACT PAUL PAPERPUSHER AND HE STATED HE WILL CHECK ON GAINING ACCESS WITH BASE CONTACT.
0955 MOBILIZE TO WELL MW-19

JS 5-12-03

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STANDARD OPERATING PROCEDURE 002

General Considerations for PFAS Investigations

I. Purpose and Scope

This SOP describes the techniques to be used in conjunction with other approved standard operating procedures (SOPs) to conduct PFAS investigation.

II. Materials and Equipment

- Loose leaf paper without waterproof coating or a spiralbound notebook (not waterproof) or tablet (see tablet use notes below)
- Metal clip board (if using loose-leaf paper)
- Pen (not Sharpie)
- Personal Protective Equipment (PPE) to be PFAS free – confirm with PFAS SME to confirm which products are suitable if using non-standard PPE (i.e, personal floatation device (PFD) and waders)
- PFAS-free tubing (avoid Teflon, Viton, PTFE and other fluorinated compounds)
  - High density polyethylene (HDPE) tubing (unlined)
  - If Masterflex tubing is needed for peristaltic pumps, Cole Parmer C-Flex (06424 series) and Tygon E-3603 (06509 series) are suitable options
- Sample containers (HDPE bottle with HDPE screwcap unless conducting drinking water sampling), sample bottles should not be glass as glass may sorb PFAS. Sample bottle caps should not contain Teflon. Notify your project manager (PM) if bottles provided by the lab are glass or contain Teflon parts.
- Laboratory prepared deionized, certified PFAS-free water for field blank collection
- PFAS-free shipping supplies (labels [if available][1], coolers, and ice)
- Nitrile or latex gloves (powder-free gloves only)
- Durham Geoslope Water Level Indicators and the Solinst Model 101 with the P2 meter have been shown to be fluorine free.
  - PFAS-free Pump such as:
    - Geotech PFAS-free Portable Bladder Pump (note, most bladder pumps include a Teflon-lined bladder, but Geotech currently has one model which is Teflon-free).

[1] Efforts will be made to obtain PFAS-free labels; however, information on labels is scarce and labels are frequently mounted on PFAS-coated paper to allow for easy removal.

        - Panacea P120 or P125. The P200 Stainless Steel Pump may also be used, but the standard model contains Teflon at the tube connection. If you are using this Panacea model, you must request one with the "PTFE-free thread sealant option."
        - Waterra stainless foot-valve
        - QED Sample Pro
        - Monsoon or Mega Monsoon submersible pump
        - Grundfos Rediflo2 (this pump contains small Teflon components, but has not been shown to leach, it is less preferable than the other options)
        - Peristaltic pump (may be suitable for some sample locations)
    - Specifically, the following material should be avoided by the field team during sampling:
- Gore-Tex brand or similar high-performance outdoor clothing, clothing treated with ScotchGuard® brand or similar water repellent, fluoropolymer-coated Tyvek®, wrinkle-resistant fabrics, and fire-resistant clothing with fluorochemical treatment or anything advertised as water repellant.
- New clothing that has been washed fewer than six times.
- Weather-proof log books with fluorochemical coatings.
- Teflon or PTFE tape
- Fluorinate pipe dope

  Dry erase markers

III. Sampling Guidelines and Considerations

The sample collection area should be clear of the following items:

- Pre-packaged food wrappers (e.g., fast food sandwich wrappers, pizza boxes, etc.)
- Microwave popcorn bags
- Blue ice containers
- Non-stick aluminum foil
- Kim-Wipes
- Sunscreen, insect repellant and other personal hygiene products that may contain PFAS (contact your PFAS SME for an approved list of sunscreens and insect repellants)

The use of electronics (e.g., cell phones and tablets) should be avoided without the implementation of precautionary measures outlined below:

- All devices should be used with clean, ungloved hands and an approved stylus (if desired).
- Following the use of a device, hands must be washed with soap and water and clean gloves should be used prior to contact with sampling equipment (bottleware, tubing, etc.).
- Wash hands before sampling with dish detergent and don nitrile gloves.

- Affix labels immediately after samples have been collected and bottles have been closed, collect one sample at a time to ensure sample bottles are not mixed up.
- Place samples into Ziploc bags and then into a cooler immediately following sampling,

IV. Equipment Decontamination

Whenever possible, use disposable equipment when collecting samples. The use of any non-standard equipment must be approved by the SME to confirm the equipment does not contain any PFAS parts. If reusable equipment must be used, the equipment must be cleaned/decontaminated between uses. Alconox and Liquinox soap are acceptable for cleaning/decontaminating reusable equipment at PFAS sites. Any water used for cleaning/decontamination must be certified PFAS-free by a laboratory (or otherwise approved by the SME). Consider triple-rinsing. Once decontaminated, wrap equipment in plastic bags (such as Ziploc) or un-coated aluminum foil, and store away from potential PFAS sources.

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Decontamination of Personnel and Equipment

I. Purpose

To provide general guidelines for the decontamination of personnel, sampling equipment, and monitoring equipment used in potentially contaminated environments.

II. Scope

This is a general description of decontamination procedures.

III. Equipment and Materials

- Demonstrated analyte-free, deionized ("DI") water (specifically, ASTM Type II water or lab-grade DI water)
- Potable water; must be from a municipal water supplier, otherwise an analysis must be run for appropriate volatile and semivolatile organic compounds and inorganic chemicals (e.g., Target Compound List and Target Analyte List chemicals)
- 2.5% (W/W) Liquinox and water solution
- Pesticide-grade (90%) isopropanol in squeeze bottle
- Large plastic pails or tubs for Liquinox and water, scrub brushes, squirt bottles for Liquinox solution, and water, plastic bags and sheets
- DOT approved 55-gallon drum for disposal of waste
- Personal Protective Equipment as specified by the Health and Safety Plan
- Decontamination pad and steam cleaner/high pressure cleaner for large equipment

IV. Procedures and Guidelines

A. Personnel Decontamination

To be performed after completion of tasks whenever potential for contamination exists, and upon leaving the exclusion zone.

1. Wash boots in Liquinox solution, then rinse with water. If disposable latex booties are worn over boots in the work area, rinse with Liquinox solution, remove, and discard into DOT-approved 55-gallon drum.
2. Wash outer gloves in Liquinox solution, rinse, remove, and discard into DOT-approved 55-gallon drum.
3. Remove disposable coveralls ("Tyvek") and discard into DOT-approved 55-gallon drum.

4. Remove respirator (if worn).
5. Remove inner gloves and discard.
6. At the end of the workday, shower entire body, including hair, either at the work site or at home.
7. Sanitize respirator if worn.

B. Sampling Equipment Decontamination—Groundwater Sampling Pumps

Sampling pumps are decontaminated after each use as follows.

1. Don phthalate-free gloves.
2. Spread plastic on the ground to keep equipment from touching the ground
3. Turn off pump after sampling. Remove pump from well and remove and dispose of tubing. Place pump in decontamination tube.
4. Turn pump back on and recirculate 1 gallon of Liquinox solution through the sampling pump for a minute. Turn off the pump and containerize the used solution.
5. Turn pump back on and recirculate 1 gallon of tap water for a minute (deionized water may be substituted for tap water) Turn off the pump and containerize the used solution.
6. If pump was exposed to non-aqueous phase liquids remove pump from the tube and rinse lightly (a few cc's of solvent is sufficient) with isopropanol, over and through the pump, and allow to air dry. Note that isopropanol is highly flammable and should be used very sparingly and away from potential sources of ignition.
7. *Turn pump back on and recirculate 1 gallon of tap water for a minute (deionized water may be substituted for tap water) Turn off the pump and containerize the used solution.*
8. Keep decontaminated pump in decontamination tube or remove and wrap in aluminum foil or clean plastic sheeting.
9. Collect all rinsate and dispose of in a DOT-approved 55-gallon drum.
10. Decontamination materials (e.g., plastic sheeting, tubing, etc.) that have come in contact with used decontamination fluids or sampling equipment will be disposed of in either DOT-approved 55-gallon drums or with solid waste in garbage bags, dependent on Facility/project requirements.

C. Sampling Equipment Decontamination—Other Equipment

Reusable sampling equipment is decontaminated after each use as follows.

1. Don phthalate-free gloves.
2. Before entering the potentially contaminated zone, wrap soil contact points in aluminum foil (shiny side out).

3. Rinse and scrub with potable water.
4. Wash all equipment surfaces that contacted the potentially contaminated soil/water with Liquinox solution.
5. Rinse with potable water.
6. If equipment was exposed to non-aqueous phase liquids rinse lightly with isopropanol and allow to air dry.
7. Rinse with deionized water.
8. Completely air dry and wrap exposed areas with aluminum foil (shiny side out) for transport and handling if equipment will not be used immediately.
9. Collect all rinsate and dispose of in a DOT-approved 55-gallon drum.
10. Decontamination materials (e.g., plastic sheeting, tubing, etc.) that have come in contact with used decontamination fluids or sampling equipment will be disposed of in DOT-approved 55-gallon drums or with solid waste in garbage bags, dependent on Facility/project requirements.

D. Health And Safety Monitoring Equipment Decontamination

1. Before use, wrap soil contact points in plastic to reduce need for subsequent cleaning.
2. Wipe all surfaces that had possible contact with contaminated materials with a paper towel wet with Liquinox solution, and finally three times with a towel wet with distilled water. Solvents should not be used to clean plastic instruments as they could cause damage. Dispose of all used paper towels in a DOT-approved 55-gallon drum or with solid waste in garbage bags, dependent on Facility/project requirements.

E. Sample Container Decontamination

The outsides of sample bottles or containers filled in the field may need to be decontaminated before being packed for shipment or handled by personnel without hand protection. The procedure is:

1. Wipe container with a paper towel dampened with Liquinox solution or immerse in the solution AFTER THE CONTAINERS HAVE BEEN SEALED. Repeat the above steps using potable water.
2. Dispose of all used paper towels in a DOT-approved 55-gallon drum or with solid waste in garbage bags, dependent on Facility/project requirements.

F. Heavy Equipment and Tools

Heavy equipment such as drilling rigs, drilling rods/tools, and the backhoe will be decontaminated upon arrival at the site and between locations as follows:

1. Set up a decontamination pad in area designated by the Facility
2. Steam clean heavy equipment until no visible signs of dirt are observed. This may require wire or stiff brushes to dislodge dirt from some areas.

V. Attachments

None.

VI. Key Checks and Items

- Clean with solutions of Liquinox and distilled water.
- Use isopropanol only if heavy organic contamination is present, and then sparingly. Isopropanol should be allowed to evaporate rather than contained as it may render liquid investigation derived waste ignitable.
- Drum all contaminated rinsate and materials.
- Decontaminate filled sample bottles before relinquishing them to anyone.

Decontamination of Drilling Rigs and Equipment

I. Purpose and Scope

The purpose of this guideline is to provide methods for the decontamination of drilling rigs, downhole drilling tools, and water-level measurement equipment. Personnel decontamination procedures are not addressed in this SOP; refer to the site safety plan and SOP *Decontamination of Personnel and Equipment*. Sample bottles will not be field decontaminated; instead, they will be purchased with certification of laboratory sterilization.

II. Equipment and Materials

- Portable steam cleaner and related equipment
- Potable water
- 2.5% (W/W) Liquinox and water solution
- Buckets
- Brushes
- Isopropanol, pesticide grade
- Personal Protective Equipment as specified by the Health and Safety Plan
- ASTM–Type II grade water or Laboratory Grade Deionized Water
- Aluminum foil

III. Procedures and Guidelines

A. Drilling Rigs and Monitoring Well Materials

Before the onset of drilling, after each borehole, before drilling through permanent isolation casing, and before leaving the site, heavy equipment and machinery will be decontaminated by steam cleaning at a designated area. The steam-cleaning area will be designed to contain decontamination wastes and waste waters and can be an HDPE-lined, bermed pad. A pumping system will be used to convey decontaminated water from the pad to drums.

Surface casings may be steam cleaned in the field if they are exposed to contamination at the site prior to use.

B. Downhole Drilling Tools

Downhole tools will be steam cleaned before the onset of drilling, prior to drilling through permanent isolation casing, between boreholes, and prior to leaving the site. This will include, but is not limited to, rods, split spoons or similar samplers, coring equipment, augers, and casing.

Before the use of a sampling device such as a split-spoon sampler for the collection of a soil sample for physical characterization, the sampler shall be cleaned by scrubbing with a detergent solution followed by a potable water rinse.

Before the use of a sampling device such as a split-spoon sampler for the collection of a soil sample for chemical analysis, the sampler shall be decontaminated following the procedures outlined in the following subsection.

C. Field Analytical Equipment

1. Water Level Indicators

   Water level indicators that consist of a probe that comes into contact with the groundwater must be decontaminated using the following steps:

   – Rinse with Liquinox and water solution

   – Rinse with de-ionized water

   – Solvent rinse with isopropanol (optional)

   – Rinse with deionized water

2. Probes

   Probes, for example, pH or specific ion electrodes, geophysical probes, or thermometers that would come in direct contact with the sample, will be decontaminated using the procedures specified above unless manufacturer's instructions indicate otherwise. For probes that make no direct contact, for example, PID equipment, the probe will be wiped with clean paper-towels or cloth wetted with isopropanol.

IV. Attachments

None.

V. Key Checks and Preventative Maintenance

The effectiveness of field cleaning procedures may be monitored by rinsing decontaminated equipment with organic-free water and submitting the rinse water in standard sample containers for analysis.

Disposal of Waste Fluids and Solids

I. Purpose and Scope

This SOP describes the procedures used to dispose of hazardous fluid and solid materials generated as a result of the site operations. This SOP does not provide guidance on the details of Department of Transportation regulations pertaining to the transport of hazardous wastes; the appropriate Code of Federal Regulations (49 CFR 171 through 177) should be referenced. Also, the site investigation-derived waste management plan should be consulted for additional information and should take precedence over this SOP.

II. Equipment and Materials

A. Fluids

- DOT-approved 55-gallon steel drums or frac tanks
- Tools for securing drum lids
- Funnel for transferring liquid into drum
- Labels
- Paint Pens
- Marking pen for appropriate labels
- Seals for 55-gallon steel drums

B. Solids

- DOT-approved 55-gallon steel drums or rolloffs
- Tools for securing drum lids
- Paint Pens
- Plastic sheets
- Labels
- Marking pen for appropriate labels

III. Procedures and Guidelines

A. Methodology

Clean, empty drums or roll-offs or frac tanks will be brought to the site by the drilling subcontractor for soil and groundwater collection and storage. The empty drums will be located

at the field staging area and moved to drilling locations as required. The drums will be filled with the drilling and well installation wastes (fill drum ¾, not to top), capped, sealed, and moved to the onsite drum storage area by the drilling subcontractor. The full drums will separate types of wastes by media. The drums will be labeled as they are filled in the field and labels indicating that the contents are pending analysis affixed.

The drum contents will be sampled to determine the disposal requirements of the drilling wastes. Check with the Environmental Manager (EM) assigned to the project prior to sample collection for frequency and analysis. Unless otherwise specified by the EM, the drum sampling will be accomplished through the collection and submittal of composite samples, one sample per 10 drums (check with disposal facility to determine sample frequency) containing the same media. Similar compositing will be performed in each rolloff to obtain a representative sample. The compositing of the sample will be accomplished by collecting a specific volume of the material in each drum into a large sample container. When samples from each of the drums being sampled in a single compositing are collected, the sample will be submitted for TCLP, ignitability, corrosivity, and reactivity analysis. Additional analysis may be required by your EM.

If rolloffs are used, compositing and sampling of soil will comply with applicable state and federal regulations.

B. Labels

Drums and other containers used for storing wastes from drilling operations will be labeled when accumulation in the container begins. Analysis pending labels should be used initially. Labels will include the following minimum information:

- Container number
- Container contents
- Origin (source area including individuals wells, piezometers, and soil borings)
- Date that accumulation began
- Date that accumulation ended
- Generator Contact Information
- When laboratory results are received, drum labels will be completed or revised to indicate the hazardous waste constituents in compliance with Title 40 of the Code of Federal Regulations, Part 262, Subpart C if the results indicate hazardous waste or labeled as non-hazardous if applicable.

C. Fluids

Drilling fluids generated during soil boring and groundwater discharged during development and purging of the monitoring wells will be collected in 55-gallon, closed-top drums. When a drum is filled, the bung will be secured tightly. Fluids may also be transferred to frac tanks after being temporarily contained in drums to minimize the amount of drums used.

When development and purging is completed, the water will be tested for appropriate hazardous waste constituents as per instruction from the project EM. Compositing and sampling of fluids will comply with applicable state and federal regulations.

D. Solids

The soil cuttings from well and boring drilling will constitute a large portion of the solids to be disposed of.

The solid waste stream also will include plastic sheeting used for decontamination pads, Tyveks, disposable sampling materials, and any other disposable material used during the field operations that appears to be contaminated. These materials will be placed in designated drums.

E. Storage and Disposal

The wastes generated at the site at individual locations will be transported to the drum storage area by the drilling services subcontractor. Drums should be stored on plastic sheeting with a short berm wall (hay bales or 2 x 4 planks or equivalent) to capture small spills. The drums should be staged such that the labels are all visible and there should be enough room to walk between rows of drums if applicable.

Waste solid materials that contain hazardous constituents will be disposed of at an offsite location in a manner consistent with applicable solid waste, hazardous waste, and water quality regulations. Transport and disposal will be performed by a commercial firm under subcontract.

The liquid wastes meeting acceptable levels of discharge contamination may be disposed of through the sanitary sewer system at the site. However, prior to disposal to the sanitary sewer system, approval and contract arrangements will be made with the appropriate authorities. Wastes exceeding acceptable levels for disposal through the sanitary sewer system will be disposed of through contract with a commercial transport and disposal firm.

IV. Attachments

None.

V. Key Checks and Preventative Maintenance

- Contact the project Environmental Manager prior to containerizing waste to determine containerization method and sampling frequency and analysis.
- Check that representative samples of the containerized materials are obtained.
- Be sure that all state and federal regulations are considered when classifying waste for disposal.

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Field Measurement of pH, Specific Conductance, Turbidity, Dissolved Oxygen, ORP, and Temperature Using a Water Quality Meter with Flow-Through Cell

I. Purpose and Scope

The purpose of this procedure is to provide a general guideline for using a water quality meter for field measurements of pH, specific conductance, turbidity, dissolved oxygen, oxidation-reduction potential (ORP), and temperature of aqueous samples. The operator's manual should be consulted for detailed operating procedures.

II. Equipment and Materials

- Water Quality Monitoring System with flow-through cell (Horiba, YSI, In-Situ, Ion Science, etc.)
- Calibration Standard Solution(s) (provided by rental company)
- Deionized water in spray bottle

III. Procedures and Guidelines

A. General Parameters and Specifications:

Note: the general parameters listed below may not be available for every type of meter used. Please refer to the specific meter's manual to determine meter's range of measurement and accuracy.

Parameter	Range of measurement	Accuracy
pH	0 to 14 pH units	+/- 0.1 pH units
Specific conductance	0 to 9.99 S/m	+/- 3 % full scale
Turbidity	0 to 800 NTU	+/- 5 % full scale
Dissolved oxygen	0 to 19.99 mg/l	+/- 0.2 mg/l
Temperature	0 to 55 ^{o}C	+/- 1.0 ^{o}C
ORP	-999 to +999 mV	+/- 15 mV
Salinity	0 to 4 %	+/- 0.3 %

B. Calibration:

Prior to each day's use, clean the probe and flow-through cell using deionized water and calibrate using the Standard Solution. Refer to the specific instrumentation manual for the proper calibration methods.

C. Sample Measurement:

The water quality probes are inserted into a flow-through cell, and the purged groundwater is directed through the cell by connecting the pump discharge tubing to the bottom port on the flow through cell, allowing measurements to be collected before the water contacts the atmosphere. The flow-through cell should be positioned out of direct sunlight to reduce solar heating, and wrapped in aluminum foil to minimize heat loss or gain.

As water passes through the flow-through the flow cell, press MEAS to obtain readings or the readings are displayed on the meter for each parameter (dependent on the type of meter used). Record the water quality parameter data in a field notebook.

Once the parameters have stabilized (see *Low-Flow Groundwater Sampling from Monitoring Wells – EPA Region I and III* or *Low-Flow Groundwater Sampling from Monitoring Wells – EPA Region IV* depending on project site location), remove the tubing from the bottom port of the flow-through cell.

Never collect a groundwater sample for laboratory analysis from the flow-through cell. Rinse the flow-through cell between wells to remove any sediment buildup within the cell.

IV. Key Checks and Preventive Maintenance

- Calibrate meter
- Clean probe with deionized water when done
- Refer to operations manual for recommended maintenance and troubleshooting
- Check batteries, and have a replacement set on hand
- Due to the importance of obtaining these parameters, the field team should have a spare unit readily available in case of an equipment malfunction

Multi RAE Photoionization Detector (PID)

I. Purpose

The purpose of this SOP is to provide general reference information for using the Multi RAE PID in the field. Calibration and operation, along with field maintenance, will be included in this SOP.

II. Scope

This procedure provides information on the field operation and general maintenance of the Multi RAE PID. Review of the information contained herein will ensure that this type of field monitoring equipment will be properly utilized. Review of the owner's instruction manuals is a necessity for more detailed descriptions.

III. Definitions

Carbon Monoxide Sensor (CO) - Carbon Monoxide concentration in ppm.

Volatile Organic Compound (VOC) – VOC concentration in ppm

Lower Explosive Limit (LEL) - Combustible gas is expressed as a percent of the lower explosive limit.

Hydrogen Sulfide Sensor (H_2S) - Hydrogen Sulfide concentration in ppm.

Oxygen Sensor (OXY) - Oxygen concentration as a percentage.

ppm - parts per million: parts of vapor or gas per million parts of air by volume.

IV. Procedures

The PID operates on the principle that most organic compounds and some inorganic compounds are ionized when they are bombarded by high-energy ultraviolet light. The air sample is drawn across a UV lamp using a pump or a fan. The energy of the lamp determines whether a particular chemical will be ionized. Each chemical compound has a unique photoionization potential (PIP). When the UV light energy is greater than the ionization potential of the chemical, ionization will occur. All PID readings are relative to the calibration gas, usually isobutylene.

It is important to calibrate the PID in the same temperature and elevation that the equipment will be used, and to determine the background concentrations in the field before taking measurements. For environments where background readings are high, factory zero calibration gas should be used.

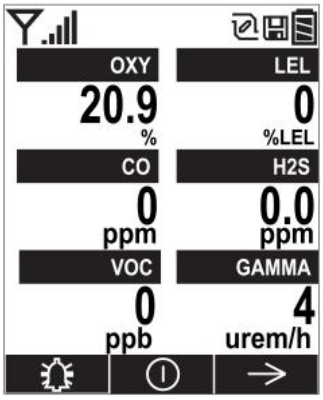
Note: For volatile and semi-volatile compounds, knowing the PIP is critical in determining the appropriate instrument to use when organic vapor screening. Consult the QAPP and manufacturer's manual to determine that the proper instrument has been selected for the contaminate vapors of interest. If an expected compound at a site has a PIP less than 11.7 eV, it is possible to use a PID. If the ionization potential is greater than 11.7eV, a flame-ionization detector is required.

The following subsections will discuss Mini RAE calibration, operation, and maintenance. These sections, however, do not take the place of the instruction manual.

A. Calibration

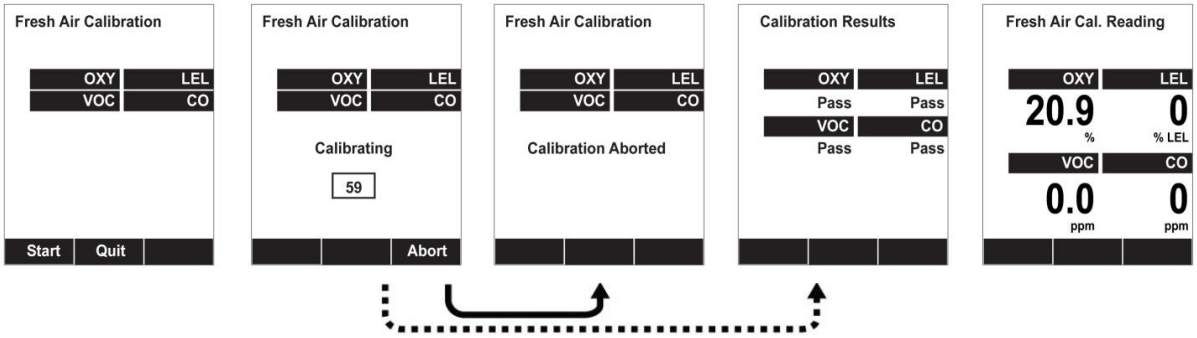
For Multi RAE configured with O_2, LEL, H_2S, CO, sensors and a 10.6 eV PID Lamp.

1. Start up Instrument
    - Press Mode button
    - A RAE Systems logo (or a company name) should appear first. This is followed by a progression of screens that tell you the MultiRAE's current settings:
        - Product name and model number, air flow type, and serial number
        - Application firmware version, build date, and build time
        - Sensor firmware, build date, build time
        - Installed sensors (including serial number/production/expiration/calibration date and alarm limit settings)
        - Current date, time, temperature, and relative humidity
        - User mode and operation mode
        - Battery type, voltage, shutoff voltage
        - Alarm mode and alarm settings
        - Datalog period (if it is activated) and interval
        - Policy Enforcement settings (whether calibration and/or bump testing are enforced)
    - Then the MultiRAE's main reading screen appears. It may take a few minutes for sensors to show a reading, so if any have not warmed up by the time the main screen is shown, you will see "- - -" instead of a numerical value until the sensor provides data (typically less than 2 minutes). Then it displays instantaneous readings similar to the following screen (depending on the sensors installed) and is ready for use.



2. Calibration Check and Adjustment
    - Zero Calibration
    - At the Calibration Menu, select “Fresh Air.” Press [Y/+] once to enter the fresh air calibration sub-menu.

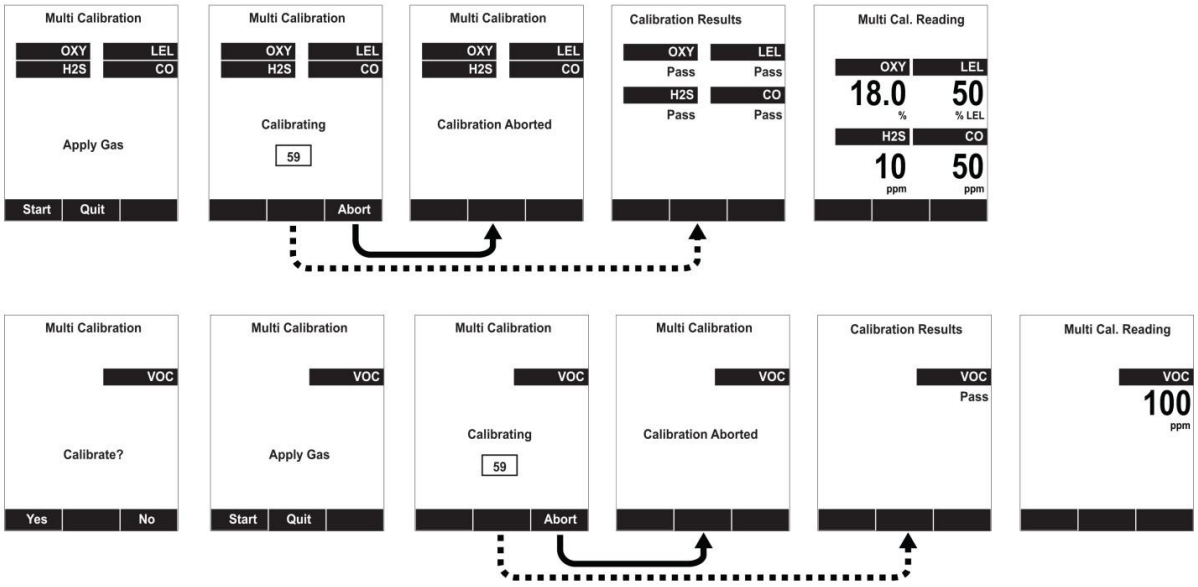
    - Press **[Y/+]** to start fresh air calibration
    - A countdown screen appears. You can abort the calibration at any time during the countdown by pressing [N/-].



    - Note: Dotted line indicates automatic progression
    - If the calibration is not aborted, the display shows the sensor names and tells you whether the fresh air calibration passed or failed, followed by the sensors’ fresh air readings

3. Multi Sensor Span Calibration
    - Depending on the configuration of your MultiRAE and span gas you have, you can perform a span calibration simultaneously on multiple sensors. You can define which sensors are calibrated together using the Multi Cal Select menu described in section 8.3.2.9.

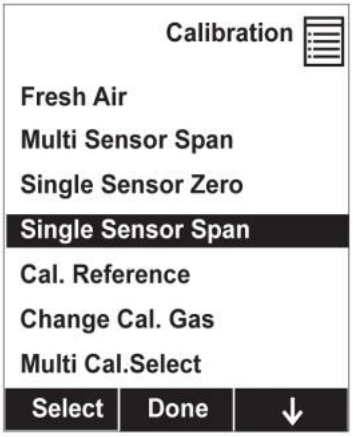
- In case all sensors in the instrument cannot be calibrated with the same gas, the MultiRAE will intelligently split the span calibration process into several steps and will provide menu prompts accordingly.
- At the Calibration Menu, select “Multi Sensor Span.”
- Install the calibration adapter and connect it to a source of calibration gas.
- Start the flow of calibration gas.
- Press **[Y/+]** to start calibrating or wait for calibration to start automatically.
- A countdown screen is shown. You can abort the calibration at any time during the countdown by pressing **[N/-]**.



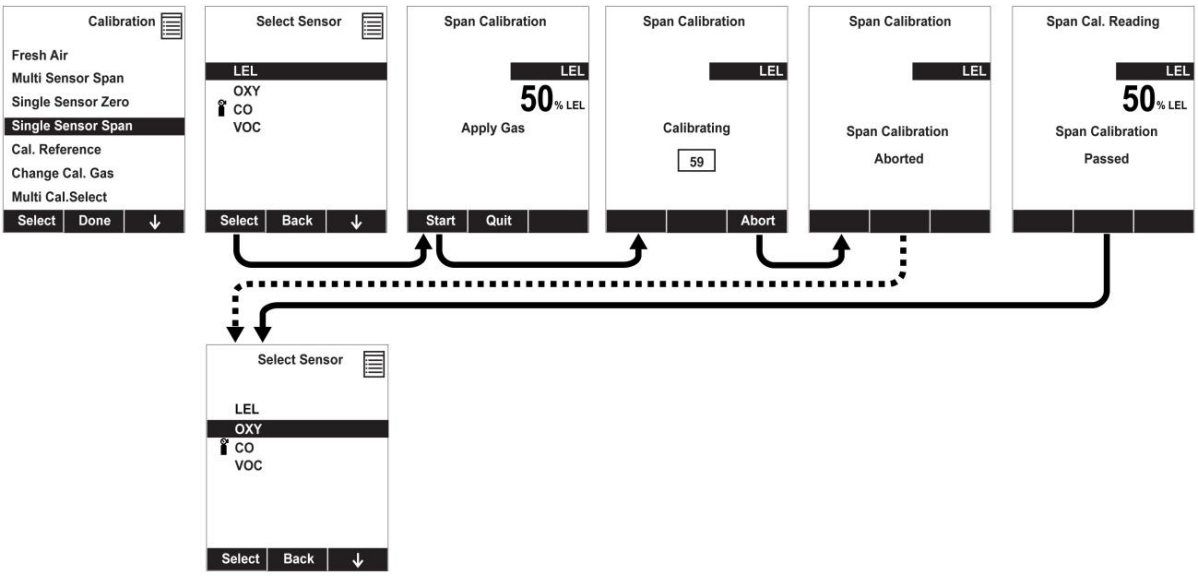
- Note: Dotted line indicates automatic progression
- If the calibration is not aborted, the display shows the sensor names and tells you whether the calibration passed or failed, followed by the sensor readings.

4. Single Sensor Span Calibration
   - Instead of performing a span calibration on multiple sensors simultaneously, you can select a single sensor and perform a span calibration.
   - To perform span calibration of an individual sensor, follow these steps:
   - At the Calibration Menu, select “Single Sensor Span.”
   - Select a sensor to calibrate from the list.
   - Install the calibration adapter and connect it to a source of calibration gas.

- Verify that the displayed calibration value meets the concentration specified on the gas cylinder.
- Start the flow of calibration gas.



- Press [Y/+] to start calibrating or wait for calibration to start automatically.
- A countdown screen appears. You can abort the calibration at any time during the countdown by pressing [N/-].



- Note: Dotted line indicates automatic progression
- Select the done button when calibration is complete.
- **CALIBRATION IS COMPLETE!**

5. Operation
    - Due to the Multi RAE having many functions in terms of operation, it is recommended that you follow the operational procedures as outlined in the instruction manual.
6. Site Maintenance
    - After each use, the meter should be recharged and the outside of the instruments should be wiped clean with a soft cloth.
7. Scheduled Maintenance

Function	Frequency
Check alarm and settings	Monthly/before each use
Clean screens and gaskets around sensors	Monthly
Replace sensors	Biannually or when calibration is unsuccessful

V. Quality Assurance Records

Quality assurance records will be maintained for each air monitoring event. The following information shall be recorded in the field logbook.

- Identification - Site name, date, location, CTO number, activity monitored, (surface water sampling, soil sampling, etc.), serial number, time, resulting concentration, comments and identity of air monitoring personnel.
- Field observations - Appearance of sampled media (if definable).
- Additional remarks (e.g., Multi RAE had wide range fluctuations during air monitoring activities.)

VI. References

Multi RAE User's Guide, RAE Systems, Revision C, May 2013.

Installation of Monitoring Wells by Sonic Drilling

I. Purpose and Scope

The purpose of this guideline is to describe methods for drilling and installation of groundwater monitoring wells and piezometers in unconsolidated or poorly consolidated materials using sonic drilling techniques. Sonic drilling technology potentially eliminates telescoping monitoring wells, allowing the installation of aquifer penetrating, single-cased wells.

II. Equipment and Materials

A. Drilling

1. Sonic drilling rig without per- and polyfluoroalklyl substances (PFAS)-containing components (Avoid Teflon, Viton, PTFE and all other fluorinated compounds). This includes drilling and well development equipment.
2. Override casings and core barrel
3. Ensure the driller has not used and will not use drilling lube containing polytetrafluoroethylene (PFTE) or any other fluorine-containing substance. Biolube has been determined to be an acceptable substitute.
4. Do not use water from the facility (e.g., fire hydrants) for decontamination of equipment or preparation of grout mix if there is a possibility that the water available is contaminated with PFAS.

B. Well Riser/Screen

1. Polyvinyl chloride (PVC), Schedule 40, minimum 2-inch ID, flush-threaded riser; alternatively, stainless steel riser
2. PVC, Schedule 40, minimum 2-inch ID, flush-threaded, factory slotted screen; alternatively, stainless-steel screen.

C. Bottom Cap

1. PVC, threaded to match the well screen; alternatively, stainless-steel
2. Centering guides (if used)

D. Well Cap

1. Above-grade well completion: PVC, threaded or push-on type, vented
2. Flush-mount well completion: PVC, locking, leak-proof seal
3. Stainless-steel to be used as appropriate

E. Sand

1. Clean silica sand, provided in factory-sealed bags, well-rounded, containing no organic material, anhydrite, gypsum, mica, or calcareous material; primary (coarse – e.g., Morie #1) filter pack, and secondary (fine sand seal) filter pack. Grain size determined based on sediments observed during drilling.

F. Bentonite

1. PFAS-free Pure, additive-free bentonite pellets
2. PFAS-free Pure, additive-free powdered bentonite
3. PFAS-free Coated bentonite pellets; coating must biodegrade within 7 days
4. Cement-Bentonite Grout: proportion of 6 to 8 gallons of water per 94-pound bag of Portland cement; 3 pounds of bentonite added per bag of cement to reduce shrinkage

G. Protective Casing

1. Above-grade well completion: 6-inch minimum ID black iron steel pipe with locking cover, diameter at least 2 inches greater than the well casing, painted with epoxy paint for rust protection; heavy duty lock; protective posts if appropriate
2. Flush-mount well completion: 8-inch or 12-inch dia. manhole cover, or equivalent; rubber seal to prevent leakage

H. Well Development

1. Surge block
2. Well-development pump and associated equipment
3. Calibrated meters to measure pH, temperature, specific conductance, and turbidity of development water
4. Containers (e.g., 55-gallon drums) for water produced from well.

III. Procedures and Guidelines

A. Drilling Method

1. Drill rods and core barrel with a minimum 6-inch inside diameter (ID) will be used to drill monitoring well boreholes. Continuous core soil samples (4-inches outside diameter) will be collected for lithologic classification and intervals may be selected for chemical analysis. Soil sampling procedures are detailed in SOP *Shallow Soil Sampling.*
2. The use of water and additives to assist in sonic drilling for monitoring well installation will be minimized, unless required for such conditions as running sands or drilling bedrock formations.

3. Override casings, core barrels, and other downhole drilling tools will be decontaminated prior to the initiation of drilling activities and between each borehole location. Core barrels and other downhole soil sampling equipment will also be decontaminated before and after each use. SOP *Decontamination of Drilling Rigs and Equipment* details proper decontamination procedures.
4. Drill cuttings and decontamination fluids generated during well drilling activities will be contained according to the procedures detailed in the Sampling and Analysis Plan.

B. Monitoring Well Installation

1. Sonic drilling technology eliminates the necessity to install double or triple cased wells since the borehole will be fully cased during drilling activities. Monitoring wells will be constructed inside the override casing(s), once the borehole has been advanced to the desired depth. Following setting the well screen, riser, filter pack, and bentonite seal, the well will be grouted as the temporary casing is withdrawn, preventing cross contamination. If the borehole has been drilled to a depth greater than that at which the well is to be set, the borehole will be backfilled with bentonite pellets or a bentonite-cement slurry to a depth approximately 2 feet below the intended well depth. Approximately 2 feet of clean sand will be placed on top of the bentonite to return the borehole to the proper depth for well installation.
2. The appropriate lengths of well screen, nominally 10 feet (with bottom cap), and casing will be joined watertight and lowered inside the temporary casing to the bottom of the borehole. Centering guides, if used, will be placed at the bottom of the screen and above the interval in which the bentonite seal is placed.
3. A primary sand pack consisting of clean Morie No. 00 (or DSI No.1) silica sand for 0.010-inch slotted screen and Morie No. 01 (or DSI No.2) silica sand for 0.020-inch slotted screen will be placed around the well screen. The sand will be placed into the borehole at a uniform rate, in a manner that will allow even placement of the sand pack. The inner-most override casing will be raised gradually during sand pack installation to avoid caving of the borehole wall; at no time will the innermost override casing be raised higher than the top of the sand pack during installation. During placement of the sand, the position of the top of the sand will be continuously sounded. The primary sand pack will extend from the bottom of the borehole to a minimum of 2 feet above the top of the well screen. A secondary, finer-grained sand pack may be installed for a minimum of 1 foot above the coarse sand pack. Heights of the coarse and fine sand packs and bentonite seal may be modified in the field to account for a shallow water table and small saturated thickness of the surficial aquifer.
4. A bentonite seal at least 2 feet thick will be placed above the sand pack. The seal will be placed into the borehole in a manner that will prevent bridging. The position of the top of the bentonite seal will be verified using a weighted tape measure. If all or a portion of the bentonite seal is above the water table, clean water will be added to hydrate the bentonite. A hydration period of at least 30 minutes will be required following installation of the bentonite seal.