Naval Facilities Engineering Systems Command Northwest

Final

2021 Groundwater Monitoring Report

OPERABLE UNIT 1

NAVAL BASE KITSAP KEYPORT
KEYPORT, WASHINGTON

April 2023

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NAVAL BASE KITSAP KEYPORT
BREMERTON, WASHINGTON

April 2023

Prepared for:
Department of the Navy
Naval Facilities Engineering Systems Command Northwest
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Final
2021 Groundwater Monitoring Report
Operable Unit 1
Naval Base Kitsap Keyport
Keyport, Washington

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Acronyms and Abbreviations

µg/L ..... *microgram(s) per liter*

bgs ..... *below ground surface*

COC ..... *chemical of concern*

DO ..... dissolved oxygen

DoD ..... *Department of Defense*

DON ..... *Department of the Navy*

EA ..... *EA Engineering, Science, and Technology, Inc., PBC*

Ecology ..... *Washington State Department of Ecology*

EPA ..... *U.S. Environmental Protection Agency*

FS ..... *Feasibility Study*

LTM ..... *long-term monitoring*

msl ..... *mean sea level*

NAVFAC NW ..... *Naval Facilities Engineering Systems Command Northwest*

NBK ..... *Naval Base Keyport*

ORP ..... oxidation reduction potential

OU ..... *Operable Unit*

PA ..... *Preliminary Assessment*

PCB ..... *polychlorinated biphenyl*

PFAS ..... *per- and polyfluoroalkyl substances*

PFBS ..... *perfluorobutanesulfonic acid*

PFOA ..... *perfluorooctanoic acid*

PFOS ..... *perfluorooctanesulfonic acid*

RI ..... *Remedial Investigation*

ROD ..... *Record of Decision*

RSL ..... *Regional Screening Level*

SAP ..... *Sampling and Analysis Plan*

THQ..... *target hazard quotient*

VOC ..... *volatile organic compound*

1 Introduction

This report summarizes and evaluates the December 2021 groundwater monitoring results for Operable Unit (OU) 1, consisting of Area 1, the former base landfill, at Naval Base Kitsap (NBK) Keyport, Washington. The locations of NBK Keyport and OU 1 are depicted on Figures 1-1 through 1-3 in relationship to surrounding properties and other features.

Field activities were performed by EA Engineering, Science, and Technology, Inc., PBC (EA) in December 2021 and included groundwater gauging and sampling in accordance with the Tier I Sampling and Analysis Plan (SAP, Department of the Navy [DON] 2021).

EA conducted this work for Naval Facilities Engineering Systems Command Northwest (NAVFAC NW) under Contract No. N44255-20-D-6006, Task Order N4425521F4076.

1.1 Site Description and Background

NBK Keyport occupies 340 acres (including tidelands) adjacent to Keyport in Kitsap County, Washington, on a small peninsula in the central portion of the east side of the Puget Sound. The peninsula is bordered by Liberty Bay to the northwest, north, and northeast and by Port Orchard inlet to the east and southeast.

Marine and brackish water bodies on and near the site consist of Liberty Bay, Dogfish Bay, the tide flats, a marsh, and a shallow lagoon. Freshwater bodies include two creeks discharging into the marsh pond and two creeks discharging into the lagoon.

The topography of the site rises gently from the shoreline to an average of 25 to 30 feet above mean sea level (msl), and then rises steeply at the southeast corner of the site to approximately 130 feet above msl.

The NBK Keyport property was acquired by the DON in 1913 and first used as a quiet water range for torpedo testing. The base was expanded during World Wars I and II. During the early 1960s, manufacturing and fabrication operations such as welding, metal plating, carpentry, and sheet metal work were added. In 1978, the facility's function broadened to include various undersea warfare weapons and systems engineering and development activities. Operations currently include test and evaluation, in-service engineering, maintenance and repair, and fleet readiness and industrial base support for undersea weapons systems, countermeasures, and sonar systems.

NBK Keyport OU 1 consists of Area 1, which is the Former Base Landfill and adjacent potentially impacted areas to the northwest, west, and south. The former landfill comprises approximately 9 acres in the western part of the base, located adjacent to a wetland area and the tide flats that flow into Dogfish Bay. Most of the landfill area was formerly a marshland. The landfill was the primary disposal area for both domestic and industrial wastes generated by the base from the 1930s until closure of the landfill in 1973. A burn pile for trash and demolition debris was located at the north end of the landfill from the 1930s to the 1960s. Unburned or partially burned materials from this pile were buried in the landfill or pushed into the marsh. A trash incinerator was operated at the north end of the landfill from the 1930s to the 1960s, and incinerator ash was disposed of in the landfill. Burning continued at the landfill until the early 1970s.

The base of the landfill is not lined, and the top is covered with areas of grass, trees, concrete, and asphalt. Data generated to date indicate that the unlined landfill is an ongoing source of groundwater contamination, which may impact downgradient groundwater, surface water, and sediments.

1.2 Previous Investigations

In September 1984, the DON began the investigation and assessment of OU 1 to identify areas of environmental contamination resulting from past site activities and to select environmental remedies. A Remedial Investigation (RI)/Feasibility Study (FS) process and human health and ecological risk assessments for OU 1 were completed in 1993 (DON 1993a, 1993b, and 1993c). A focused FS was completed in 1997 for OU 1 (DON 1997). The additional data collected in 1995 and 1996 to supplement the RI were used to evaluate two new pathways, as summarized in the human health risk section of the OU1 Record of Decision (ROD). The two pathways evaluated were risks to current and future seafood harvesters in the tide flats and Dogfish Bay and current and future off-site residential domestic use of groundwater from what was then thought to be the intermediate aquifer (DON 1993b and 1993c).

The OU 1 ROD was executed in September 1998 by United States (DON, U.S. Environmental Protection Agency [EPA], and Washington State Department of Ecology [Ecology]). The ROD specifies the maintenance of phytoremediation plantations and cover over the landfill; maintenance of a tide gate; implementation and monitoring of

LEGEND

- NBK Keyport Boundary
- Former Landfill

FIGURE 1-1
NAVAL BASE KEYPORT
VICINITY MAP

2021 GROUNDWATER
MONITORING REPORT
OPERABLE UNIT 1
NAVAL BASE KITSAP KEYPORT
KEYPORT, WA

Source: Sealaska 2019 Map Date: 11/29/2022

Path: \\eafp\departments\Federal\NAVFAC NW LTM_LTO\GIS\Keyport\21F4076\OU1_PFAS_Rpt\21F4076_Fig1-1_KeyportVicinity_rev.mxd

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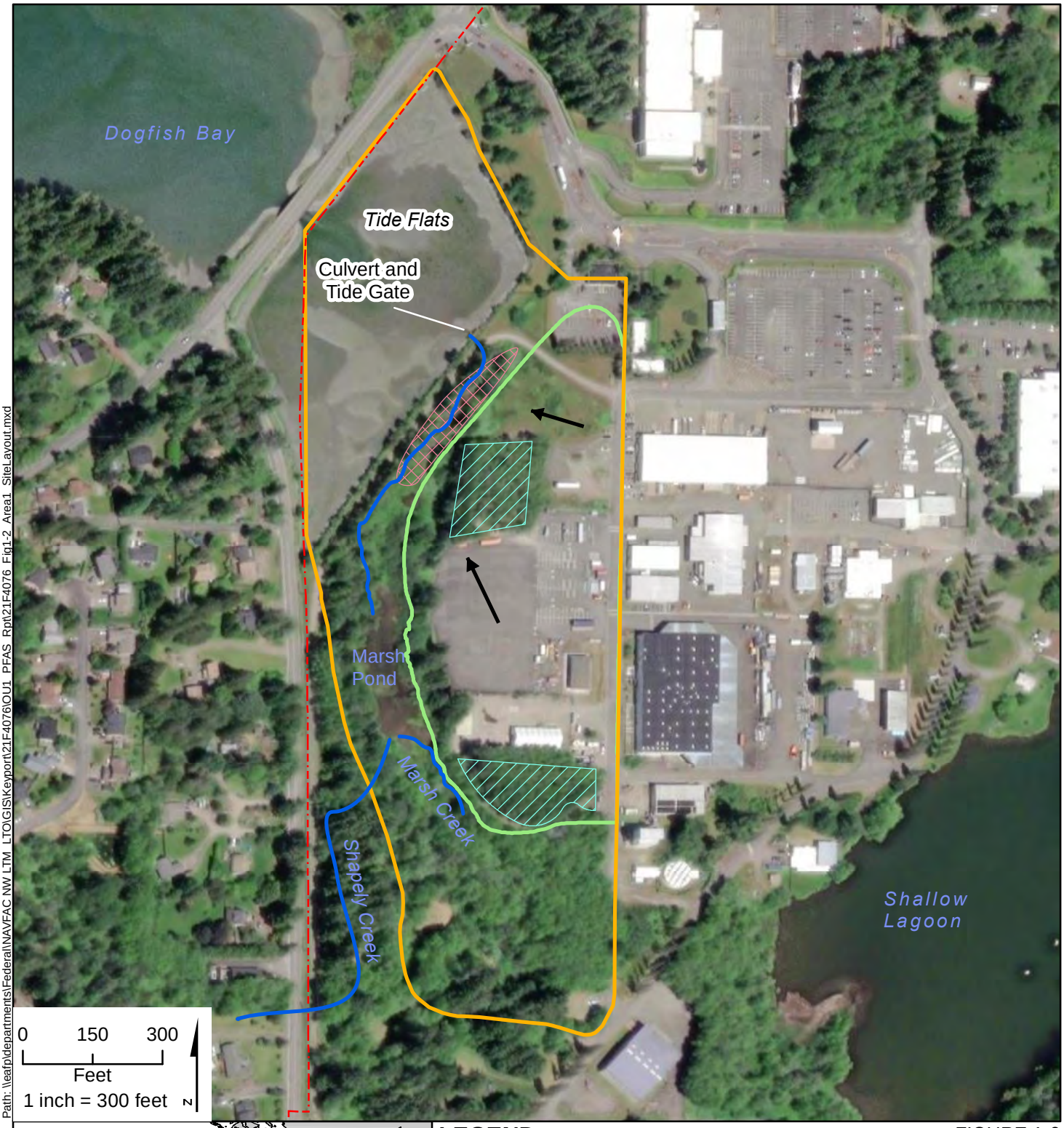

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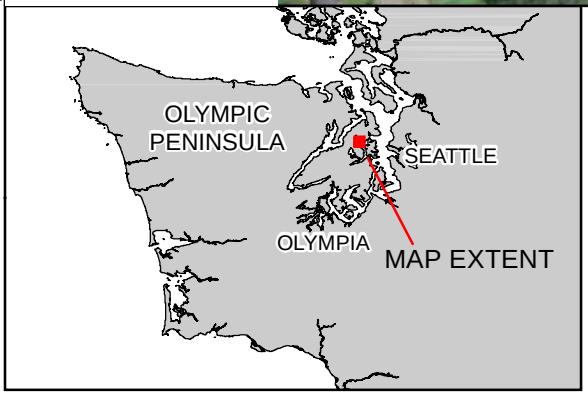

LEGEND

- OU 1
- 1999 Sediment Removal Area
- Phytoremediation Plantation
- NBK Keyport Boundary
- Former Landfill
- Groundwater Flow Direction

FIGURE 1-2
OU 1 SITE LAYOUT

2021 GROUNDWATER MONITORING REPORT
OPERABLE UNIT 1
NAVAL BASE KITSAP KEYPORT
KEYPORT, WA

Source: Sealaska 2019

Map Date: 11/29/2022

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LEGEND

- Monitoring Well Sampled in December 2021
- NBK Keyport Boundary
- OU 1, Area 1
- Former Landfill
- Phytoremediation Plantation

FIGURE 1-3
OU 1 SAMPLE LOCATIONS

2021 GROUNDWATER
MONITORING REPORT
OPERABLE UNIT 1
NAVAL BASE KITSAP KEYPORT
KEYPORT, WA

Map Date: 11/29/2022

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institutional controls; and long-term monitoring (LTM) of groundwater, surface water, a groundwater seep, sediment, and marine tissue.

Based on the original RI (DON 1993a) and the supplemental data assessment, two classes of contaminants were identified as chemicals of concern (COCs): chlorinated volatile organic compounds (VOCs) and polychlorinated biphenyls (PCBs). The chlorinated VOCs were identified as COCs based on the drinking water and seafood ingestion pathways. PCBs were identified as COCs based on the seafood ingestion and ecological pathways. Although not listed as a COC in the ROD, 1,4-dioxane was first added to the groundwater analyte list as an emergent contaminant in 2006.

As discussed in the *Preliminary Assessment for Per- and Polyfluoroalkyl Substances* (PFAS PA; DON 2020), PFAS were detected in groundwater samples collected in 2018 at the OU 1 Landfill during supplemental RI activities. The recommendation of the PFAS PA was to move the investigation of PFAS as a COC directly to the RI phase.

Due to the ongoing supplemental RI, LTM for OU 1 has been postponed, by consensus of the Navy, Ecology, EPA, and the Suquamish Tribe, until site characterization activities have been completed and the LTM monitoring well/location network may be reassessed.

1.3 Project Objective

Based on the PFAS PA (DON 2020) recommendation to move the investigation of PFAS directly to RI and detection of PFAS in previous samples collected from the site, additional sampling at OU 1 was needed to delineate PFAS concentrations in groundwater across the site. This data gap was addressed by groundwater sampling at the monitoring wells and piezometers associated with the site.

1.4 Scope of Work

The December 2021 sampling event included the following scope of work:

- Collect water level measurements
- Collect field parameter measurements, including salinity
- Sample groundwater at 54 groundwater monitoring wells and 5 piezometers associated with OU 1 (Figure 1-3)
- Manage investigation derived waste
- Perform laboratory analysis and validation of PFAS results in groundwater
- Report resulting data

1.5 Screening Levels

Screening levels for PFAS in groundwater associated with the December 2021 sampling event are presented in the approved Tier I SAP (DON 2021) and were established based on Department of Defense (DoD) policy and guidance (DoD 2019a and 2020). Regional Screening Levels (RSLs) for perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) were calculated using the 2020 EPA online calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search) using the oral reference dose of 0.00002 milligrams per kilograms per day with target hazard quotient (THQ) of 0.1. The RSL for perfluorobutanesulfonic acid (PFBS) in groundwater may also be calculated using these assumptions; however, generic tables are available on the EPA RSL website. The screening levels are 0.040 micrograms per liter (µg/L) for PFOS and PFOA individually in water and 0.60 µg/L for PFBS in water, as shown in Table 1-1 in the "SAP Screening Level" column. As indicated in the Tier I SAP (DON 2021), screening levels had not yet been established under DoD policy and guidance (2019a and 2020) for the remaining 15 PFAS target analytes. The analytical data associated with the December 2021 sampling event are evaluated using the screening levels identified in the Tier I SAP (DON 2021).

Updated DoD policy guidance was released in July 2022 (DoD 2022) to address updated EPA RSLs released in May 2022. Residential scenario screening levels calculated using the EPA RSL calculator, as summarized in the policy guidance (DoD 2022) using a THQ of 0.1 are shown in Table 1-1 in the "2022 RSL" column. These 2022 RSLs are presented for the purpose of comparison.

Table 1-1. Screening Levels for Groundwater

Analyte	SAP Screening Level (µg/L)	2022 RSL (µg/L)
Hexafluoropropylene oxide dimer acid (HFPO-DA)	NS	0.0060[1/]
N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA)	NS	NS
N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA)	NS	NS
Perfluorobutanesulfonic acid (PFBS)	0.60[1/]	0.60[1/]
Perfluorodecanoic acid (PFDA)	NS	NS
Perfluorododecanoic acid (PFDoA)	NS	NS
Perfluoroheptanoic acid (PFHpA)	NS	NS
Perfluorohexanesulfonic acid (PFHxS)	NS	0.039[1/]
Perfluorohexanoic acid (PFHxA)	NS	NS
Perfluorononanoic acid (PFNA)	NS	0.0060[1/]
Perfluorooctanesulfonic acid (PFOS)	0.040[2/]	0.0040[1/]
Perfluorooctanoic acid (PFOA)	0.040[2/]	0.0060[1/]
Perfluorotetradecanoic acid (PFTA)	NS	NS
Perfluorotridecanoic acid (PFTrDA)	NS	NS
Perfluoroundecanoic acid (PFUnA)	NS	NS
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonicacid	NS	NS
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	NS	NS
4,8-Dioxa-3H-perfluorononanoic acid (DONA)	NS	NS

Notes:
[1/] Screening level is the EPA Regional Screening Level for tapwater (target hazard quotient [THQ] = 0.1), which is based on the protection of human health via drinking water only.
[2/] The screening levels for PFOA and PFOS are calculated using the 2020 EPA online calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search) using the oral reference dose of 0.00002 milligrams per kilogram-day (THQ = 0.1).
µg/L = microgram(s) per liter
NS = not specified
RSL = Regional Screening Level
SAP = Sampling and Analysis Plan

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2 Field Activities

The field activities completed during December 2021 include groundwater level and field parameter measurement, groundwater sampling, and investigation derived waste management. Field activities were conducted in accordance with the procedures established in the Tier I SAP (DON 2021) and *NAVFAC NW Standard Operating Procedures* for environmental sampling (NAVFAC NW 2019). Field forms and logbook excerpts documenting field activities are provided in Appendix A.

2.1 Groundwater Gauging

Groundwater level measurements were conducted between 6 and 8 December 2021. Monitoring locations are shown on Figure 1-3. Groundwater level and field parameter measurements are discussed in Section 3.1 and presented in Tables 3-1 and 3-2.

2.2 Groundwater Sampling

Groundwater sampling, including field parameter measurements, was conducted between 6 and 8 December 2021. Sampling locations are shown on Figure 1-3. Results of the groundwater sampling are discussed in Section 4.2.

The groundwater monitoring wells and piezometers were purged prior to sampling. Low-flow techniques were employed using a peristaltic or submersible pump connected to dedicated, disposable silicon and polyethylene tubing. A purging rate of 500 milliliters per minute or less was maintained throughout sampling. During purging, several field parameters (pH, specific conductance, turbidity, dissolved oxygen [DO], temperature, salinity, and oxidation-reduction potential [ORP]) were measured and recorded every 3 to 5 minutes using a YSI ProDSS™ water quality instrument as shown in Table 3-2 and on the field forms included in Appendix A. When field parameters (pH, specific conductance, turbidity, DO, ORP, and temperature) met stabilization criteria presented in the Tier I SAP (DON 2021), a groundwater sample was collected. Total purge volumes ranged from 1.0 liters to 8.0 liters for piezometers, and 3.0 liters to 12 liters for the other wells.

Sample containers were handled and shipped in accordance with the Tier I SAP (DON 2021).

2.3 Investigation Derived Waste Handling and Disposal

Investigation-derived waste generated during field activities included purge water and general sampling waste (used sample tubing, disposable gloves, and paper towels).

The purge water was contained in 55-gallon drums and staged at the designated Keyport waste transportation and disposal location in accordance with the Tier I SAP (DON 2021). The general sampling waste, such as used tubing and gloves, was placed in a designated onsite commercial waste dumpster.

2.4 Deviations

Field measurements and the collection of a groundwater sample was not performed at well MW1-56 channel 0 because the well screen was buried and the well did not produce water. The screened depth at this location is 33.75 to 34.25 feet below ground surface (bgs). However, the field measured total depth was 30 feet bgs. Additionally, MW1-56 channel 1 and 2 were mislabeled on the well casings compared to the reported depths. Wells MW1-56 channel 1 was reported as having a screen interval of 20 – 22 feet bgs, with an actual field measured total depth of 12.42 feet bgs, and MW1-56 channel 2 had a reported screen interval of 9 – 10 feet bgs with a field measurement total depth of 24.62 feet bgs.

Field parameters at well MW1-58 channel 1 did not stabilize during purging and were collected after the groundwater sample was collected because the well purged dry.

3 Groundwater Results

This section evaluates the gauging data, summarizes the distribution of contaminants detected in the samples collected during the monitoring event in December 2021, and compares the reported concentrations to the screening levels discussed in Section 1.5.

3.1 Groundwater Elevations and Flow

The depth to water and total well-depth measurements were collected between 6 and 8 December 2021 at the time of groundwater sample collection from 54 wells, which included two multi-channel piezometers at the OU 1. The groundwater level measurements and calculated elevation are provided in Table 3-1. Field forms with depth to water and total well-depth measurements are provided in Appendix A. Because these measurements were taken at different times during the tidal cycle, they cannot be used to produce an accurate isocontour map. An effort will be made to measure wells during the shortest period possible during future groundwater level measurements across OU 1.

Table 3-1. Well/Piezometer Information and December 2021 Groundwater Elevations

Well ID	Northing (ft)	Easting (ft)	TOC Elevation (ft msl)	Date	Time	Depth to Water (ft)	Groundwater Elevation (ft msl)
1MW-1	259620.00	1558681.50	13.346	12/7/2021	9:45	5.50	7.85
1MW-4	260091.70	1558902.60	15.707	12/8/2021	13:33	6.14	9.57
MW1-2	259823.50	1558741.90	15.156	12/8/2021	10:28	6.95	8.21
MW1-3	259695.80	1559108.60	16.783	12/7/2021	14:48	2.91	13.87
MW1-4	259031.70	1558935.20	15.563	12/6/2021	12:50	6.31	9.25
MW1-5	259138.10	1558746.00	16.36	12/6/2021	14:55	8.20	8.16
MW1-6	259287.20	1558736.10	16.505	12/6/2021	10:45	8.19	8.32
MW1-09	259546.30	1558417.90	15.336	12/8/2021	13:08	6.05	9.29
MW1-10	259535.60	1558417.70	15.312	12/8/2021	12:23	4.71	10.60
MW1-11	259691.60	1559108.90	16.687	12/7/2021	15:57	51.51	-34.82
MW1-14	259823.60	1558873.00	17.877	12/8/2021	12:03	7.15	10.73
MW1-15	259560.40	1558848.50	16.575	12/7/2021	15:32	6.02	10.56
MW1-17	259499.60	1558679.60	12.725	12/6/2021	14:53	5.07	7.66
MW1-18	260036.50	1558861.90	15.361	12/8/2021	14:15	6.15	9.21
MW1-20	259059.70	1559112.80	13.748	12/7/2021	12:48	3.63	10.12
MW1-23	260443.50	1558863.20	19.305	12/8/2021	11:08	9.14	10.17
MW1-24	260259.30	1559041.40	16.927	12/8/2021	11:23	4.84	12.09
MW1-25	259891.10	1558671.40	15.269	12/8/2021	13:47	7.27	8.00
MW1-27	259691.38	1559104.23	16.453	12/7/2021	15:48	4.60	11.85
MW1-28	259783.90	1558591.77	16.518	12/8/2021	13:51	8.86	7.66

Well ID	Northing (ft)	Easting (ft)	TOC Elevation (ft msl)	Date	Time	Depth to Water (ft)	Groundwater Elevation (ft msl)
MW1-29	259676.50	1558514.10	16.048	12/8/2021	14:11	8.45	7.60
MW1-31	259431.50	1559138.40	15.996	12/7/2021	14:54	4.56	11.44
MW1-38	260261.87	1558354.67	13.231	12/8/2021	10:08	2.30	10.93
MW1-39	260266.50	1558358.03	13.218	12/8/2021	10:00	2.49	10.73
MW1-41	259731.50	1558880.50	18.512	12/8/2021	12:10	7.42	11.09
MW1-42	259497.02	1198819.77	12.77	12/7/2021	10:07	3.36	9.41
MW1-43	259456.23	1198809.41	12.69	12/6/2021	15:31	3.60	9.09
MW1-44	259394.52	1198806.50	12.24	12/6/2021	13:47	3.56	8.68
MW1-45	259325.26	1198822.32	12.99	12/7/2021	11:22	5.16	7.83
MW1-46	259508.60	1199026.27	16.71	12/7/2021	14:08	7.02	9.69
MW1-47	259466.25	1199023.85	16.44	12/7/2021	12:48	6.11	10.33
MW1-48	259416.03	1199082.01	15.8	12/6/2021	12:48	5.35	10.45
MW1-49	258986.91	1198907.63	14.17	12/6/2021	16:12	5.81	8.36
MW1-50	258988.47	1198967.28	16.75	12/7/2021	13:09	7.85	8.90
MW1-51	259088.54	1198979.37	17.23	12/6/2021	13:48	8.15	9.08
MW1-52	259050.35	1199004.93	17.11	12/6/2021	12:23	7.98	9.13
MW1-53	259067.70	1199065.84	13.4	12/6/2021	13:08	4.30	9.10
MW1-54	258949.79	1199050.16	15.57	12/6/2021	13:37	5.31	10.26
MW1-55	258977.68	1199101.47	15.6	12/6/2021	11:39	4.92	10.68
MW1-56, CH1	258984.05	1199144.30	15.82	12/7/2021	9:45	5.53	10.29
MW1-56, CH2	258984.05	1199144.30	15.82	12/7/2021	10:49	4.81	11.01
MW1-58, CH0	259057.79	1199138.21	16.84	12/7/2021	10:03	6.05	10.79
MW1-58, CH1	259057.79	1199138.21	16.84	12/7/2021	13:20	6.50	10.34
MW1-58, CH2	259057.79	1199138.21	16.84	12/7/2021	11:04	6.43	10.41
MW1-59	258934.36	1198963.99	12.68	12/7/2021	12:15	1.15	11.53
MW1-60	259345.11	1198555.91	18.01	12/8/2021	12:31	9.38	8.63
MW1-61	259195.56	1199035.84	13.47	12/6/2021	11:40	4.82	8.65
MW1-62	259592.91	1198976.33	19.46	12/7/2021	10:54	9.38	10.08
MW1-63	259664.43	1198921.44	18.17	12/7/2021	13:30	8.31	9.86
MW1-64	259759.23	1198871.21	17.13	12/8/2021	9:50	7.49	9.64
MW1-65	259780.55	1198937.41	16.77	12/8/2021	10:12	7.11	9.66
MW1-67	259780.68	1198935.04	16.6	12/8/2021	10:49	8.04	8.56
MW1-68	259010.62	1199148.31	14.99	12/6/2021	10:57	2.76	12.23
P1-01	259792.50	1558893.20	17.621	12/8/2021	11:32	7.09	10.53
P1-02	259769.50	1558825.70	17.031	12/7/2021	16:10	7.66	9.37
P1-03	259745.10	1558770.10	15.989	12/7/2021	14:33	7.65	8.34
P1-04	259665.80	1558755.50	15.824	12/7/2021	11:44	6.45	9.37
P1-09	259047.60	1558900.60	15.151	12/6/2021	15:54	6.22	8.93

3.2 Groundwater Field Parameters

Field parameters were measured during purging of monitoring wells and piezometers prior to sampling. Field parameter measurements are summarized in Table 3-2.

3.3 Laboratory Analysis

Groundwater samples were submitted to an off-site laboratory, Eurofins Lancaster Laboratory Environmental, located in Lancaster, Pennsylvania, for analysis in accordance with the Tier I SAP (DON 2021). Groundwater samples were analyzed for PFAS by liquid chromatography with tandem mass spectrometry compliant with Quality Systems Manual Version 5.3, Table B-15 (DoD 2019b).

3.4 Groundwater Analytical Results – December 2021

The analytical results for the December 2021 groundwater monitoring event are provided in Table 3-3.

For the December 2021 sampling event, the screening levels from the Tier I SAP for PFOS and PFOA (at 0.040 µg/L for each) were exceeded in the sample from well MW1-06, which had estimated concentrations at 0.16 µg/L and 0.12 µg/L, respectively. There were no other exceedances for PFOA or PFOS. There were no exceedances in groundwater of the screening level from the Tier I SAP for PFBS.

Analytical results that exceed the screening levels presented in the Tier I SAP (DON 2021) are summarized on Figure 3-1.

The following analytical results from the December 2021 sampling event are above the updated 2022 RSLs:

- PFOS for the samples from wells 1MW-1, MW1-05, MW1-06, MW1-14, MW1-15, MW1-17, MW1-41, MW1-42, MW1-47, MW1-48, MW1-56 CH1, MW1-56 CH2, MW1-58 CH1, MW1-58 CH2, MW1-61, MW1-67, and P1-3.
- PFOA for the samples from wells 1MW-1, MW1-02, MW1-06, MW1-14, MW1-15, MW1-17, MW1-41, MW1-42, MW1-47, MW1-48, MW1-58 CH1, MW1-61, MW1-63, MW1-64, MW1-67, P1-1, P1-2, and P1-3.
- Hexafluoropropylene oxide dimer acid for the sample from well MW1-58 CH1
- Perfluorohexanesulfonic acid for the sample from well MW1-06.

3.5 Data Quality

Data validation was performed by a third-party data validator, Laboratory Data Consultants, Inc., in Carlsbad, California on the analytical results associated with groundwater samples using the guidelines presented in the Tier I SAP (DON 2021). The data validation was performed at a minimum frequency of 10 percent at Stage 4 and the remainder at Stage 2B, as defined in the General Data Validation Guidelines (DoD 2019c). The results of the validation were reviewed, and a data quality assessment report was prepared by the Contractor's Project Chemist. The data quality assessment report is presented in Attachment B-1 and includes the data validation reports prepared by the third-party data validator.

The results of data verification and validation processes indicate that the data generated from the samples collected during the December 2021 field activities are generally of sufficient quality and quantity to accomplish project objectives. Unless rejected during data assessment, sample results accurately indicate the presence and/or absence of target analyte concentrations at sampled locations. Samples were analyzed as specified in the Tier I SAP (DON 2021), except as noted in Attachment B-1. Fifty-four sample results were rejected: 52 results due to labeled compound recovery below 20 percent and two results due to poor matrix spike/matrix spike duplicate recovery. However, the overall analytical percent completeness was calculated to be 94% which meets the 90% usable data acceptance criteria specified in the Tier I SAP (DON 2021).

Sample results are representative of site conditions at the time of collection. Results obtained are comparable to industry standards, in that collection and analytical techniques followed approved, documented procedures. Results are reported in industry standard units.

MW1-23
10.17

MW1-39
10.73

MW1-38
10.93

Tide Flats

MW1-24
12.09

1MW-4
9.25

Culvert and
Tide Gate

MW1-18
9.21

MW1-25
8.00

MW1-65
9.66

MW1-2
8.21

MW1-67
8.56*

MW1-14
10.73

MW1-64
9.64

P1-1
10.53

MW1-28
7.66

P1-2
9.37

P1-3
8.34

MW1-41
11.09

MW1-63
9.86

MW1-3
13.87

MW1-11
-34.82*

MW1-29
7.60

P1-4
9.37

MW1-62
10.08

1MW-1
7.85

MW1-9
9.29

MW1-42
9.41

MW1-15
10.56

MW1-46
9.69*

MW1-10
10.60

MW1-47
10.33

MW1-43
9.09

MW1-17
7.66

MW1-48
10.45

MW1-44
8.68

MW1-60
8.63

MW1-45
7.83

Marsh
Pond

MW1-06
8.32

Analyte	PFOS (µg/L)	PFOA (µg/L)
Screening Level	0.040	0.040
Result	0.16 J	0.12 J

MW1-61
8.65

MW1-05
8.16

MW1-51
9.08

MW1-52
9.13

MW1-53
9.10

MW1-58
10.34

MW1-49
8.36

MW1-50
8.90

P1-9
8.93

MW1-04
9.57

MW1-68
12.23*

MW1-20
10.12

MW1-55
10.68

MW1-56
10.29

MW1-54
10.26

MW1-59
11.53

0 55 110
Feet
1 inch = 110 feet
N

Path: \\eafp\departments\Federal\NAVFAC NW LTM_LTO\GIS\Keyport\21F4076\OU1_PFAS_Rpt\21F4076_Fig3-1_OU1_GWElevations.mxd

LEGEND

- Monitoring Well Sampled in December 2021 - Exceeds PFOS/PFOA Screening Level
- December 2021 Sampling Locations - Below PFOS/PFOA Screening Level
- NBK Keyport Boundary
- OU 1, Area 1
- Former Landfill
- Phytoremediation Plantation
- 10.26 December 2021 Groundwater Elevation (ft AMSL)

Notes:
Sample results are only shown for analytes exceeding screening levels.
* = Groundwater elevation is not consistent with nearby wells.
ft AMSL = feet above mean sea level
J = The reported result is an estimated value.
PFOA = Perfluorooctanoic acid
PFOS = Perfluorooctanesulfonic acid
µg/L = Micrograms per Liter

FIGURE 3-1
OU 1 GROUNDWATER ANALYTICAL RESULTS

2021 GROUNDWATER
MONITORING REPORT
OPERABLE UNIT 1
NAVAL BASE KITSAP KEYPORT
KEYPORT, WA

Map Date: 11/29/2022

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Table 3-2. Groundwater Field Parameters, December 2021

Well ID	Temperature (°C)	pH (S.U)	ORP (mv)	Spec. Cond. (ms/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (ppt)
1MW-1	12.80	6.15	-3.20	0.24	7.97	0.16	0.12
1MW-4	13.00	7.03	-41.90	0.99	4.33	0.09	0.49
MW1-2	11.50	6.78	14.10	0.67	14.26	0.33	0.33
MW1-3	14.30	5.89	40.80	0.14	4.59	5.19	0.07
MW1-4	11.40	8.46	147.00	0.26	5.48	2.89	0.12
MW1-5	11.60	6.39	-66.90	0.32	30.34	3.87	0.15
MW1-6	13.50	6.37	39.80	0.76	33.46	0.11	0.38
MW1-09	12.10	7.03	-89.20	0.76	55.49	3.47	0.38
MW1-10	12.10	6.27	38.30	0.20	31.12	4.87	0.09
MW1-11	14.60	6.15	90.80	0.22	36.97	0.36	0.11
MW1-14	11.60	6.28	-30.40	0.65	12.97	0.48	0.32
MW1-15	16.70	6.20	-36.00	0.66	1.88	0.41	0.32
MW1-17	11.30	6.82	-80.90	0.46	7.37	0.38	0.22
MW1-18	10.90	6.62	-12.80	0.31	89.98	0.15	0.15
MW1-20	14.30	6.45	11.60	0.50	11.77	3.44	0.23
MW1-23	13.20	7.66	127.70	0.26	20.09	0.49	0.13
MW1-24	14.60	7.00	-95.40	0.22	106.75	3.18	0.11
MW1-25	12.10	6.79	13.70	0.99	2.23	0.49	0.49
MW1-27	15.20	6.76	-81.40	0.16	28.51	3.20	0.08
MW1-28	11.70	7.12	52.70	1.40	12.07	0.47	0.71
MW1-29	11.90	7.20	-68.60	2.15	10.01	3.46	1.11
MW1-31	15.60	6.14	85.00	0.23	17.69	0.29	0.11
MW1-38	13.40	7.66	-106.50	0.76	14.81	3.34	0.37
MW1-39	13.30	8.30	75.80	0.37	12.22	0.48	0.18
MW1-41	12.30	6.40	-38.00	0.90	5.92	0.07	0.45
MW1-42	15.00	7.40	-84.50	0.38	3.95	0.46	0.18
MW1-43	12.70	7.56	-116.20	1.96	7.34	0.45	1.02
MW1-44	4.05	12.90	8.65	-59.50	1.69	3.00	0.86
MW1-45	14.20	8.95	-82.50	0.73	6.66	0.42	0.36
MW1-46	15.60	7.13	-58.40	1.18	1.68	0.47	0.59
MW1-47	15.00	6.26	-29.10	0.59	6.00	0.46	0.29
MW1-48	15.70	6.32	-40.10	0.71	28.83	0.37	0.35
MW1-49	11.70	7.38	-28.40	0.26	2.84	3.88	0.12
MW1-50	11.60	7.45	85.80	0.23	8.01	0.29	0.11
MW1-51	11.40	8.55	10.50	0.29	3.59	3.86	0.14
MW1-52	11.00	8.52	-43.20	0.30	6.96	3.98	0.15
MW1-53	11.50	8.04	17.60	0.35	7.85	3.93	0.17
MW1-54	10.90	7.66	158.70	0.20	10.77	1.47	0.10
MW1-55	11.20	7.64	137.00	0.25	12.14	0.60	0.12
MW1-56, CH1	11.50	6.73	25.00	0.55	8.77	0.41	0.27
MW1-56, CH2	12.10	6.71	58.90	0.43	11.48	0.30	0.21
MW1-58, CH0	12.40	7.20	-127.00	0.32	46.50	3.67	0.15
MW1-58, CH1	11.60	6.36	158.10	0.89	541.24	7.49	0.44
MW1-58, CH2	13.20	6.60	-59.50	0.32	64.97	3.52	0.15
MW1-59	10.10	7.54	103.80	0.24	30.12	0.37	0.12
MW1-60	11.60	7.66	116.10	0.30	21.87	0.58	0.14
MW1-61	14.30	7.03	5.70	0.39	5.22	0.48	0.19
MW1-62	13.70	6.67	19.80	0.52	16.03	0.12	0.25

Table 3-2. Groundwater Field Parameters, December 2021

Well ID	Temperature (°C)	pH (S.U)	ORP (mv)	Spec. Cond. (ms/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (ppt)
MW1-63	13.00	6.70	-21.00	0.95	10.07	0.08	0.47
MW1-64	11.50	6.69	-11.20	0.88	6.64	0.09	0.44
MW1-65	11.60	6.74	-35.90	0.80	8.54	0.47	0.40
MW1-67	11.00	6.79	-78.40	0.85	4.24	0.50	0.42
MW1-68	12.20	7.24	-118.90	0.28	131.28	3.82	0.13
P1-01	11.90	6.36	-44.30	0.83	13.89	0.06	0.41
P1-02	11.50	6.38	-23.00	1.72	32.23	0.05	0.87
P1-03	13.10	6.34	-25.00	0.78	4.11	0.09	0.38
P1-04	13.00	6.84	-28.90	0.68	4.20	0.13	0.33
P1-09	11.40	8.06	70.10	0.26	0.18	0.31	0.12

Notes:

°C = degrees Celsius

DO = dissolved oxygen

mg/L = milligrams per liter

ms/cm = milliSiemens per centimeter

mV = millivolts

ppt = parts per thousand

Spec. Cond. = specific conductivity

S.U. = standard units

Table 3-3. Groundwater Analytical Results, December 2021

	Analyte		HFPO-DA		NEtFOSAA		NMeFOSAA		PFBS		PFDA		PFDoA		PFHpA		PFHxS		PFHxA		PFNA		PFOS		PFOA		PFTA		PFTrDA		PFUnA		11Cl-PF3OUdS		9Cl-PF3ONS		DONA	
	Screening Level		NS		NS		NS		0.60 [1]		NS		NS		NS		NS		NS		NS		0.040 [2]		0.040 [2]		NS		NS		NS		NS		NS		NS	
	2022 Screening Level [3]		0.0060 [1]		NS		NS		0.60 [1]		NS		NS		NS		0.039 [1]		NS		0.0060 [1]		0.0040 [1]		0.0060 [1]		NS		NS		NS		NS		NS		NS	
	Unit		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L	
Well	Sample ID	Sample Date	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
1MW-1	GM-21-001	7-Dec-2021	0.00089	U	0.0014	J	0.0011	U	0.0015	J	0.00047	J	0.00089	U	0.0025		0.012		0.0045		0.00079	J	0.020		0.030		0.00089	U	0.00089	U	0.00089	U	0.00089	U	0.00089	U	0.00089	U
1MW-4	GM-21-002	8-Dec-2021	0.00052	J	0.00088	U	0.0011	U	0.0011	J	0.00088	U	0.00089	U	0.00099	J	0.00067	J	0.0023		0.00088	U	0.00088	U	0.0035		R		0.00089	U	0.00088	U	0.00088	U	0.00088	U	0.00088	U
1MW-4 (DUP)	GM-21-003	8-Dec-2021	0.00046	J	0.00088	U	0.0011	U	0.0012	J	0.00088	U	0.00088	U	0.00082	J	0.00069	J	0.0023		0.00088	U	0.00088	U	0.0037		0.00088	UJ	0.00088	U	0.00088	U	0.00088	U	0.00088	U	0.00088	U
MW1-02	GM-21-004	8-Dec-2021	0.00085	U	0.00085	U	0.0010	U	0.0014	J	0.00085	U	0.00085	U	0.0053		0.0026		0.011		0.0013	J	0.0025		0.014		0.00085	UJ	0.00085	U	0.00085	U	0.00085	U	0.00085	U	0.00085	U
MW1-03	GM-21-005	7-Dec-2021	0.00089	U	0.00089	U	0.0011	U	0.0024		0.00089	U	0.00089	U	0.0011	J	0.0024		0.00051	J	0.00089	U	0.0015	J	0.0028		0.00089	U	0.00089	U	0.00089	U	0.00089	U	0.00089	U	0.00089	U
MW1-04	GM-21-006	6-Dec-2021	0.0009	U	0.0009	U	0.0011	U	0.00090	U	0.00090	UJ	0.00090	U	0.00090	U	0.00090	U	0.00090	U	0.00090	U	0.00090	U	0.00090	U	0.00090	U	0.00090	U	0.00090	U	0.00090	UJ	0.00090	U	0.00090	U
MW1-05	GM-21-007	6-Dec-2021	0.00089	J	0.00090	U	0.0011	U	0.00080	J	0.00090	UJ	0.00090	U	0.00059	J	0.0023	J	0.00077	J	0.00090	U	0.0044	J	0.0020	J	0.00090	U	0.00090	U	0.00090	U	0.00090	UJ	0.00090	U	0.00090	U
MW1-06	GM-21-008	6-Dec-2021	0.0021	J	0.00094	U	0.0011	U	0.0051	J	0.00094	UJ	0.00094	U	0.0076	J	0.051	J	0.023	J	0.00091	J	**0.16**	J	**0.12**	J	R		0.00094	U	0.00094	U	0.00094	UJ	0.00094	U	0.00094	U
MW1-09	GM-21-009	8-Dec-2021	0.00089	U	0.00089	U	0.0011	U	0.00060	J	0.00089	U	0.00091	U	0.00089	U	0.00089	U	0.00089	U	0.00089	U	0.00048	J	0.0012	J	0.00091	UJ	0.00091	U	0.00091	U	0.00089	U	0.00089	U	0.00089	U
MW1-10	GM-21-010	8-Dec-2021	0.00087	U	0.00087	U	0.0010	U	0.00049	J	0.00087	U	0.00087	UJ	0.00087	U	0.00087	U	0.00087	U	0.00087	U	0.00068	J	0.00067	J	0.00087	UJ	0.00087	UJ	0.00087	U	0.00087	U	0.00087	U	0.00087	U
MW1-11	GM-21-011	7-Dec-2021	0.00091	U	0.00091	U	0.0011	U	0.00091	U	0.00091	U	0.00091	U	0.00091	U	0.00091	U	0.00091	U	0.00091	U	0.00088	J	0.00091	U	0.00091	UJ	0.00091	U	0.00091	U	0.00091	U	0.00091	U	0.00091	U
MW1-11 (DUP)	GM-21-012	7-Dec-2021	0.00054	J	0.00093	U	0.0011	U	0.00093	U	0.00093	U	0.00093	UJ	0.00093	U	0.00093	U	0.00093	U	0.00093	U	0.00096	J	0.00093	U	R		0.00093	UJ	0.00093	U	0.00093	U	0.00093	U	0.00093	U
MW1-14	GM-21-013	8-Dec-2021	0.0020	J	0.00092	U	0.0011	U	0.00093	J	0.00092	U	0.00092	U	0.0024		0.0024		0.0051		0.00049	J	0.0053		0.0098		R		0.00092	U	0.00092	U	0.00092	U	0.00092	U	0.00092	U
MW1-15	GM-21-014	7-Dec-2021	0.00096	U	0.00096	UJ	0.0012	UJ	0.0026	J	0.00096	UJ	R		0.0026	J	0.0085		0.0037	J	0.00065	J	0.014	J	0.020	J	R		R		R		0.00096	U	0.00096	U	0.00096	U
MW1-17	GM-21-015	6-Dec-2021	0.00050	J	0.0036	J	0.00090	J	0.00076	J	0.00093	UJ	0.00093	U	0.0012	J	0.0076	J	0.0023	J	0.00052	J	0.015	J	0.017	J	0.00093	UJ	0.00093	U	0.00093	U	0.00093	UJ	0.00093	U	0.00093	U
MW1-18	GM-21-016	8-Dec-2021	0.00090	U	R		R		0.0013	J	R		R		0.00056	J	0.0011	J	0.00085	J	R		R		0.0015	J	R		R		R		R		0.00090	U
MW1-20	GM-21-018	7-Dec-2021	0.00086	U	0.00086	U	0.0010	U	0.00047	J	0.00086	U	0.00086	U	0.00086	U	0.00066	J	0.00086	U	0.00086	U	0.0026		0.00059	J	0.00086	U	0.00086	U	0.00086	U	0.00086	U	0.00086	U	0.00086	U
MW1-23	GM-21-019	8-Dec-2021	0.00093	U	0.00093	U	0.0011	U	0.00053	J	0.00093	U	0.00093	U	0.00093	U	0.00093	U	0.00093	U	0.00093	U	0.00093	U	0.00093	U	0.00092	U	0.00093	U	0.00093	U	0.00093	U	0.00093	U	0.00093	U
MW1-24	GM-21-020	8-Dec-2021	0.00086	U	0.00086	U	0.0010	U	0.00086	U	0.00086	U	0.00086	U	0.00086	U	0.00086	U	0.00086	U	0.00086	U	0.00086	U	0.00086	U	R		0.00086	U	0.00086	U	0.00086	U	0.00086	U	0.00086	U
MW1-24 (DUP)	GM-21-021	8-Dec-2021	0.00086	U	0.00086	U	0.0010	U	0.00086	U	0.00086	U	0.00086	U	0.00086	U	0.00086	U	0.00086	U	0.00086	U	0.00086	U	0.00086	U	0.00086	UJ	0.00086	U	0.00086	U	0.00086	U	0.00086	U	0.00086	U
MW1-25	GM-21-022	8-Dec-2021	0.00097	U	0.00097	UJ	0.0012	UJ	0.0010	J	0.00097	UJ	R		0.0011	J	0.0017	J	0.0018	J	0.00097	U	0.0026	J	0.0035	J	R		R		0.00097	UJ	0.00097	U	0.00097	U	0.00097	U
MW1-27	GM-21-023	7-Dec-2021	0.00091	U	0.00091	U	0.0011	U	0.00091	U	0.00091	U	0.00091	UJ	0.00091	U	0.00091	U	0.00091	U	0.00091	U	0.00091	U	0.00091	U	R		R		0.00091	UJ	R		0.00091	U	0.00091	U
MW1-28	GM-21-024	8-Dec-2021	0.00091	U	0.00091	U	0.0011	U	0.00058	J	0.00091	U	0.00091	UJ	0.0009	J	0.0012	J	0.0017	J	0.00091	U	0.0013	J	0.0030		R		0.00091	UJ	0.00091	UJ	0.00091	U	0.00091	U	0.00091	U
MW1-29	GM-21-025	8-Dec-2021	0.00096	U	0.00096	U	0.0012	U	0.00096	U	0.00096	U	0.00096	U	0.00096	U	0.00096	U	0.00096	U	0.00096	U	0.00096	U	0.00096	U	0.00096	UJ	0.00096	U	0.00096	U	0.00096	U	0.00096	U	0.00096	U
MW1-31	GM-21-026	7-Dec-2021	0.00089	UJ	0.00089	UJ	0.0011	UJ	0.0014	J	0.00089	UJ	0.00089	UJ	0.00089	UJ	0.00073	J	0.00089	UJ	0.00057	J	0.0022	J	0.0007	J	0.0009	UJ	0.00089	UJ	0.00089	UJ	0.00089	UJ	0.00089	UJ	0.00089	UJ
MW1-38	GM-21-027	8-Dec-2021	0.00088	U	0.00088	U	0.0011	U	0.00062	J	0.00088	U	0.00088	U	0.00088	U	0.0008	J	0.00059	J	0.00088	U	0.00088	U	0.0011	J	0.00088	U	0.00088	U	0.00088	U	0.00088	U	0.00088	U	0.00088	U
MW1-39	GM-21-028	8-Dec-2021	0.00094	U	0.00094	U	0.0011	U	0.00055	J	0.00094	U	0.00094	U	0.00094	U	0.00094	U	0.00094	U	0.00094	U	0.00094	U	0.00094	U	0.00094	U	0.00094	U	0.00094	U	0.00094	U	0.00094	U	0.00094	U
MW1-41	GM-21-029	8-Dec-2021	0.00068	J	0.00088	U	0.0011	U	0.00092	J	0.00088	U	0.00088	UJ	0.0029		0.0020		0.0050		0.00060	J	0.0044		0.0099		R		0.00088	UJ	0.00088	U	0.00088	U	0.00088	U	0.00088	U
MW1-42	GM-21-030	7-Dec-2021	0.00098	UJ	0.00098	UJ	0.0012	UJ	0.0012	J	0.00062	J	0.00098	UJ	0.0021	J	0.0021	J	0.0031	J	0.0011	J	0.0062	J	0.0074	J	R		0.00098	UJ	0.00098	UJ	0.00098	UJ	0.00098	UJ	0.00098	UJ
MW1-43	GM-21-031	6-Dec-2021	0.00090	U	0.00090	U	0.0011	U	0.00095	J	0.00090	UJ	0.00090	U	0.0013	J	0.0026	J	0.0022	J	0.00048	J	0.0023	J	0.0051	J	0.00090	U	0.00090	U	0.00090	U	0.00090	UJ	0.00090	U	0.00090	U
MW1-44	GM-21-032	6-Dec-2021	0.00091	U	0.00091	U	0.0011	U	0.0018	J	0.00091	UJ	0.00091	U	0.00075	J	0.0074	J	0.0014	J	0.0009	UJ	0.0012	J	0.0024	J	0.00091	U	0.00091	U	0.00091	U	0.00091	UJ	0.00091	U	0.00091	U
MW1-45	GM-21-033	7-Dec-2021	0.00096	U	0.00096	U	0.0012	U	0.0011	J	0.00096	U	0.00096	U	0.00068	J	0.0026	J	0.0011	J	0.00096	U	0.00065	J	0.0019		0.00096	U	0.00096	U	0.00096	U	0.00096	U	0.00096	U	0.00096	U
MW1-45 (DUP)	GM-21-034	7-Dec-2021	0.00094	UJ	0.00094	UJ	0.0011	UJ	0.0015	J	0.00094	UJ	0.00094	UJ	0.00070	J	0.0055	J	0.0015	J	0.00094	UJ	0.0026	J	0.0027	J	0.00094	UJ	0.00094	UJ	0.00094	UJ	0.00095	UJ	0.00094	UJ	0.00094	UJ
MW1-46	GM-21-035	7-Dec-2021	0.00092	U	0.00092	U	0.0011	U	0.00060	J	0.00092	U	0.00092	U	0.00049	J	0.0011	J	0.0012	J	0.00092	U	0.00084	J	0.0018		0.00092	U	0.00092	U	0.00092	U	0.00092	U	0.00092	U	0.00092	U
MW1-47	GM-21-036	7-Dec-2021	0.00095	U	0.00082	J	0.0011	U	0.0028	J	0.00054	J	0.00095	U	0.0030		0.0044		0.0057		0.0013	J	0.016		0.021		0.00095	U	0.00095	U	0.00095	U	0.00095	U	0.00095	U	0.00095	U
MW1-48	GM-21-037	6-Dec-2021	0.00099	UJ	0.0027	J	0.0012	UJ	0.0023	J	0.00088	J	0.00099	UJ	0.0032	J	0.0033	J	0.0054	J	0.0015	J	0.012	J	0.0096	J	0.00099	UJ	0.00099	UJ	0.00099	UJ	0.00099	UJ	0.00099	UJ	0.00099	UJ
MW1-49	GM-21-038	6-Dec-2021	0.00088	U	0.00088	U	0.0011	U	0.00088	U	0.00088	UJ	0.00088	U	0.00088	U	0.00088	U	0.00088	U	0.00088	U	0.00056	J	0.00088	U	0.00088	U	0.00088	U	0.00088	U	0.00088	UJ	0.00088	U	0.00088	U
MW1-50	GM-21-039	7-Dec-2021	0.00092	UJ	0.00092	UJ	0.0011	UJ	0.00078	J	0.00092	UJ	0.00092	UJ	0.00092	UJ	0.00092	UJ	0.00092	UJ	0.00092	UJ	0.00092	UJ	0.00092	UJ	0.00092	UJ	0.00092	UJ	0.00092	UJ	0.00092	UJ	0.00092	UJ	0.00092	UJ
MW1-51	GM-21-040	6-Dec-2021	0.00089	U	0.00089	U	0.0011	U	0.00089	U	0.00089	UJ	0.00089	U	0.00089	U	0.00089	U	0.00089	U	0.00089	U	0.00089	U	0.00057	J	0.00089	U	0.00089	U	0.00089	U	0.00089	UJ	0.00089	U	0.00089	U
MW1-52	GM-21-041	6-Dec-2021	0.00090	U	0.00090	U	0.0011	U	0.00090	U	0.00090	UJ	0.00090	U	0.00090	U	0.00090	U	0.00050	J	0.00090	U	0.00090	U	0.00082	J	0.00090	U	0.00090	U	0.00090	U	0.00090	UJ	0.00090	U	0.00090	U
MW1-53	GM-21-042	6-Dec-2021	0.00090	U	0.00090	U	0.0011	U	0.00057	J	0.00090	UJ	0.00090	U	0.0016	J	0.00098	J	0.0023	J	0.00060	J	0.0024	J	0.0039	J	0.00090	U	0.00090	U	0.00090	U	0.00090	UJ	0.00090	U	0.00090	U
MW1-54	GM-21-043	6-Dec-2021	0.00091	U	0.00091	U	0.0011	U	0.0070	J	0.00091	UJ	0.00091	U	0.00091	U	0.00091	U	0.00091	U	0.00091	U	0.00091	U	0.00091	U	0.00091	U	0.00091	U	0.00091	U	0.00091	UJ	0.00091	U	0.00091	U
MW1-55	GM-21-044	6-Dec-2021	0.00091	U	0.00091	U	0.0011	U	0.00091	U	0.00091	UJ	0.00091	UJ	0.00091	U	0.00091	U	0.00091	U	0.00091	U	0.00091	U	0.00091	U	0.00091	U	0.00091	U	0.00091	U	0.00091	UJ	0.00091	U	0.00091	U
MW1-56, CH2	GM-21-045	7-Dec-2021	0.00091	U	0.00091	U	0.0011	U	0.0026		0.00091	U	0.00091	U	0.00091	J	0.011		0.0027		0.00091	U	0.0084		0.0023		0.00091	UJ	0.00091	U	0.00091	U	0.00091	U	0.00091	U	0.00091	U
MW1-56, CH1	GM-21-046	7-Dec-2021	0.00071	J	0.00092	UJ	0.0011	UJ	0.0014	J	0.00047	J	R		0.0017	J	0.0053		0.0028		0.0005	J	0.0086		0.0038		R		R		R		0.00092	U	0.00092	U	0.00092	U
MW1-58, CH2	GM-21-048	7-Dec-2021	0.00092	U	0.00092	U	0.0011	U	0.0012	J	0.00064	J	0.00092	U	0.0021		0.0018		0.0033		0.00093	J	0.0060		0.0046		R		0.00092	U	0.00092	U	0.00092	U	0.00092	U	0.00092	U
MW1-58, CH1	GM-21-049	7-Dec-2021	0.0061	J	0.00095	U	0.0011	U	0.0020	J	0.00095	U	0.00095	U	0.0022		0.0023		0.0056	J	0.0006	J	0.0048	J	0.0061		0.00095	UJ	0.00095	U	0.00095	U	0.00095	U	0.00095	U	0.00095	U
MW1-58, CH0	GM-21-050	7-Dec-2021	0.00092	U	0.00092	UJ	0.0011	UJ	0.00092	U	0.00092	U	R		0.00092	U	0.00068	J	0.00092	U	0.00092	U	0.00092	U	0.00092	U	R		R		0.00092	UJ	0.00092	U	0.00092	U	0.00092	U
MW1-59	GM-21-051	7-Dec-2021	0.00091	U	0.00091	UJ	0.0011	U	0.00091	U	0.00091	U	0.00091	UJ	0.00091	U	0.00091	U	0.00091	U	0.00091	U	0.00091	U	0.00091	U	R		0.00091	UJ	0.00091	U	0.00091	U	0.00091	U	0.00091	U
MW1-60	GM-21-052	8-Dec-2021	0.00092	U	0.00092	U	0.0011	U	0.00092	U	0.00092	U	0.00092	U	0.00092	U	0.00092	U	0.00092	U	0.00092	U	0.00092	U	0.00092	U	0.00092	UJ	0.00092	U	0.00092	U	0.00092	U	0.00092	U	0.00092	U
MW1-60 (DUP)	GM-21-053	8-Dec-2021	0.00093	U	0.00093	UJ	0.0011	UJ	0.00093	U	0.00093	U	R		0.00093	U	0.00093	U	0.00093	U	0.00093	U	0.00093	U	0.00093	U	R		R		0.00093	UJ	0.00093	U	0.00093	U	0.00093	U
MW1-61	GM-21-054	6-Dec-2021	0.00095	U	0.00095	U	0.0011	U	0.0012	J	0.00056	J	0.00095	U	0.0023	J	0.0016	J	0.0029	J	0.0010	J	0.0052	J	0.0064	J	0.00095	U	0.00095	U	0.00095	U	0.00095	UJ	0.00095	U	0.00095	U
MW1-62	GM-21-055	7-Dec-2021	0.00094	U	0.00094	UJ	0.0011	UJ	0.0010	J	0.00094	U	R		0.00054	J	0.0025		0.0016	J	0.00094	U	0.0034		0.0026		R		R		0.00094	UJ	0.00094	U	0.00094	U	0.00094	U
MW1-63	GM-21-056	7-Dec-2021	0.00085	U	0.00085	U	0.0010	U	0.00085	J	0.00085	U	0.00085	U	0.0019		0.0024		0.0032		0.00085	U	0.0035		0.0073		0.00085	U	0.00085	UJ	0.00085	U	0.00085	UJ	0.00085	U	0.00085	U
MW1-64	GM-21-057	8-Dec-2021	0.00088	U	0.00088	U	0.0011	U	0.0011	J	0.00088	U	0.00088	UJ	0.0024		0.0024		0.0050		0.00088	U	0.0028		0.0065		R		0.00088	UJ	0.00088	UJ	0.00088	U	0.00088	U	0.00088	U
MW1-65	GM-21-058	8-Dec-2021	0.00092	U	0.00092	U	0.0011	U	0.0012	J	0.00092	U	0.00092	UJ	0.0014	J	0.0019		0.0050	J	0.00092	U	0.0019	J	0.0041		0.00092	UJ	0.00092	UJ	0.00092	U	0.00092	U	0.00092	U	0.00092	U
MW1-67	GM-21-059	8-Dec-2021	0.0020	J	0.0011	J	0.0012	U	0.00098	J	0.00096	U	0.00096	U	0.0016	J	0.0042		0.0032		0.00096	U	0.012		0.018		0.00096	UJ	0.00096	U	0.00096	U	0.00096	U	0.00096	U	0.00096	U
MW1-68	GM-21-060	6-Dec-2021	0.00089	U	0.00089	U	0.0011	U	0.00075	J	0.00089	UJ	0.00089	U	0.00044	J	0.0011	J	0.0009	J	0.00089	U	0.0012	J	0.0016	J	0.00089	UJ	0.00089	U	0.00089	U	0.00089	UJ	0.00089	U	0.00089	U
P1-1	GM-21-061	8-Dec-2021	0.00075	J	0.00088	U	0.0011	U	0.00081	J	0.00088	U	0.00088	UJ	0.0051		0.0011	J	0.0097		0.00071	J	0.0028		0.013		R		0.00088	UJ	0.00088	U	0.00088	U	0.00088	U	0.00088	U
P1-2	GM-21-062	7-Dec-2021	0.0023	J	0.00093	U	0.0011	U	0.00049	J	0.00093	U	0.00093	U	0.0057		0.0018	J	0.014	J	0.00093	U	0.00093	U	0.023		0.00093	UJ	0.00093	U	0.00093	U	0.00093	U	0.00093	U	0.00093	U
P1-3	GM-21-063	7-Dec-2021	0.00091	UJ	0.00091	UJ	0.0011	UJ	0.0014	J	0.00091	UJ	0.00091	UJ	0.0031	J	0.0038	J	0.0053	J	0.00095	J	0.0058	J	0.017	J	R		0.00091	UJ	0.00091	UJ	0.00091	UJ	0.00091	UJ	0.00091	UJ
P1-3 (DUP)	GM-21-064	7-Dec-2021	0.0017	J	0.00053	J	0.0011	U	0.0012	J	0.00089	U	R		0.0028	J	0.0041	J	0.0054	J	0.00085	J	0.0062	J	0.017	J	R		R		0.00089	UJ	0.00089	U	0.00089	U	0.00089	U
P1-4	GM-21-065	7-Dec-2021	0.00087	UJ	0.00087	UJ	0.0010	UJ	0.00080	J	0.00087	UJ	R		0.0013	J	0.0015	J	0.0029	J	0.00087	UJ	0.0025	J	0.0042	J	R		R		R		0.00087	UJ	0.00087	UJ	0.00087	UJ
P1-9	GM-21-066	6-Dec-2021	0.00096	U	0.00096	U	0.0012	U	0.00096	U	0.00096	UJ	0.00096	U	0.00096	U	0.00096	U	0.00096	U	0.00096	U	0.00096	U	0.00096	U	0.00096	U	0.00096	U	0.00096	U	0.00096	UJ	0.00096	U	0.00096	U

Notes:

[1] Screening level is the EPA Regional Screening Level for tapwater (target hazard quotient [THQ] = 0.1), which is based on the protection of human health via drinking water only.

[2] The screening levels for PFOA and PFOS are calculated using the 2020 EPA online calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search) using the oral reference dose of 0.00002 milligrams per kilogram-day (THQ = 0.1).

[3] As discussed in Section 1.5 of this report, 2022 screening levels are presented only for the purpose of comparison. Analytical results from the December 2021 sampling event were not evaluated in comparison to these values.

Results that exceed the screening level are boldfaced and shaded grey.

µg/L = microgram(s) per liter

Data Qualifiers:

J = The reported result is an estimated value.

R = The result is rejected.

U = The analyte is not detected; the associated numerical value is the limit of detection or as qualified during data validation.

UJ = The analyte is not detected; the associated numerical value is approximate.

Analytes:

DONA = 4,8-dioxa-3H-perfluorononanoic acid

HFPO-DA = Hexafluoropropylene oxide dimer acid

NEtFOSAA = N-ethyl perfluorooctanesulfonamidoacetic acid

NMeFOSAA = N-methyl perfluorooctanesulfonamidoacetic acid

PFBS = Perfluorobutanesulfonic acid

PFDA = Perfluorodecanoic acid

PFDoA = Perfluorododecanoic acid

PFHpA = Perfluoroheptanoic acid

PFHxA = Perfluorohexanoic acid

PFHxS = Perfluorohexanesulfonic acid

PFNA = Perfluorononanoic acid

PFOA = Perfluorooctanoic acid

PFOS = Perfluorooctanesulfonic acid

PFTA = Perfluorotetradecanoic acid

PFTrDA = Perfluorotridecanoic acid

PFUnA = Perfluoroundecanoic acid

9Cl-PF3ONS = 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid

11Cl-PF3OUdS = 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonicacid

4 Conclusions and Recommendations

This section presents conclusions and recommendations related to the field work completed at OU 1 in December 2021.

4.1 Conclusions

The analytical results for PFAS in groundwater samples collected during the monitoring event conducted in December 2021 were compared to available screening levels for PFBS, PFOS, and PFOA as outlined in the SAP. However, since the development of the SAP on which this report is based, available screening levels have been revised during 2022 to include more stringent RSLs as described in Sections 1.5 and 3.4. The analytical results that exceed the SAP screening levels (0.040 µg/L) are PFOS and PFOA at estimated concentrations of 0.16 µg/L and 0.12 µg/L, respectively, in the sample from well MW1-06 located at the southwest end of the landfill.

Analytical results that exceed the 2022 screening levels are summarized in Section 3.4 but not further evaluated in this report. Further evaluation of PFAS results for OU 1 will be conducted under separate contract.

4.2 Recommendations

The LTM program at OU 1 was suspended for 2021 during the ongoing supplemental RI work to reevaluate OU 1 groundwater conditions and the magnitude and extent of contaminants in groundwater and other media across OU 1. Once the supplemental RI has been completed and the conceptual site model has been updated based on data collected by all contractors and the results of this PFAS groundwater investigation, the OU 1 LTM program should be updated to reflect the new understanding of contaminant distribution at OU 1.

It is recommended that periodic sampling and analysis for PFAS in groundwater near MW1-06 be considered in the future because of the exceedance of screening levels. In addition, it is recommended that the results obtained be compared to revised action levels developed by the regulatory agencies and approved for use by the DON. The monitoring well network should also be evaluated in the future to determine the most representative well network to allow for meaningful future long-term monitoring of the horizontal and vertical extent of PFAS and other COCs in groundwater at OU 1.

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Appendix A
Field Forms and Field Logbooks

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EA®	EA Engineering, Science, and Technology, Inc., PBC 2200 6th Ave, Suite 707 Seattle, WA 98121	Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: TO21F4076 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: 1MW-1 Well Head Locked: Y: ___ N: ✓ Depth to Water (ft btoc): 5.50

Total Well Depth (ft btoc): 17.43 Inner Casing Straight and Clear: Y: ✓ N: ___ Depth to Product (ft btoc): —

Length of Water Column in Well (ft): 11.93 Exterior Seal Good: Y: ✓ N: ___ Product Thickness (ft): —

Diameter of Well Casing (in): 2 Pooled water in Head: Y: ___ N: ✓ Purge Rate (liters/min): 0.15

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 7.16 Volume Purged (liters): 5.4

Purge Method: (Peristaltic)/Submersible/Bailer/Other: ___ Date Well Purged: 12/7/21

Water Sample Data

Sample ID: GM-21-001 Type: MS/MSD Date: 12/7/21 Time: 0945 # Containers: 7

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: K. Hopper

Remarks (color, odor, etc.): Colorless, odorless

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or (ppt))	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
0902	—	~~5.00~~ 5.50	Initial Depth to Water (pre-pumping)							
0905	Begin	purge	@	150 mL/min						
0913	1.2	5.79	12.6	6.20	32.8	0.242	21.00	0.35	0.12	
0917	1.8	6.10	12.6	6.19	14.7	0.242	18.08	0.29	0.12	
0921	2.4	6.07	12.5	6.18	7.1	0.241	17.11	0.27	0.12	
0925	3.0	6.05	12.7	6.16	2.7	0.242	16.01	0.22	0.12	
0929	3.6	6.05	12.8	6.15	-0.1	0.242	12.10	0.19	0.12	
0933	4.2	6.05	12.9	6.16	-2.4	0.244	9.96	0.17	0.12	
0937	4.8	6.05	12.9	6.15	-3.2	0.243	9.72	0.16	0.12	
0941	5.4	6.05	12.8	6.15	-3.2	0.243	7.97	0.16	0.12	
Stabilized										
				12/7/21						

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
2" → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: K. Hopper Date: 12/7/21 Page 1 of 1 Meter Model: YSI Pro DSS

Reviewed by: H. Dennis Date: 12/7/21 Filename: Well Inspection, Purging, and Field Measurement Form.docx

EA Engineering, Science, and Technology, Inc., PBC

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: 7021F4076 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: MW1-4 Well Head Locked: Y: ✓ N: ___ Depth to Water (ft btoc): 6.14

Total Well Depth (ft btoc): 27.60 Inner Casing Straight and Clear: Y: ✓ N: ___ Depth to Product (ft btoc): —

Length of Water Column in Well (ft): 21.46 Exterior Seal Good: Y: ✓ N: ___ Product Thickness (ft): —

Diameter of Well Casing (in): 2 Pooled water in Head: Y: ___ N: ✓ Purge Rate (liters/min): 0.15

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 12.88 Volume Purged (liters): 4.8

Purge Method: Peristaltic/Submersible/Bailer/Other: ___ Date Well Purged: 12/8/21

Water Sample Data

Sample ID: GM-21-002 Type: ENV Date: 12/8/21 Time: 1333 # Containers: 3

QC Sample ID: GM-21-003 Type: FD Date: 12/8/21 Time: 1340 # Containers: 3

Sampling Personnel: M. Hopper

Remarks (color, odor, etc.): Colorless, odorless

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1253	—	6.14	Initial Depth to Water (pre-pumping)							
1257	Begin purge		@ 150 mL/min							N/A
1305	1.2	6.58	13.0	7.04	16.2	0.992	5.75	0.36	0.49	
1309	1.8	6.60	13.0	7.04	-10.8	0.997	5.49	0.22	0.49	
1313	2.4	6.65	13.0	7.02	-25.4	0.996	5.86	0.16	0.50	
1317	3.0	6.68	13.0	7.02	-31.9	0.994	4.86	0.14	0.49	
1321	3.6	6.70	13.0	7.03	-36.0	0.992	4.71	0.12	0.49	
1325	4.2	6.73	13.0	7.03	-40.1	0.991	4.08	0.10	0.49	
1329	4.8	6.75	13.0	7.03	-41.9	0.989	4.33	0.09	0.49	
Stabilized	—	—	—	—	—	—	—	—	—	
				12/8/21						

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
2" → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: M. Hopper Date: 12/8/21 Page 1 of 1 Meter Model: YSI Pro DSS

Reviewed by: H. Dennis Date: 12/8/21

Filename: Well Inspection, Purging, and Field Measurement Form.docx

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: T021F4076 Naval Installation: Iceyard Site Name: 001

Well Data

Well ID: MW1-2 Well Head Locked: Y: ✓ N: Depth to Water (ft btoc): 6.95

Total Well Depth (ft btoc): 21.00 Inner Casing Straight and Clear: Y: ✓ N: Depth to Product (ft btoc): —

Length of Water Column in Well (ft): 14.05 Exterior Seal Good: Y: ✓ N: Product Thickness (ft): —

Diameter of Well Casing (in): 4 Pooled water in Head: Y: N: ✓ Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 2.5 Well Volume (liters): 35.13 Volume Purged (liters): 5.6

Purge Method: Peristaltic/Submersible/Bailer/Other: Date Well Purged: 12/8/21

Water Sample Data

Sample ID: GM-21-004 Type: EW Date: 12/8/21 Time: 1028 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: IC, Hopper

Remarks (color, odor, etc.): colorless, odorless

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
0956	—	6.95	Initial Depth to Water (pre-pumping)							
0958	Begin purge @ 200mL/min									NA
1002	0.8	6.95	11.6	6.77	-7.3	0.673	19.98	0.53	0.33	
1006	1.6	6.95	11.6	6.80	-2.1	0.673	19.59	0.39	0.33	
1010	2.4	6.95	11.6	6.80	1.7	0.671	19.00	0.36	0.33	
1014	3.2	6.98	11.5	6.78	6.6	0.672	15.90	0.35	0.35	
1018	4.0	6.98	11.8	6.78	10.5	0.671	14.90	0.34	0.33	
1022	4.8	6.98	11.5	6.78	12.9	0.671	14.50	0.34	0.33	
1026	5.6	6.98	11.5	6.78	14.1	0.671	14.26	0.33	0.33	
Stabilized	—									
				✓	✓					
				12/8/21						

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
2" → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: IC, Hopper Date: 12/8/21

Reviewed by: M. Dennis Date: ~~12/9/21~~ 12/8/21 MD

Meter Model: YSI Pro DSS

Filename: Well Inspection, Purging, and Field Measurement Form.docx

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-P-6006 Task Order: 2F4676 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: MW1-3 Well Head Locked: Y: ___ N: ✓ Depth to Water (ft btoc): 2.91

Total Well Depth (ft btoc): 11.03 Inner Casing Straight and Clear: Y: ✓ N: ___ Depth to Product (ft btoc): NA

Length of Water Column in Well (ft): 8.12 Exterior Seal Good: Y: ___ N: ✓ Product Thickness (ft): NA

Diameter of Well Casing (in): 4" Pooled water in Head: Y: ✓ N: ___ Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 2.5 Well Volume (liters): 20.3 Volume Purged (liters): 4.0

Purge Method: Peristaltic/Submersible/Bailer/Other: Low Flow Date Well Purged: 12-7-21

Water Sample Data

Sample ID: GM-21005 Type: ENV Date: 12-7-21 Time: 1448 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: S. Kethlewell, B. Haines

Remarks (color, odor, etc.): Clear

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (‰ or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1425	0.2	2.91	Initial Depth to Water (pre-pumping)							
1430	1.0	3.06	14.3	5.99	26.3	0.143	5.12	5.53	0.07	
1435	2.0	3.16	14.4	5.97	30.8	0.143	4.90	5.47	0.07	
1440	3.0	3.16	14.4	5.90	38.8	0.142	4.88	5.29	0.07	
1445	4.0	3.16	14.3	5.89	40.8	0.140	4.59	5.19	0.07	
1448	Collect sample									

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)			Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)		
2" → 0.6	4" → 2.5	6" → 5.5	1/4" → 0.010	3/8" → 0.022	1/2" → 0.039

Recorded by: S. Kethlewell Date: 12-7-21

Reviewed by: H. Dennis Date: 12/7/21

Meter Model: PROSS 20F00312

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: N4425521F4076 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: MW1-04 Well Head Locked: Y: ✓ N: ___ Depth to Water (ft btoc): ~~NA~~ 6.31 BH

Total Well Depth (ft btoc): 15.03 Inner Casing Straight and Clear: Y: ✓ N: ___ Depth to Product (ft btoc): NA

Length of Water Column in Well (ft): 8.72 Exterior Seal Good: Y: ✓ N: ___ Product Thickness (ft): NA

Diameter of Well Casing (in): 4 Pooled water in Head: Y: ___ N: ✓ Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 2.5 Well Volume (liters): 21.8 Volume Purged (liters): 3.0

Purge Method: Peristaltic/Submersible/Bailer/Other: ___ Date Well Purged: 12/6/21

Water Sample Data

Sample ID: GM-21-006 Type: ENV Date: 12/6/21 Time: 1250 # Containers: ~~2~~ 3 BH

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: B. Haines

Remarks (color, odor, etc.): clear, no odor

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1211	—	6.31	Initial Depth to Water (pre-pumping)							
1230	Begin	purge.	Set flow to 0.2 L/min							NA
1235	1.0	6.31	11.5	8.49	149.2	0.256	7.69	2.88	0.12	
1240	2.0	6.31	11.5	8.56	147.0	0.256	5.12	2.83	0.12	
1245	3.0	6.31	11.4	8.46	147.0	0.256	5.48	2.89	0.12	
1250	collect	sample								
									BH	

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
2" → 0.6 (4)" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: B. Haines Date: 12/6/21

Reviewed by: H. Dennis Date: 12/7/21

Meter Model: YSI ProDSS #94500

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-D-6006 Task Order: 2F4076 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: MW1-6 Well Head Locked: Y: ✓ N: — Depth to Water (ft btoc): 8.20

Total Well Depth (ft btoc): 14.25 Inner Casing Straight and Clear: Y: ✓ N: — Depth to Product (ft btoc): NA

Length of Water Column in Well (ft): 6.05 Exterior Seal Good: Y: — N: ✓ Product Thickness (ft): NA

Diameter of Well Casing (in): 4" Pooled water in Head: Y: — N: ✓ Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 2.5 Well Volume (liters): 15.125 Volume Purged (liters): 5.0

Purge Method: Peristaltic/Submersible/Bailer/Other: low flow, lock broke Date Well Purged: 12-6-21

Water Sample Data

Sample ID: GM-21-007 Type: ENV Date: 12-6-21 Time: 1455 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: S Kettlewell

Remarks (color, odor, etc.): Turbid, slight odor (petroleum)
↳Black

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1425	0.2	8.40	Initial Depth to Water (pre-pumping)							
1430	1.0	8.50	11.9	6.28	9.4	0.324	41.88	4.06	0.16	
1435	2.0	8.50	11.9	6.40	-47.5	0.321	36.10	3.91	0.15	
1440	3.0	8.50	11.8	6.42	-57.8	0.321	34.29	3.90	0.15	
1445	4.0	8.50	11.7	6.40	-65.0	0.322	30.52	3.89	0.15	
1450	5.0	8.50	11.6	6.39	-66.9	0.322	30.34	3.87	0.15	
1455	~~6.0~~	~~8.50~~	Sample collected							

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)			Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)		
2" → 0.6	4" → 2.5	6" → 5.5	1/4" → 0.010	3/8" → 0.022	1/2" → 0.039

Recorded by: S. Kettlewell Date: 12-6-21 Page 1 of 1 Meter Model: YSI ODO 20F0312

Reviewed by: H. Dennis Date: 12/6/21

Filename: Well Inspection, Purging, and Field Measurement Form.docx

EA®	**EA Engineering, Science, and Technology, Inc., PBC** 2200 6th Ave, Suite 707 Seattle, WA 98121	**Well Inspection, Purging, and Field Measurement Form**

Contract Number: N44255-20-D-6006 Task Order: TO21F4076 Naval Installation: NUWC Keyport Site Name: Keyport 001

Well Data

Well ID: MW1-6 Well Head Locked: Y: ___ N: ✓ Depth to Water (ft btoc): 8.19

Total Well Depth (ft btoc): 16.02 Inner Casing Straight and Clear: Y: ✓ N: ___ Depth to Product (ft btoc): —

Length of Water Column in Well (ft): 7.83 Exterior Seal Good: Y: ✓ N: ___ Product Thickness (ft): —

Diameter of Well Casing (in): 4 Pooled water in Head: Y: ___ N: ✓ Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 2.5 Well Volume (liters): 19.58 Volume Purged (liters): 5.0

Purge Method: (Peristaltic)/Submersible/Bailer/Other: ___ Date Well Purged: 12/6/21

Water Sample Data

Sample ID: GM-21-008 Type: ENV Date: 12/6/21 Time: 1045 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: K. Hopper

Remarks (color, odor, etc.): Colorless, odorless

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or (ppt))	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
0954	—	8.19	DTB = 16.02 ft btoc Initial Depth to Water (pre-pumping)							
1004	Begin purge @ 200 mL/min									
1009	1.0	8.41	13.2	6.40	74.6	0.767	13.82	0.41	0.38	
1013	1.8	8.45	13.2	6.43	56.2	0.768	19.26	0.27	0.38	
1017	2.6	8.53	13.3	6.41	50.5	0.765	14.32	0.23	0.38	reduce flow to 100
1021	~~3.4~~	8.53	13.4	6.40	47.1	0.766	17.20	0.20	0.38	Purge vol = 3.0
1025	3.4	8.51	13.2	6.38	45.4	0.762	19.49	0.19	0.38	
1029	3.8	8.51	13.3	6.37	44.6	0.762	24.77	0.17	0.38	
1033	4.2	8.54	13.4	6.36	43.6	0.763	~~49.90~~	0.15	0.38	Turb = 34.33
1037	4.6	8.56	13.4	6.37	41.2	0.763	32.21	0.13	0.38	
1041	5.0	8.56	13.5	6.37	39.8	0.762	33.46	0.11	0.38	
Stabalized										
				12/6/21						

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
2" → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: K. Hopper Date: 12/6/21 Page 1 of 1 Meter Model: YSI Pro DSS

Reviewed by: H. Dennis Date: 12/7/2021 Filename: Well Inspection, Purging, and Field Measurement Form.docx

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: 21F4076 Naval Installation: Keyport Site Name: OU 1

Well Data

Well ID: ~~MW1-009~~ SK MW1-09 Well Head Locked: Y: ✓ N: __ Depth to Water (ft btoc): 6.05'

Total Well Depth (ft btoc): 60.88 Inner Casing Straight and Clear: Y: ✓ N: __ Depth to Product (ft btoc): NA

Length of Water Column in Well (ft): 54.83 Exterior Seal Good: Y: ✓ N: __ Product Thickness (ft): NA

Diameter of Well Casing (in): 2" Pooled water in Head: Y: __ N: ✓ Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 32.898 Volume Purged (liters): 7

Purge Method: (Peristaltic)/Submersible/Bailer/Other: Low Flow Date Well Purged: 12.8.21

Water Sample Data

Sample ID: GM-21-009 Type: ENV Date: 12-8-21 Time: 1308 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: S. Kettlewell

Remarks (color, odor, etc.): Clear, slight petroleum odor

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or (ppt))	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1230	0.2	6.05	Initial Depth to Water (pre-pumping)							
1235	1.0	7.20	12.3	6.62	32.6	0.617	94.49	3.63	0.32	
1240	2.0	6.15	12.2	6.84	-21.8	0.750	93.51	3.52	0.37	
1245	3.0	6.15	12.2	6.93	-57.1	0.757	83.08	3.48	0.37	
1250	4.0	6.15	12.2	6.96	-66.1	0.763	56.12	3.47	0.38	
1255	5.0	6.15	12.2	6.98	-80.7	0.764	58.74	3.48	0.38	
1300	6.0	6.15	12.1	7.02	-86.4	0.762	54.58	3.47	0.38	
1305	7.0	6.15	12.1	7.03	-89.2	0.764	55.49	3.47	0.38	
1308	Collect Sample									

SK

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
2" → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: S. Kettlewell Date: 12-8-21 Page 1 of 1 Meter Model: [illegible]

Reviewed by: H. Dennis Date: 12/8/2021

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6001 Task Order: 21F407 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: MW1-10 Well Head Locked: Y: ✓ N: __ Depth to Water (ft btoc): 4.71'

Total Well Depth (ft btoc): 16.80' Inner Casing Straight and Clear: Y: ✓ N: __ Depth to Product (ft btoc): NA

Length of Water Column in Well (ft): 12.09' Exterior Seal Good: Y: ✓ N: __ Product Thickness (ft): NA

Diameter of Well Casing (in): 2" Pooled water in Head: Y: __ N: ✓ Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 7.254' Volume Purged (liters): 5.0

Purge Method: Peristaltic/Submersible/Bailer/Other: Low Flow Date Well Purged: 12-8-21

Water Sample Data

Sample ID: GM-21-010 Type: ENV Date: 12-8-21 Time: 1223 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: S. Kettlewell

Remarks (color, odor, etc.): Clear, No odor

lock very rusted.

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (‰ or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1155	0.2	4.71	Initial Depth to Water (pre-pumping)							
1200	1.0	6.0	11.9	6.70	27.6	0.174	50.12	5.77	0.08	
1205	2.0	5.90	11.9	6.45	34.9	0.179	44.30	5.47	0.09	
1210	3.0	5.80	12.0	6.33	39.0	0.194	34.26	5.22	0.09	
1215	4.0	5.65	12.1	6.28	39.1	0.200	33.73	5.01	0.09	
1220	5.0	5.60	12.1	6.27	38.3	0.201	31.12	4.87	0.09	
1223	Collect Sample									

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
2" → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: S. Kettlewell Date: 12-8-21

Reviewed by: H. Dennis Date: 12/8/21

Meter Model: PROSS 20F00812

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2200 6th Ave, Suite 707 Seattle, WA 98121

Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: N4425521F4016 Naval Installation: Keyport Site Name: ac1

Well Data

Well ID: MW1-11 Well Head Locked: Y: __ N: ✓ Depth to Water (ft btoc): 52.51

Total Well Depth (ft btoc): 60.77 Inner Casing Straight and Clear: Y: ✓ N: __ Depth to Product (ft btoc): NA

Length of Water Column in Well (ft): 8.26 Exterior Seal Good: Y: ✓ N: __ Product Thickness (ft): NA

Diameter of Well Casing (in): 2" Pooled water in Head: Y: __ N: ✓ Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 4.95 (incorrect?) Volume Purged (liters): 7.0

Purge Method: Peristaltic/Submersible/Bailer/Other: _____ Date Well Purged: 12/7/21

Water Sample Data

Sample ID: Gw-21-011 Type: ENV Date: 12/7/21 Time: 1557 # Containers: 3

QC Sample ID: ~~BH~~ Gw-21-012 Type: ~~BH~~ FD Date: ~~BH~~ 12/7/21 Time: ~~BH~~ 1602 # Containers: 3

Sampling Personnel: BH.

Remarks (color, odor, etc.): clear, no odor

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1510	—	52.51	Initial Depth to Water (pre-pumping)							
1517	Begin	Purge	Set flow to		0.2 L/min					NA
1522	1.0	52.51	14.4	6.58	-68.2	0.246	47.93	1.06	0.12	
1527	2.0	52.51	14.4	6.42	86.1	0.249	44.51	0.67	0.12	
1532	3.0	52.51	14.5	6.27	92.0	0.231	38.99	0.48	0.11	
1537	4.0	51.22	14.6	6.19	90.7	0.227	32.10	0.42	0.11	
1542	5.0	50.10	14.6	6.18	90.8	0.220	37.42	0.38	0.10	
1547	6.0	50.08	14.5	6.17	90.8	0.219	35.23	0.36	0.10	
1552	7.0	50.08	14.6	6.15	90.8	0.222	36.97	0.36	0.11	
1557	collect	samples								
									BH	

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
(2") → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: B. Hawes Date: 12/7/21 Page 1 of 1 Meter Model: YSI ProDSS H44500

Reviewed by: H. Dennis Date: 12/7/21 Filename: Well Inspection, Purging, and Field Measurement Form.docx

QC Note - * DTW seems possibly incorrect (peristaltic typically does not work >30ft & inconsistent w/ other wells)

EA Engineering, Science, and Technology, Inc., PBC

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 | Task Order: 21F4076 | Naval Installation: Keyport | Site Name: OU1

Well Data

Well ID: MW1-14 | Well Head Locked: Y: ✓ N: | Depth to Water (ft btoc): 7.15

Total Well Depth (ft btoc): 15.59 | Inner Casing Straight and Clear: Y: ✓ N: | Depth to Product (ft btoc): NP

Length of Water Column in Well (ft): 8.44 | Exterior Seal Good: Y: ✓ N: | Product Thickness (ft): —

Diameter of Well Casing (in): 2 | Pooled water in Head: Y: N: ✓ | Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 0.6 | Well Volume (liters): 5.064 | Volume Purged (liters): 1006

Purge Method: Peristaltic/Submersible/Bailer/Other: | Date Well Purged: 12/8/2021

Water Sample Data

Sample ID: GM-21-013 Type: ENV Date: 12/8/2021 Time: 1203 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: H. Hajek

Remarks (color, odor, etc.): clear, colorless, odorless, sediment

some sediment in flow cell from well, bubbles in flow cell, red/brown residue on probe & tubing

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (‰ or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1058		7.15	Initial Depth to Water (pre-pumping)							
1105	Begin Purge		Set Purge Rate @ 0.2 L/min							NA
1110	1.0	8.06	11.2	6.28	25.2	0.650	13.21	0.96	0.32	
1114	1.8	8.19	11.4	6.28	11.3	0.651	18.01	0.75	0.32	
1118	2.6	8.23	11.5	6.28	1.4	0.649	28.55	0.65	0.32	
1122	3.4	8.23	11.5	6.28	-6.1	0.650	17.02	0.60	0.32	
1126	4.2	8.23	11.4	6.28	-13.4	0.651	17.10	0.56	0.32	
1130	5.0	8.23	11.4	6.28	-17.2	0.650	16.41	0.53	0.32	
1134	5.8	8.23	11.4	6.28	-21.6	0.650	12.30	0.49	0.32	
1138	6.6	8.23	11.5	6.28	-25.4	0.650	16.83	0.48	0.32	Large chunks of sediment left flow cell
1142	7.4	8.23	11.6	6.28	-18.8	0.648	14.74	0.78	0.32	
1146	8.2	8.23	11.6	6.28	-21.8	0.651	12.69	0.62	0.32	
1150	9.0	8.23	11.7	6.28	-25.3	0.650	13.78	0.53	0.32	
1154	9.8	8.23	11.7	6.28	-28.7	0.650	14.23	0.50	0.32	
1158	10.6	8.23	11.6	6.28	-30.4	0.650	12.97	0.48	0.32	

STABILIZED

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
2" → 0.6 (circled) 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: H. Hajek Date: 12/8/2021 Page 1 of 1 Meter Model: YSI PRO DSS

Reviewed by: H. Dennis Date: 12/8/2021 Filename: Well Inspection, Purging, and Field Measurement Form.docx

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: 21F4076 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: MW1-15 Well Head Locked: Y: ✓ N: Depth to Water (ft btoc): 6.02

Total Well Depth (ft btoc): 12.78 Inner Casing Straight and Clear: Y: ✓ N: Depth to Product (ft btoc): NP

Length of Water Column in Well (ft): 6.76 Exterior Seal Good: Y: N: ✓ Product Thickness (ft): —

Diameter of Well Casing (in): 2 Pooled water in Head: Y: ✓ N: Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 4.056 Volume Purged (liters): 8.0

Purge Method: Peristaltic/Submersible/Bailer/Other: Date Well Purged: 12/7/2021

Water Sample Data

Sample ID: GM-21-014 Type: ENV Date: 12/7/2021 Time: 1532 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: H. Hajek

Remarks (color, odor, etc.): clear, colorless, odorless

Bailed, no seal, rusted bolts

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1434		6.02	Initial Depth to Water (pre-pumping)							
1447	Begin Purge		Set Purge Rate @ 0.2 L/min							MD
1452	1.0	6.04	16.5	6.19	27.2	0.665	0.61	0.71	0.33	
1457	2.0	6.05	16.5	6.20	8.2	0.665	0.22	0.59	0.33	
1502	3.0	6.05	16.7	6.20	-5.3	0.664	1.21	0.53	0.33	
1507	4.0	6.04	16.6	6.20	-15.8	0.664	1.61	0.48	0.33	
1512	5.0	6.04	16.5	6.20	-22.4	0.664	1.85	0.45	0.32	
1517	6.0	6.04	16.7	6.20	-27.6	0.663	1.74	0.43	0.32	
1522	7.0	6.04	16.7	6.20	-33.8	0.662	1.67	0.42	0.32	
1527	8.0	6.04	16.7	6.20	-36.0	0.661	1.88	0.41	0.32	
STABILIZED										
						HH 12/7/2021				

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)			Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)		
2" → 0.6	4" → 2.5	6" → 5.5	1/4" → 0.010	3/8" → 0.022	1/2" → 0.039

Recorded by: H. Hajek Date: 12/7/2021 Page 1 of 1 Meter Model: YSI PRO DSS

Reviewed by: H. Dennis Date: 12/9/2021 Filename: Well Inspection, Purging, and Field Measurement Form.docx

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: 21F4076 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: MW1-17 Well Head Locked: Y: ✓ N: ___ Depth to Water (ft btoc): 5.07

Total Well Depth (ft btoc): 13.82 Inner Casing Straight and Clear: Y: ✓ N: ___ Depth to Product (ft btoc): NP

Length of Water Column in Well (ft): 8.75 Exterior Seal Good: Y: ___ (HH 12/6/21) N: ✓ Product Thickness (ft): ___

Diameter of Well Casing (in): 2 Pooled water in Head: Y: ___ N: ✓ Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 5.25 Volume Purged (liters): 9.0

Purge Method: Peristaltic/Submersible/Bailer/Other: ___ Date Well Purged: 12/6/2021

Water Sample Data

Sample ID: GM-21-015 Type: ENV Date: 12/6/2021 Time: 1453 # Containers: 3

QC Sample ID: ___ Type: ___ Date: ___ Time: ___ # Containers: ___

Sampling Personnel: H. Hajek, K. Hopper

Remarks (color, odor, etc.): clear, colorless, odorless, bubbles in flow cell seal broken, old tubing removed from well

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1356		5.07	Initial Depth to Water (pre-pumping)							
1403	Begin	Purge	Set	Purge Rate @ 0.2 L/min						SPC out HH 12/6/21
1408	1.0	5.14	11.1	6.72	-65.3	0.194	12.17	0.67	0.09	
1412	1.8	5.17	11.1	6.63	-62.9	0.198	16.16	0.56	0.09	
1416	2.6	5.17	11.1	6.59	-59.7	0.201	19.18	0.50	0.10	
1420	3.4	5.17	11.1	6.54	-55.5	0.213	21.95	0.46	0.10	
1424	4.2	5.17	11.3	6.61	-58.0	0.281	11.24	0.43	0.14	SPC slightly
1428	5.0	5.17	11.4	6.64	-60.4	0.314	11.72	0.42	0.15	out.
1432	5.8	5.17	11.4	6.68	-64.1	0.350	10.92	0.41	0.17	
1436	6.6	5.17	11.5	6.71	-67.9	0.388	13.44	0.40	0.19	
1440	7.4	5.17	11.5	6.75	-71.6	0.417	7.92	0.40	0.20	
1444	8.2	5.17	11.4	6.79	-76.5	0.445	7.86	0.39	0.22	
1448	9.0	5.17	11.3	6.82	-80.9	0.459	7.37	0.38	0.22	
STABILIZED										

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
2" → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: H. Hajek Date: 12/6/2021 Page 1 of 1 Meter Model: YSI PRODSS

Reviewed by: H. Dems Date: 12/7/2021 Filename: Well Inspection, Purging, and Field Measurement Form.docx

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: T021F4076 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: MW1-18 Well Head Locked: Y: ✓ N: ___ Depth to Water (ft btoc): 6.15

Total Well Depth (ft btoc): 20.45 Inner Casing Straight and Clear: Y: ✓ N: ___ Depth to Product (ft btoc): —

Length of Water Column in Well (ft): 14.30 Exterior Seal Good: Y: ✓ N: ___ Product Thickness (ft): —

Diameter of Well Casing (in): 2 Pooled water in Head: Y: ___ N: ✓ Purge Rate (liters/min): 0.15

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 8.58 Volume Purged (liters): 3.6

Purge Method: Peristaltic/Submersible/Bailer/Other: ___ Date Well Purged: 12/8/21

Water Sample Data

Sample ID: GM-21-016 Type: ENV Date: 12/8/21 Time: 1415 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: K. Hopper

Remarks (color, odor, etc.): ~~Colorless~~, odorless, cloudy, brown KH 12/9

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (‰ or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1342	—	6.15	Initial Depth to Water (pre-pumping)							
1346	Begin purge @ 150mL/min									NA
1354	1.2	8.13	11.5	6.63	-14.4	0.305	110.11	0.24	0.15	
1358	1.8	8.25	11.3	6.59	-12.1	0.307	88.16	0.17	0.15	
1402	2.4	8.40	11.1	6.58	-11.0	0.310	87.16	0.17	0.15	
1406	3.0	8.52	11.0	6.60	-11.9	0.312	92.39	0.15	0.15	
1410	3.6	8.60	10.9	6.62	-12.8	0.312	89.98	0.15	0.15	
Stabalize	—	—	—	—	—	—	—	—	—	

12/8/21

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
2" → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: K. Hopper Date: 12/8/21

Reviewed by: A. Dennis Date: 12/9/21

Meter Model: YSI Pro DSS

Filename: Well Inspection, Purging, and Field Measurement Form.docx

EA®	**EA Engineering, Science, and Technology, Inc., PBC** 2200 6th Ave, Suite 707 Seattle, WA 98121	**Well Inspection, Purging, and Field Measurement Form**

Contract Number: N44255-20-D-6000 Task Order: 21F4076 Naval Installation: Keyport Site Name: OU 1

Well Data

Well ID: MW1-20 Well Head Locked: Y: ___ N: ✓ Depth to Water (ft btoc): 3.63'

Total Well Depth (ft btoc): 16.05' Inner Casing Straight and Clear: Y: ___ N: ✓ Depth to Product (ft btoc): NA

Length of Water Column in Well (ft): 12.42 Exterior Seal Good: Y: ___ N: ✓ Product Thickness (ft): NA

Diameter of Well Casing (in): ~~0.6~~ 2" Pooled water in Head: Y: ✓ N: ___ Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 7.452 Volume Purged (liters): 7.0

Purge Method: (Peristaltic)/Submersible/Bailer/Other: Low flow, No bolts in well Date Well Purged: 12-7-21

Water Sample Data

Sample ID: GW-[illegible]121-018 Type: ENV Date: 12-7-21 Time: 1248 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: S. Kettlewell

Remarks (color, odor, etc.): Clear, No odor

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or (ppt))	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1210	0.2	3.63	Initial Depth to Water (pre-pumping)							
1215	1.0	4.87	14.3	6.64	5.5	0.730	15.87	4.14	0.36	
1220	2.0	5.20	14.3	6.65	1.9	0.691	15.08	3.87	0.34	
1225	3.0	5.63	14.3	6.64	2.3	0.624	13.84	3.64	0.30	
1230	4.0	5.70	14.3	6.60	3.7	0.548	12.60	3.54	0.27	
1235	5.0	5.75	14.3	6.56	6.5	0.529	12.27	3.51	0.26	
1240	6.0	5.82	14.3	6.48	10.2	0.512	12.00	3.47	0.25	
1245	7.0	5.85	14.3	6.48	11.6	0.499	11.77	3.44	0.23	
1248	Collect Sample									

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
(2" → 0.6) 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: S. Kettlewell Date: 12-7-21 Page 1 of 1 Meter Model: PRODSS 20F[illegible]

Reviewed by: H. Dennis Date: 12/7/21

Filename: Well Inspection, Purging, and Field Measurement Form.docx

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: 2E4076 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: MW1-23 Well Head Locked: Y: ✓ N: __ Depth to Water (ft btoc): 9.14

Total Well Depth (ft btoc): 30.02 Inner Casing Straight and Clear: Y: ✓ N: __ Depth to Product (ft btoc): NA

Length of Water Column in Well (ft): 20.88 Exterior Seal Good: Y: ✓ N: __ Product Thickness (ft): NA

Diameter of Well Casing (in): 2" Pooled water in Head: Y: __ N: ✓ Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 12.53 Volume Purged (liters): 6.0

Purge Method: Peristaltic/Submersible/Bailer/Other: Date Well Purged: 12/8/21

Water Sample Data

Sample ID: GM-21-019 Type: Env Date: 12/8/21 Time: 1108 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: BH

Remarks (color, odor, etc.): clear, no odor

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1023	—	9.14	Initial Depth to Water (pre-pumping)							
1033	Begin	Purge	set	flow	to 0.2	L/min				NA
1038	1.0	9.22	13.5	8.07	104.8	0.268	26.09	0.87	0.13	
1043	2.0	9.22	13.4	8.00	112.5	0.269	26.90	0.75	0.13	
1048	3.0	9.22	12.9	7.91	113.9	0.269	25.62	0.65	0.13	
1053	4.0	9.22	13.2	7.76	124.5	0.265	20.40	0.54	0.13	
1058	5.0	9.22	12.9	7.75	126.6	0.260	21.43	0.51	0.13	
1103	6.0	9.22	13.2	7.66	127.7	0.258	20.09	0.49	0.13	
1108	—	9.22 BH	collect sample							

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
(2") → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: B. Haines Date: 12/8/21 Page 1 of 1 Meter Model: YSI pro DSS #44500

Reviewed by: H. Dennis Date: 12/8/21 Filename: Well Inspection, Purging, and Field Measurement Form.docx

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-16-D-6006 Task Order: 4E4076 Naval Installation: Keyport Site Name: OU 1

Well Data

Well ID: MW1-24 Well Head Locked: Y: ✓ N: Depth to Water (ft btoc): 4.84'

Total Well Depth (ft btoc): 29.30' Inner Casing Straight and Clear: Y: ✓ N: Depth to Product (ft btoc): NA

Length of Water Column in Well (ft): 24.46 Exterior Seal Good: Y: N: ✓ Product Thickness (ft): NA

Diameter of Well Casing (in): 2" Pooled water in Head: Y: ✓ N: Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 14.676 Volume Purged (liters): 6.0

Purge Method: Peristaltic/Submersible/Bailer/Other: Low Flow, water in well Date Well Purged: 12-8-21

Water Sample Data

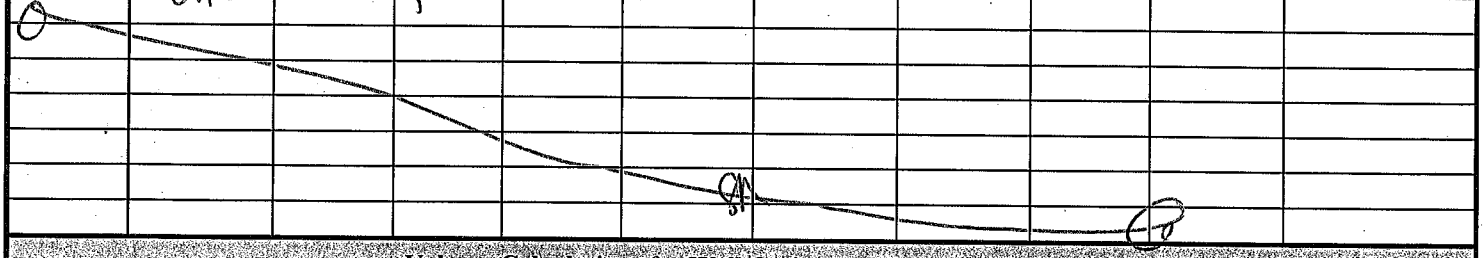
Sample ID: GM-21-020 Type: ENV Date: 12-8-21 Time: 1123 # Containers: 3

QC Sample ID: GM-21-021 Type: DUP Date: 12-8-21 Time: 1126 # Containers: 3

Sampling Personnel: S. Kettlewell

Remarks (color, odor, etc.): Cloudy, slight petroleum odor

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1050	0.2	4.84	Initial Depth to Water (pre-pumping)							
1055	1.0	4.90	14.5	7.14	-44.4	0.222	235.27	3.34	0.11	
1100	2.0	4.90	14.6	7.05	-66.4	0.222	232.82	3.25	0.11	
1105	3.0	4.90	14.6	7.02	-76.2	0.222	150.87	3.23	0.11	
1110	4.0	4.90	14.7	6.99	-88.4	0.222	115.93	3.19	0.11	
1115	5.0	4.90	14.5	7.00	-96.5	0.222	110.54	3.19	0.11	
1120	6.0	4.90	14.6	7.00	-95.4	0.222	106.76	3.18	0.11	
1123	Collect sample									



Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
2" → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: S. Kettlewell Date: 12-8-21 Page 1 of 1 Meter Model: YSI DSS 20F0C312

Reviewed by: H. Dennis Date: 12/8/21

Filename: Well Inspection, Purging, and Field Measurement Form.docx

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 | Task Order: 21F4076 | Naval Installation: Keyport | Site Name: OU1

Well Data

Well ID: MW1-25 | Well Head Locked: Y: ✓ N: | Depth to Water (ft btoc): 7.27

Total Well Depth (ft btoc): 51.24 | Inner Casing Straight and Clear: Y: ✓ N: | Depth to Product (ft btoc): NP

Length of Water Column in Well (ft): 43.97 | Exterior Seal Good: Y: ✓ N: | Product Thickness (ft): —

Diameter of Well Casing (in): 2 | Pooled water in Head: Y: N: ✓ | Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 0.6 | Well Volume (liters): 26.382 | Volume Purged (liters): 7.4

Purge Method: Peristaltic/Submersible/Bailer/Other: | Date Well Purged: 12/8/2021

Water Sample Data

Sample ID: GM-21-022 | Type: ENV | Date: 12/8/2021 | Time: 1347 | # Containers: 3

QC Sample ID: — | Type: — | Date: — | Time: — | # Containers: —

Sampling Personnel: H. Hajek

Remarks (color, odor, etc.): clear, colorless, odorless

soft bottom

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1253		7.27	Initial Depth to Water (pre-pumping)							
1305	Begin	Purge	Set Purge rate @ 0.2 L/min							MH
1310	1.0	7.29	12.1	6.75	113.0	0.994	15.48	1.12	0.49	
~~1304~~ HH 12/8/21 1314	1.8	7.51	12.1	6.77	97.2	0.995	8.53	0.83	0.49	
~~1308~~ 1318	2.6	7.55	12.2	6.77	83.4	0.994	7.65	0.73	0.49	
1322	3.4	7.60	12.2	6.78	67.1	0.994	7.23	0.64	0.49	
1326	4.2	7.65	12.1	6.78	51.8	0.994	6.67	0.60	0.49	
1330	5.0	7.71	12.1	6.79	37.1	0.994	4.58	0.56	0.49	
1334	5.8	7.78	12.1	6.79	21.7	0.994	2.28	0.51	0.49	
1338	6.6	7.83	12.1	6.79	20.5	0.994	2.34	0.49	0.49	
1342	7.4	7.87	12.1	6.79	13.7	0.994	2.23	0.49	0.49	
STABILIZED					HH 12/12/2021					

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
2" → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: H. Hajek Date: 12/8/2021 | Page 1 of 1 | Meter Model: YSI PRO DSS

Reviewed by: H. Dennis Date: 12/9/2021 | Filename: Well Inspection, Purging, and Field Measurement Form.docx

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: 216076 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: MW1-27-023 Well Head Locked: Y: ___ N: ✓ Depth to Water (ft btoc): 4.60

Total Well Depth (ft btoc): 29.88 Inner Casing Straight and Clear: Y: ✓ N: ___ Depth to Product (ft btoc): NA

Length of Water Column in Well (ft): 25.28 Exterior Seal Good: Y: ___ N: ✓ Product Thickness (ft): NA

Diameter of Well Casing (in): 2" Pooled water in Head: Y: ✓ N: ___ Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 15.168 Volume Purged (liters): 9.0

Purge Method: Peristaltic/Submersible/Bailer/Other: Low Flow, water in well up to wellhead Date Well Purged: 12-7-21

Water Sample Data

Sample ID: GW-21-023 Type: MS/MSD Date: 12-7-21 Time: 1548 # Containers: 6 7

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: S. Kettlewell, B. Haines

Remarks (color, odor, etc.): Clear, No odor to slight.

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1500	0.2	4.60	Initial Depth to Water (pre-pumping)							
1505	1.0	5.20	15.6	6.30	39.6	0.162	18.84	3.44	0.08	
1510	2.0	5.20	15.5	6.49	5.0	0.156	38.25	3.29	0.07	
1515	3.0	5.20	15.6	6.61	-22.4	0.158	36.49	3.23	0.07	
1520	4.0	5.20	15.3	6.70	-44.3	0.162	47.36	3.22	0.08	
1525	5.0	5.20	15.2	6.74	-59.4	0.164	39.98	3.24	0.08	
1530	6.0	5.20	15.2	6.74	-65.6	0.164	27.21	3.22	0.08	
1535	7.0	5.20	15.2	6.75	-78.4	0.164	25.63	3.21	0.08	
1540	8.0	5.20	15.2	6.78	-80.2	0.164	30.09	3.21	0.08	
1545	9.0	5.20	15.2	6.76	-81.4	0.164	28.51	3.20	0.08	
1548	Sample Collection									

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
2" → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: S. Kettlewell Date: 12-7-21

Reviewed by: H. Dennis Date: 12/7/21

Meter Model: PRODSS 20F00312

Filename: Well Inspection, Purging, and Field Measurement Form.docx

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: 2F4076 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: MW1-28 Well Head Locked: Y: ✓ N: ___ Depth to Water (ft btoc): 8.86

Total Well Depth (ft btoc): 49.00 Inner Casing Straight and Clear: Y: ✓ N: ___ Depth to Product (ft btoc): NA

Length of Water Column in Well (ft): 40.14 Exterior Seal Good: Y: ✓ N: ___ Product Thickness (ft): NA

Diameter of Well Casing (in): 2" Pooled water in Head: Y: ___ N: ✓ Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): ~~24.08~~ 0.6 Well Volume (liters): 24.08 Volume Purged (liters): 7.0

Purge Method: Peristaltic/Submersible/Bailer/Other: ___ Date Well Purged: 12/8/21

Water Sample Data

Sample ID: GM-21-024 Type: Env Date: 12/8/21 Time: 1351 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: BH

Remarks (color, odor, etc.): clear, no odor

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1300	—	8.86	Initial Depth to Water (pre-pumping)							
1311	Begin	Purge	set flow to 0.2 L/min							NA
1316	1.0	8.88	11.8	7.36	151.7	1.341	11.21	1.43	0.67	
1321	2.0	8.88	11.7	7.37	33.5	1.362	12.19	0.88	0.69	
1326	3.0	8.88	11.8	7.29	42.10	1.376	12.71	0.68	0.69	
1331	4.0	8.88	11.8	7.20	47.6	1.387	12.68	0.57	0.70	
1336	5.0	8.88	11.7	7.18	49.3	1.393	12.56	0.52	0.70	
1341	6.0	8.90	11.7	7.14	52.0	1.404	12.38	0.48	0.71	
1346	7.0	8.90	11.7	7.12	52.7	1.403	12.07	0.47	0.71	
1351	Collect	Sample							BH	

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
(2") → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: B. Haines Date: 12/8/21 Page 1 of 1 Meter Model: YSI pro DSS #44500

Reviewed by: M. Dennis Date: 12/9/21 Filename: Well Inspection, Purging, and Field Measurement Form.docx

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: 21F4036 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: MW1-29 Well Head Locked: Y: ✓ N: ___ Depth to Water (ft btoc): 8.45'

Total Well Depth (ft btoc): 39.63' Inner Casing Straight and Clear: Y: ✓ N: ___ Depth to Product (ft btoc): NA

Length of Water Column in Well (ft): 31.18 Exterior Seal Good: Y: ✓ N: ___ Product Thickness (ft): NA

Diameter of Well Casing (in): 2" Pooled water in Head: Y: ___ N: ✓ Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 18.708 Volume Purged (liters): 8.0

Purge Method: (Peristaltic)/Submersible/Bailer/Other: Low Flow Date Well Purged: 12-8-21

Water Sample Data

Sample ID: GM-21-025 Type: ENV Date: 12-8-21 Time: 1411 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: S. Kettlewell

Remarks (color, odor, etc.): Clear, slight petroleum odor, lock rusted.

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or (ppt))	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1328	0.2	8.45	Initial Depth to Water (pre-pumping)							
1333	1.0	8.76	12.1	6.96	-1.1	2.129	65.11	3.53	1.10	
1338	2.0	8.80	12.0	7.05	-16.4	2.141	70.16	3.52	1.10	
1343	3.0	8.90	12.0	7.11	-32.4	2.145	77.33	3.49	1.10	
1348	4.0	8.90	11.9	7.15	-44.2	2.146	79.28	3.48	1.10	
1353	5.0	8.90	11.8	7.17	-52.6	2.150	10.07	3.48	1.10	
1358	6.0	8.90	12.0	7.18	-63.0	2.147	10.46	3.40	1.10	
1403	7.0	8.90	11.9	7.20	-64.7	2.152	11.28	3.46	1.11	
1408	8.0	8.90	11.9	7.20	-68.6	2.148	10.01	3.46	1.11	
1411	Collect Sample									

SK

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
(2" → 0.6) 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: S. Kettlewell Date: 12-8-21 Page 1 of 1 Meter Model: PRO DSS 20F00312

Reviewed by: H. Deans Date: 12/18/21

Filename: Well Inspection, Purging, and Field Measurement Form.docx

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: N4425524F4072 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: MW1-31 Well Head Locked: Y: ___ N: ✓ Depth to Water (ft btoc): 4.56

Total Well Depth (ft btoc): 23.08 Inner Casing Straight and Clear: Y: ✓ N: ___ Depth to Product (ft btoc): NA

Length of Water Column in Well (ft): 18.52 Exterior Seal Good: Y: ___ N: ✓ Product Thickness (ft): NA

Diameter of Well Casing (in): 2" Pooled water in Head: Y: ✓ N: ___ Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 11.11 Volume Purged (liters): 5.6

Purge Method: (Peristaltic)/Submersible/Bailer/Other: ___ Date Well Purged: 12/7/2021

Water Sample Data

Sample ID: GM-21-026 Type: ENV Date: 12/7/2021 Time: 1454 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: Hannah Dennis

Remarks (color, odor, etc.): Slightly cloudy, no odor

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1405	0.0	4.56	Initial Depth to Water (pre-pumping)							
1417	Pump on									
1422	1.0	5.11	15.3	6.97	114.7	0.218	35.83	0.76	0.10	
1426	1.8	5.11	15.4	6.95	109.7	0.224	27.18	0.51	0.11	
1430	2.6	5.11	15.4	6.72	104.5	0.225	24.24	0.43	0.11	
1434	3.2	5.11	15.5	6.50	99.1	0.225	22.60	0.40	0.11	
1438	3.8	5.13	15.5	6.37	94.9	0.226	21.67	0.36	0.11	
1442	4.4	5.14	15.5	6.26	89.8	0.228	16.90	0.32	0.11	
1446	5.0	5.14	15.7	6.19	87.2	0.227	17.16	0.31	0.11	
1450	5.6	5.14	15.6	6.14	85.0	0.228	17.69	0.29	0.11	
1454	Collect	sample								

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
2" → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: Hannah Dennis Date: 12/7/2021 Page 1 of 1 Meter Model: YSI Pro DSS #44520

Reviewed by: H. Dennis Date: 12/7/2021

Filename: Well Inspection, Purging, and Field Measurement Form.docx

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: N1F4076 Naval Installation: Keyport Site Name: all

Well Data

Well ID: MW1-38 Well Head Locked: Y: ✓ N: ___ Depth to Water (ft btoc): 2.30'

Total Well Depth (ft btoc): 50.25' Inner Casing Straight and Clear: Y: ✓ N: ___ Depth to Product (ft btoc): NA

Length of Water Column in Well (ft): 47.95 Exterior Seal Good: Y: ___ N: ✓ Product Thickness (ft): NA

Diameter of Well Casing (in): 2" Pooled water in Head: Y: ___ N: ✓ Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 28.77 Volume Purged (liters): 9.0

Purge Method: (Peristaltic)/Submersible/Bailer/Other: Low Flow Date Well Purged: 12-8-21

Water Sample Data

Sample ID: GM 21-027 Type: ENV Date: 12-8-21 Time: 1008 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: S Kettlewell

Remarks (color, odor, etc.): clear, sewage smell

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or (ppt))	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
0920	0.2	2.30	Initial Depth to Water (pre-pumping)							
0925	1.0	2.55	13.5	7.50	104.2	0.733	26.07	3.50	0.36	
0930	2.0	2.70	13.6	7.62	40.2	0.737	33.02	3.40	0.36	
0935	3.0	2.75	13.6	7.65	-26.2	0.745	22.62	3.36	0.37	
0940	4.0	2.83	13.5	7.66	-56.1	0.752	15.26	3.35	0.37	
0945	5.0	2.85	13.3	7.67	-86.1	0.760	15.10	3.38	0.37	
0950	6.0	2.90	13.4	7.67	-89.1	0.759	15.80	3.34	0.37	
0955	7.0	2.93	13.4	7.66	-100.4	0.761	15.41	3.34	0.37	
1000	8.0	2.93	13.4	7.69	-104.2	0.761	15.43	3.33	0.38	
1005	9.0	3.01	13.4	7.66	-106.5	0.761	14.81	3.34	0.37	
1008	Sample collected									

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
(2" → 0.6) 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: S Kettlewell Date: 12-8-21 Page 1 of 1 Meter Model: PRO DSS 21E0312

Reviewed by: A. Dennis Date: 12/9/21

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: 21F4076 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: MW1-39 Well Head Locked: Y: ✓ N: ___ Depth to Water (ft btoc): 2.49

Total Well Depth (ft btoc): 33.71 Inner Casing Straight and Clear: Y: ✓ N: ___ Depth to Product (ft btoc): NA

Length of Water Column in Well (ft): 31.22 Exterior Seal Good: Y: ___ N: ✓ Product Thickness (ft): NA

Diameter of Well Casing (in): 2" Pooled water in Head: Y: ✓ N: ___ Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 18.73 Volume Purged (liters): 8.0

Purge Method: Peristaltic/Submersible/Bailer/Other: ___ Date Well Purged: 12/8/21

Water Sample Data

Sample ID: Gw-21-028 Type: ENV Date: 12/8/21 Time: 1000 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: B. Haines

Remarks (color, odor, etc.): clear, no odor

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (‰ or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
0900	—	2.49	Initial Depth to Water (pre-pumping)							
0915	Begin	purge	set	flow	to 0.2	L/m	in			NA
0920	1.0	2.49	12.7	8.20	181.2	0.397	12.34	1.31	0.19	
0925	2.0	2.49	13.0	8.34	151.8	0.376	12.27	0.95	0.18	
0930	3.0	2.49	13.3	8.38	104.1	0.370	12.52	0.75	0.18	
0935	4.0	2.49	13.2	8.41	37.1	0.370	13.83	0.66	0.18	
0940	5.0	2.49	13.5	8.39	31.1	0.369	12.87	0.57	0.18	
0945	6.0	2.49	13.4	8.38	28.9	0.369	12.30	0.54	0.18	
0950	7.0	2.49	13.3	8.34	71.5	0.370	12.11	0.50	0.18	
0955	8.0	2.49	13.3	8.30	75.8	0.370	12.22	0.48	0.18	
1000	collect	sample								
									pH	

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
(2") → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: B. Haines Date: 12/8/21 Page 1 of 1 Meter Model: YSI Pro DSS #44500

Reviewed by: H. Dennis Date: 12/8/21 Filename: Well Inspection, Purging, and Field Measurement Form.docx

EA Engineering, Science, and Technology, Inc., PBC

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: T021F407G Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: MW1-41 Well Head Locked: Y: ✓ N: ___ Depth to Water (ft btoc): 7.42

Total Well Depth (ft btoc): 17.65 Inner Casing Straight and Clear: Y: ✓ N: ___ Depth to Product (ft btoc): —

Length of Water Column in Well (ft): 10.23 Exterior Seal Good: Y: ✓ N: ___ Product Thickness (ft): —

Diameter of Well Casing (in): 2 Pooled water in Head: Y: ___ N: ✓ Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 6.14 Volume Purged (liters): 4.2

Purge Method: Peristaltic/Submersible/Bailer/Other: ___ Date Well Purged: 12/8/21

Water Sample Data

Sample ID: GM-21-029 Type: ENV Date: 12/8/21 Time: 1210 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: K. Hopper

Remarks (color, odor, etc.): light grey, odorless

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1140	—	7.42	Initial Depth to Water (pre-pumping)							
1145	Begin purge @ 200 mL/min									NA
1150	1.0	8.51	12.2	6.35	-30.6	0.931	11.60	0.33	0.46	
1154	1.8	7.51	12.3	6.37	-32.6	0.923	7.60	0.20	0.46	
1158	2.6	7.51	12.3	6.39	-34.6	0.918	9.80	0.14	0.46	
1202	3.4	7.50	12.3	6.40	-36.4	0.911	7.67	0.10	0.45	
1206	4.2	7.50	12.3	6.40	-38.0	0.900	5.92	0.07	0.45	
Stabilized	—	—	—	—	—	—	—	—	—	

12/8/21

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
2" → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: K. Hopper Date: 12/8/21 Page 1 of 1 Meter Model: YSI Pro DSS

Reviewed by: H. Sims Date: 12/9/21 Filename: Well Inspection, Purging, and Field Measurement Form.docx

EA Engineering, Science, and Technology, Inc., PBC

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: 21F4076 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: MW1-42 Well Head Locked: Y: ✓ N: Depth to Water (ft btoc): 3.36

Total Well Depth (ft btoc): 24.28 Inner Casing Straight and Clear: Y: ✓ N: Depth to Product (ft btoc): NP

Length of Water Column in Well (ft): 20.92 Exterior Seal Good: Y: N: ✓ Product Thickness (ft): —

Diameter of Well Casing (in): 2 Pooled water in Head: Y: ✓ N: Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 12.552 Volume Purged (liters): 9.0

Purge Method: Peristaltic/Submersible/Bailer/Other: Date Well Purged: 12/7/2021

Water Sample Data

Sample ID: GM-21-030 Type: ENV Date: 12/7/2021 Time: 1007 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: H. Hajek

Remarks (color, odor, etc.): clear, colorless, odorless

Bailed, water 2/3 up well casing; Bolts extremely rusty (hard to open), no seal

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
0904		3.36	Initial Depth to Water (pre-pumping)							
0917	Begin	Purge	Set	Purge	Rate @					
0922	1.0	3.86	14.5	7.25	140.0	0.506	9.91	1.02	0.25	NA
0926	1.8	3.89	14.8	7.33	64.0	0.481	7.21	0.71	0.23	
0930	2.6	3.90	14.8	7.35	33.0	0.466	6.66	0.66	0.23	
0934	3.4	3.91	14.9	7.37	8.0	0.454	5.49	0.62	0.22	
0938	4.2	3.91	14.9	7.38	-19.9	0.424	5.81	0.58	0.20	
0942	5.0	3.91	14.9	7.38	-44.7	0.405	4.27	0.54	0.20	
0946	5.8	3.91	14.9	7.39	-57.1	0.393	4.15	0.53	0.19	
0950	6.6	3.91	14.9	7.40	-69.0	0.381	3.78	0.50	0.18	
0954	7.4	3.91	14.9	7.39	-75.5	0.383	4.22	0.47	0.18	
0958	8.2	3.91	15.0	7.39	-79.6	0.382	4.20	0.47	0.18	
1002	9.0	3.91	15.0	7.40	-84.5	0.376	3.95	0.46	0.18	
STABILIZED										

HH 12/7/21

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
(2" → 0.6) 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: H. Hajek Date: 12/7/2021 Page 1 of 1 Meter Model: YSI PRO DSS

Reviewed by: H. Dennis Date: 12/17/2021 Filename: Well Inspection, Purging, and Field Measurement Form.docx

EA Engineering, Science, and Technology, Inc., PBC

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: T021F406 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: MW1-43 Well Head Locked: Y: ✓ N: Depth to Water (ft btoc): 3.60

Total Well Depth (ft btoc): 25.39 Inner Casing Straight and Clear: Y: ✓ N: Depth to Product (ft btoc): —

Length of Water Column in Well (ft): 21.79 Exterior Seal Good: Y: ✓ N: Product Thickness (ft): —

Diameter of Well Casing (in): 2 Pooled water in Head: Y: N: ✓ Purge Rate (liters/min): 0.15

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 13.07 Volume Purged (liters): 4.2

Purge Method: Peristaltic/Submersible/Bailer/Other: Date Well Purged: 12/6/21

Water Sample Data

Sample ID: GM-21-031 Type: ENV Date: 12/6/21 Time: 1531 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: K. Hopper

Remarks (color, odor, etc.): Colorless/odorless

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1457	—	3.60	Initial Depth to Water (pre-pumping)							
1459	Begin purge @ 150 mL/min									NA
1507	1.2	3.90	12.7	7.58	-86.2	1.979	17.33	0.68	1.02	
1511	1.8	3.88	12.7	7.62	-102.5	1.989	16.81	0.54	1.02	
1515	2.4	3.88	12.8	7.63	-107.6	1.992	12.66	0.51	1.02	
1519	3.0	3.90	12.7	7.64	-110.8	1.992	9.98	0.49	1.02	
1523	3.6	3.90	12.7	7.65	-114.5	1.983	8.77	0.47	1.02	
1527	4.2	3.90	12.7	7.65	-116.2	1.962	7.34	0.45	1.02	
Stabilized										
				lw 12/6/21						

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
2" → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: K. Hopper Date: 12/6/21 Page 1 of 1 Meter Model: YSI Pro DSS

Reviewed by: H. Dennis Date: 12/7/2021 Filename: Well Inspection, Purging, and Field Measurement Form.docx

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: 21F4076 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: MW1-44
Well Head Locked: Y: ___ N: ___
Depth to Water (ft btoc): 3.56

Total Well Depth (ft btoc): 27.65
Inner Casing Straight and Clear: Y: ___ N: ___
Depth to Product (ft btoc): —

Length of Water Column in Well (ft): 24.00
Exterior Seal Good: Y: ___ N: ___
Product Thickness (ft): —

Diameter of Well Casing (in): 2
Pooled water in Head: Y: ___ N: ___
Purge Rate (liters/min): 0.15

Well Casing Volume (liters/ft): 0.6
Well Volume (liters): 14.4
Volume Purged (liters): 6.2

Purge Method: (Peristaltic circled)/Submersible/Bailer/Other: ___
Date Well Purged: 12/6/21

Water Sample Data

Sample ID: GM-21-032 Type: EN Date: 12/6/21 Time: 1347 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: K. Hopper

Remarks (color, odor, etc.): colorless, odorless

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1258 ~~1144~~		3.56	DTB = 27.56' btoc Initial Depth to Water (pre-pumping)							
1303 ~~1154~~	Begin purge @ 150 mL/min (lowest possible rate)									NA
1311 ~~1202~~	1.2	3.55	12.8	8.55	43.2	1.646	3.87	0.81	0.83	
1315 ~~1206~~	1.8	3.55	13.0	8.63	-3.8	1.645	3.14	0.60	0.84	
1319	2.4	3.72	12.9	8.64	-15.7	1.658	3.32	0.55	0.85	
1323	3.0	4.00	12.9	8.64	-28.7	1.680	3.54	0.50	0.86	
1327	3.6	4.04	12.7	8.64	-37.0	1.684	3.56	0.48	0.86	
1331	4.2	4.06	12.6	8.65	-44.6	1.681	3.30	0.46	0.86	
1335	4.8	4.06	12.9	8.65	-50.2	1.683	3.30	0.45	0.86	
1339	5.6	4.04	12.8	8.65	-55.8	1.686	2.92	0.44	0.86	
1343	6.2	4.05	12.9	8.65	-59.5	1.690	3.00	0.43	0.86	

KH 12/6/21

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
2" → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: K. Hopper Date: 12/6/21 Page 1 of 1 Meter Model: YSI ProDSS

Reviewed by: H. Dennis Date: 12/7/2021

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: 21F4076 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: MW1-45 Well Head Locked: Y: ✓ N: Depth to Water (ft btoc): 5.16

Total Well Depth (ft btoc): 25.03 Inner Casing Straight and Clear: Y: ✓ N: Depth to Product (ft btoc): NP

Length of Water Column in Well (ft): 19.87 Exterior Seal Good: Y: N: ✓ Product Thickness (ft): —

Diameter of Well Casing (in): 2 Pooled water in Head: Y: ✓ N: Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 11.922 Volume Purged (liters): 7.4

Purge Method: (Peristaltic)/Submersible/Bailer/Other: Date Well Purged: 12/7/2021

Water Sample Data

Sample ID: GM-21-033 Type: ENV Date: 12/7/2021 Time: 1122 # Containers: 3

QC Sample ID: GM-21-034 Type: DUP Date: 12/7/2021 Time: 1127 # Containers: 3

Sampling Personnel: H. Hajek

Remarks (color, odor, etc.): slightly cloudy initially, egg smell, colorless

Bailed, water to top of well head, soft bottom, egg smell upon opening well cap, no seal

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1026		5.16	Initial Depth to Water (pre-pumping)							
1040	Begin	Purge	Set Purge Rate @ 0.2L/min							
1045	1.0	5.21	14.0	8.47	-14.8	0.726	23.25	0.77	0.36	N/A
1049	1.8	5.20	14.1	8.97	-28.6	0.724	15.48	0.65	0.36	
1053	2.6	5.20	14.2	8.97	-37.9	0.722	8.55	0.57	0.36	
1057	3.4	5.20	14.2	8.97	-49.3	0.725	7.94	0.51	0.36	
1101	4.2	5.20	14.2	8.97	-58.9	0.725	7.77	0.48	0.36	
1105	5.0	5.20	14.2	8.96	-65.1	0.724	7.48	0.46	0.36	
1109	5.8	5.20	14.3	8.96	-73.3	0.721	6.88	0.44	0.35	
1113	6.6	5.20	14.3	8.95	-77.8	0.724	6.96	0.43	0.36	
1117	7.4	5.20	14.2	8.95	-82.5	0.725	6.66	0.42	0.36	
STABILIZED										
				HH 12/7/2021						

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)			Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)		
(2" → 0.6)	4" → 2.5	6" → 5.5	1/4" → 0.010	3/8" → 0.022	1/2" → 0.039

Recorded by: H. Hajek Date: 12/7/2021 Page 1 of 1 Meter Model: YSI PRO DSS

Reviewed by: H. Dennis Date: 12/7/2021

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: 21F4076 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: MW1-46 Well Head Locked: Y: ✓ N: Depth to Water (ft btoc): 7.02

Total Well Depth (ft btoc): 32.74 Inner Casing Straight and Clear: Y: ✓ N: Depth to Product (ft btoc): NP

Length of Water Column in Well (ft): 25.72 Exterior Seal Good: Y: N: ✓ Product Thickness (ft): —

Diameter of Well Casing (in): 2 Pooled water in Head: Y: ✓ N: Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 15.432 Volume Purged (liters): 5.8

Purge Method: Peristaltic/Submersible/Bailer/Other: Date Well Purged: 12/7/2021

Water Sample Data

Sample ID: GM-21-035 Type: ENV Date: 12/7/2021 Time: 1408 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: H. Hajek

Remarks (color, odor, etc.): Slightly cloudy initially, odorless

No seal, bailed (water to brim of head) rusted bolts

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1317		7.02	Initial Depth to Water (pre-pumping)							
1331	Begin Purge		Set purge rate @ 0.2 L/min							NA
1339	1.0	7.09	15.7	7.18	8.3	1.254	22.77	0.85	0.63	
1343	1.8	7.11	15.6	7.15	-10.5	1.222	16.09	0.66	0.61	
1347	2.6	7.10	15.5	7.16	-32.6	1.229	12.07	0.62	0.61	
1351	3.4	7.10	15.5	7.15	-40.5	1.218	7.51	0.58	0.61	
1355	4.2	7.10	15.6	7.15	-49.9	1.205	5.49	0.52	0.61	
1359	5.0	7.10	15.6	7.14	-54.7	1.203	3.51	0.50	0.60	
1403	5.8	7.10	15.6	7.13	-58.4	1.179	1.68	0.47	0.59	
STABILIZED										
					HH 12/7/2021					

HH 12/7/21

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
2" → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: H. Hajek Date: 12/7/2021 Page 1 of 1 Meter Model: YSI PRO DSS

Reviewed by: H. Dems Date: 12/7/2021 Filename: Well Inspection, Purging, and Field Measurement Form.docx

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: 21F4076 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: MW1-47 Well Head Locked: Y: ✓ N: Depth to Water (ft btoc): 6.11

Total Well Depth (ft btoc): 24.32 Inner Casing Straight and Clear: Y: ✓ N: Depth to Product (ft btoc): NP

Length of Water Column in Well (ft): 18.21 Exterior Seal Good: Y: N: ✓ Product Thickness (ft): —

Diameter of Well Casing (in): 2 Pooled water in Head: Y: ✓ N: Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 10.926 Volume Purged (liters): 6.6

Purge Method: Peristaltic/Submersible/Bailer/Other: Date Well Purged: 12/7/2021

Water Sample Data

Sample ID: GM-21-036 Type: ENV Date: 12/7/2021 Time: 1248 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: H. Hajek

Remarks (color, odor, etc.): clear, colorless, odorless

rusted bolts, bailed (filled to top of head), no seal

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1154		6.11	Initial Depth to Water (pre-pumping)							
1210	Begin	Purge	Set Purge Rate @ 0.2 L/min							MH
1215	1.0	6.37	15.4	6.23	48.6	0.594	40.17	0.87	0.29	
1219	1.8	6.39	15.4	6.24	17.6	0.593	29.89	0.68	0.29	
1223	2.6	6.39	15.4	6.25	3.2	0.592	23.50	0.60	0.29	
1227	3.4	6.39	15.3	6.25	-9.1	0.593	16.04	0.54	0.29	
1231	4.2	6.39	15.3	6.25	-16.9	0.592	11.33	0.50	0.29	
1235	5.0	6.39	15.2	6.25	-21.5	0.593	9.23	0.48	0.29	
1239	5.8	6.39	15.0	6.26	-27.1	0.592	5.25	0.47	0.29	
1243	6.6	6.39	15.0	6.26	-29.1	0.592	6.00	0.46	0.29	
STABILIZED										
				HH 12/17/2021						

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)			Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)		
2" → 0.6	4" → 2.5	6" → 5.5	1/4" → 0.010	3/8" → 0.022	1/2" → 0.039

Recorded by: H. Hajek Date: 12/7/2021 Page 1 of 1 Meter Model: YSI PRODSS

Reviewed by: H. Penn Date: 12/7/2021

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2200 6th Ave, Suite 707 Seattle, WA 98121

Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: 21F4076 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: MW1-48 Well Head Locked: Y: ✓ N: Depth to Water (ft btoc): 5.35

Total Well Depth (ft btoc): 24.72 Inner Casing Straight and Clear: Y: ✓ N: Depth to Product (ft btoc): NP

Length of Water Column in Well (ft): 19.37 Exterior Seal Good: Y: ✓ N: Product Thickness (ft): —

Diameter of Well Casing (in): 2 Pooled water in Head: Y: ✓ N: Purge Rate (liters/min): 0.3

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 11.622 Volume Purged (liters): 12.0

Purge Method: Peristaltic/Submersible/Bailer/Other: Date Well Purged: 12/6/2021

Water Sample Data

Sample ID: GM-21-037 Type: ENV Date: 12/6/2021 Time: 1248 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: H. Hajek, K. Hopper

Remarks (color, odor, etc.): slightly cloudy initially, odorless, colorless, bubbles in flow cell

Bailed well casing of rust orange water

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1154		5.35	Initial Depth to Water (pre-pumping)							
1203	Begin	Purge	Set purge Rate @ 0.3 L/min							
1207	1.2	5.39	15.5	6.35	5.8	0.705	98.59	0.64	0.35	NA
1211	2.4	5.41	15.5	6.32	-8.7	0.707	65.50	0.54	0.35	
1215	3.6	5.41	15.3	6.32	-14.3	0.705	58.76	0.50	0.35	
1219	4.8	5.41	15.4	6.32	-21.0	0.707	51.03	0.46	0.35	
1223	6.0	5.41	15.5	6.32	-25.4	0.706	47.59	0.44	0.35	
1227	7.2	5.41	15.5	6.32	-29.3	0.708	39.86	0.42	0.35	
1231	8.4	5.41	15.5	6.32	-32.6	0.708	33.83	0.41	0.35	
1235	9.6	5.41	15.1	6.32	-35.2	0.708	28.46	0.41	0.35	
1239	10.8	5.41	15.7	6.32	-37.8	0.706	27.41	0.38	0.35	
1243	12.0	5.41	15.7	6.32	-40.1	0.705	28.83	0.37	0.35	
STABILIZED							HH 12/6/2021			

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)			Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)		
2" → 0.6	4" → 2.5	6" → 5.5	1/4" → 0.010	3/8" → 0.022	1/2" → 0.039

Recorded by: H. Hajek Date: 12/6/2021 Page 1 of 1 Meter Model: YSI PRO DSS

Reviewed by: H. Dennis Date: 12/7/2021

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EA Engineering, Science, and Technology, Inc., PBC

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: 2F4076 Naval Installation: Keyport Site Name: ONI

Well Data

Well ID: MW1-49 Well Head Locked: Y: ✓ N: ___ Depth to Water (ft btoc): 5.81'

Total Well Depth (ft btoc): 17.85' Inner Casing Straight and Clear: Y: ___ N: ✓ Depth to Product (ft btoc): NA

Length of Water Column in Well (ft): 12.04 Exterior Seal Good: Y: ___ N: ✓ Product Thickness (ft): NA

Diameter of Well Casing (in): ~~2~~ 2" Pooled water in Head: Y: ✓ N: ___ Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 7.224 Volume Purged (liters): 6.0

Purge Method: Peristaltic/Submersible/Bailer/Other: low flow, water in stickup Date Well Purged: 12-6-21

Water Sample Data

Sample ID: GW-21-038 Type: ENV Date: 12-6-21 Time: 1612 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: S. Kettlewell

Remarks (color, odor, etc.): Clear, slight petroleum odor.

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (‰ or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1540	0.2		Initial Depth to Water (pre-pumping)							
1545	1.0	5.94	11.7	7.04	-6.7	0.256	6.09	4.06	0.12	
1550	2.0	5.94	11.7	7.11	-10.4	0.256	4.71	4.02	0.12	
1555	3.0	5.94	11.7	7.16	-12.9	0.256	4.34	3.99	0.12	
1600	4.0	5.94	11.7	7.31	-22.4	0.256	3.92	3.92	0.12	
1605	5.0	5.94	11.7	7.36	-25.7	0.256	3.47	3.91	0.12	
1610	6.0	5.94	11.7	7.38	-28.4	0.256	2.84	3.88	0.12	
1612	Sample collected									

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)			Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)		
2" → 0.6	4" → 2.5	6" → 5.5	1/4" → 0.010	3/8" → 0.022	1/2" → 0.039

Recorded by: S Kettlewell Date: 12-6-21

Reviewed by: H. Dennis Date: 12/6/21

Meter Model: PRO DSS 20F0312

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: N4425521F4076 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: MW1-50 Well Head Locked: Y: ✓ N: Depth to Water (ft btoc): 7.85

Total Well Depth (ft btoc): 17.19 Inner Casing Straight and Clear: Y: ✓ N: Depth to Product (ft btoc): NA

Length of Water Column in Well (ft): 9.34 Exterior Seal Good: Y: ✓ N: Product Thickness (ft): NA

Diameter of Well Casing (in): 2 Pooled water in Head: Y: N: ✓ Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 5.60 Volume Purged (liters): 5.6

Purge Method: (Peristaltic) Submersible/Bailer/Other: Date Well Purged: ~~12/6~~ 12/7/21

Water Sample Data

Sample ID: GM-21-039 Type: ENV Date: 12/7/21 Time: 1309 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: Brooke Haines & Hannah Dennis

Remarks (color, odor, etc.): Clear, no odor

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1232	—	7.85	Initial Depth to Water (pre-pumping)							
1233	Begin	Purge.								
1238	1.0	7.90	11.6	7.42	140.5	0.229	12.15	0.60	0.11	
1242	1.8	7.90	11.5	7.51	126.5	0.228	9.76	0.47	0.11	
1246	2.6	7.90	11.6	7.52	120.6	0.228	9.37	0.43	0.11	
1250	3.2	7.90	11.6	7.52	111.9	0.228	8.61	0.38	0.11	
1254	3.8	7.90	11.6	7.51	103.0	0.227	8.24	0.35	0.11	
1258	4.4	7.90	11.6	7.49	95.2	0.227	7.95	0.33	0.11	
1302	5.0	7.90	11.6	7.47	87.8	0.227	7.97	0.31	0.11	
1306	5.6	7.90	11.6	7.45	85.8	0.228	8.01	0.29	0.11	
1309	Collect	sample								

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
2" → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: Hannah Dennis Date: 12/7/21

Reviewed by: H. Dennis Date: 12/7/2021

Meter Model: YSI Pro DSS #44500

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: 21F4076 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: MW1-S1 Well Head Locked: Y: ___ N: ✓ Depth to Water (ft btoc): 8.15'

Total Well Depth (ft btoc): 23.06' Inner Casing Straight and Clear: Y: ✓ N: ___ Depth to Product (ft btoc): NA

Length of Water Column in Well (ft): 14.91 Exterior Seal Good: Y: ✓ N: ___ Product Thickness (ft): NA

Diameter of Well Casing (in): 2" Pooled water in Head: Y: ___ N: ✓ Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 8.946 Volume Purged (liters): 5.0

Purge Method: Peristaltic/Submersible/Bailer/Other: Low Flow (Clock broke) Date Well Purged: 12-6-21

Water Sample Data

Sample ID: GM-21-040 Type: ENV Date: 12-6-21 Time: 1348 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: SKettewell

Remarks (color, odor, etc.): None

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (‰ or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1320	0.2	8.15	Initial Depth to Water (pre-pumping)							
1325	1.0	8.35	11.3	8.50	29.9	0.285	6.23	4.06	0.14	
1330	2.0	8.35	11.4	8.50	26.0	0.285	4.56	3.94	0.14	
1335	3.0	8.35	11.4	8.53	19.4	0.285	4.15	3.90	0.14	
1340	4.0	8.35	11.4	8.55	13.0	0.285	3.58	3.88	0.14	
1345	5.0	8.35	11.4	8.55	10.5	0.285	3.59	3.86	0.14	
1348	Sample collected									

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
2" → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: S. Kettewell Date: 12-6-21

Reviewed by: H. Dennis Date: 12/6/21

Meter Model: PROSS 20FC03D

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6004 Task Order: 21E4076 Naval Installation: Keyport Site Name: OU1 Keyport PFAS

Well Data

Well ID: MW1-52 Well Head Locked: Y: ✓ N: — Depth to Water (ft btoc): 7.98

Total Well Depth (ft btoc): 19.89 Inner Casing Straight and Clear: Y: ✓ N: — Depth to Product (ft btoc): ~~19.89~~ NA

Length of Water Column in Well (ft): 11.91 Exterior Seal Good: Y: ✓ N: — Product Thickness (ft): NA

Diameter of Well Casing (in): 2 Pooled water in Head: Y: — N: ✓ Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 7.146 Volume Purged (liters): 8.0

Purge Method: (Peristaltic)/Submersible/Bailer/Other: Low Flow Date Well Purged: 12-6-21

Water Sample Data

Sample ID: GM-21-041 Type: ENV Date: 12-6-21 Time: 1223 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: Susan Kettlewell

Remarks (color, odor, etc.): clear, No odor

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1140	0.2	8.20	Initial Depth to Water (pre-pumping)							
1145	1.0	8.20	11.1	8.34	12.1	0.300	13.45	4.13	0.14	
1150	2.0	8.20	11.0	8.40	9.8	0.300	9.09	4.09	0.14	
1155	3.0	8.20	11.0	8.49	-4.1	0.300	8.09	4.06	0.14	
1200	4.0	8.20	11.0	8.46	-10.5	0.301	8.31	4.04	0.14	
1205	5.0	8.20	11.0	8.48	-20.7	0.302	7.41	4.03	0.14	
1210	6.0	8.20	11.0	8.50	-38.7	0.302	7.20	4.00	0.14	
1215	7.0	8.20	11.0	8.51	-39.9	0.303	6.95	3.99	0.15	
1220	8.0	8.20	11.0	8.52	-43.2	0.302	6.96	3.98	0.15	
1223	Sample Collected									

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
2" → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: S. Kettlewell Date: 12-6-21 Page 1 of 1 Meter Model: PROSS 20F0036

Reviewed by: A. Dennis Date: 12/6/21 Filename: Well Inspection, Purging, and Field Measurement Form.docx

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: 2F4076 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: MW1-53 Well Head Locked: Y: ✓ N: ___ Depth to Water (ft btoc): 4.30'

Total Well Depth (ft btoc): 15.29 Inner Casing Straight and Clear: Y: ✓ N: ___ Depth to Product (ft btoc): NA

Length of Water Column in Well (ft): 10.99 Exterior Seal Good: Y: ✓ N: ___ Product Thickness (ft): NA

Diameter of Well Casing (in): 2 Pooled water in Head: Y: ___ N: ✓ Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 6.594 Volume Purged (liters): 4.0

Purge Method: Peristaltic/Submersible/Bailer/Other: Low Flow Date Well Purged: 12-6-21

Water Sample Data

Sample ID: GM-21-042 Type: ENV Date: 12-6-21 Time: 1308 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: S. Kettlewell

Remarks (color, odor, etc.): clear, no odor.

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1245	0.2	3.86	Initial Depth to Water (pre-pumping)							
1250	1.0	3.90	11.5	8.04	31.8	0.351	13.83	4.09	0.17	
1255	2.0	3.90	11.4	8.04	27.0	0.351	9.44	3.99	0.17	
1300	3.0	3.90	11.3	8.05	22.3	0.350	7.99	3.99	0.17	
1305	4.0	3.90	11.5	8.04	17.6	0.350	7.85	3.93	0.17	
1308	Sample collected.									

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)			Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)		
2" → 0.6	4" → 2.5	6" → 5.5	1/4" → 0.010	3/8" → 0.022	1/2" → 0.039

Recorded by: S. Kettlewell Date: 12-6-21

Reviewed by: H. Dennis Date: 12/6/21

Meter Model: PROSS 20+C0312

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: 21F4076 Naval Installation: Keyport Site Name: OU 1

Well Data

Well ID: MW1-54 Well Head Locked: Y: ✓ N: Depth to Water (ft btoc): 5.31

Total Well Depth (ft btoc): 39 DH 41.02 Inner Casing Straight and Clear: Y: ✓ N: Depth to Product (ft btoc): NA

Length of Water Column in Well (ft): 35.71 Exterior Seal Good: Y: ✓ N: Product Thickness (ft): NA

Diameter of Well Casing (in): 2" Pooled water in Head: Y: N: ✓ Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 21.43 Volume Purged (liters): 4.0

Purge Method: (Peristaltic)/Submersible/Bailer/Other: Date Well Purged: 12/6/21

Water Sample Data

Sample ID: GM-21-043 Type: ENV Date: 12/6/21 Time: 1337 # Containers: 2 3 MD

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: B. Haines

Remarks (color, odor, etc.): Clear, no odor

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1302	-	5.31	Initial Depth to Water (pre-pumping)							
1312	Begin	purge.	set	Flow	to 0.2	L/min				MM
1317	1.0	5.31	10.9	7.80	158.7	0.201	11.13	1.85	0.10	
1322	2.0	5.31	10.9	7.76	156.7	0.201	11.07	1.57	0.10	
1327	3.0	5.31	10.9	7.70	157.3	0.202	10.89	1.51	0.10	
1332	4.0	5.31	10.9	7.66	158.7	0.202	10.77	1.47	0.10	
1337	collect	sample								

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
(2") → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: B. Haines Date: 12/6/21

Reviewed by: M. Dennis Date: 12/7/21

Meter Model: YSI Pro DSS #441500

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: N4425521F3007 Naval Installation: Keyport Site Name: OU 1

Well Data

Well ID: MW1-55 Well Head Locked: Y: ✓ N: Depth to Water (ft btoc): 4.92

Total Well Depth (ft btoc): 34.33 Inner Casing Straight and Clear: Y: ✓ N: Depth to Product (ft btoc): NA

Length of Water Column in Well (ft): 29.41 Exterior Seal Good: Y: N: ✓ Product Thickness (ft): NA

Diameter of Well Casing (in): 2" Pooled water in Head: Y: ✓ N: Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 17.64 Volume Purged (liters): 3.0

Purge Method: Peristaltic/Submersible/Bailer/Other: Date Well Purged: 12/6/21

Water Sample Data

Sample ID: GM-21-044 Type: MS/MSD Date: 12/6/21 Time: ~~1239~~ 1139 # Containers: HD 6 7

QC Sample ID: — Type: — Date: — Time: — BH # Containers: —

Sampling Personnel: B. Haines

Remarks (color, odor, etc.): clear, no odor

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1207	—	4.92	Initial Depth to Water (pre-pumping)							
1219	Begin purge. set flow to 0.2 L/min									NA
1224	1.0	4.92	11.2	7.68	137.5	0.252	12.80	0.65	0.12	
1229	2.0	4.92	11.2	7.67	136.7	0.252	12.58	0.62	0.12	
1234	3.0	4.92	11.2	7.64	137.0	0.252	12.14	0.60	0.12	
1239	collect sample									
									BH	

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
(2") → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: B. Haines Date: 12/6/21

Reviewed by: H. Dennis Date: 12/7/21

Meter Model: YSI Pro DSS #445202

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: N4425521F4076 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: MW1-56, CL2 Well Head Locked: Y: ✓ N: Depth to Water (ft btoc): 4.81

Total Well Depth (ft btoc): 24.62 Inner Casing Straight and Clear: Y: ✓ N: Depth to Product (ft btoc): NA

Length of Water Column in Well (ft): 19.81 Exterior Seal Good: Y: ✓ N: Product Thickness (ft): NA

Diameter of Well Casing (in): 2 Pooled water in Head: Y: N: ✓ Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 11.89 Volume Purged (liters): 6.0

Purge Method: Peristaltic/Submersible/Bailer/Other: Date Well Purged: 12/7/21

Water Sample Data

Sample ID: GM-21-045 Type: Env Date: 12/7/21 Time: 1049 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: BH

Remarks (color, odor, etc.): Cloudy, no odor, oil sheen

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (‰ or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
0950	—	4.81	Initial Depth to Water (pre-pumping)							
1014	Begin	Purge.	Set flow to 0.2 L/min							NA
1019	1.0	4.81	11.5	6.89	47.6	0.439	74.87	0.92	0.21	
1024	2.0	4.81	11.7	6.84	52.0	0.435	56.55	0.57	0.21	
1029	3.0	4.81	11.9	6.81	53.9	0.434	37.80	0.41	0.21	
1034	4.0	4.81	12.1	6.75	56.9	0.431	12.78	0.33	0.21	
1039	5.0	4.81	12.1	6.73	58.3	0.430	11.62	0.31	0.21	
1044	6.0	4.81	12.1	6.71	58.9	0.428	11.48	0.30	0.21	
1049	Collect Sample								BH	

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
2" → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: B. Haines Date: 12/7/21

Reviewed by: H. Dennis Date: 12/9/21

Meter Model: YSI pro DSS #44500

Filename: Well Inspection, Purging, and Field Measurement Form.docx

EA Engineering, Science, and Technology, Inc., PBC

2200 6th Ave, Suite 707 Seattle, WA 98121

Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: N4425521F4076 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: MW1-56, ch.1 Well Head Locked: Y: ✓ N: Depth to Water (ft btoc): 5.53

Total Well Depth (ft btoc): 12.42 Inner Casing Straight and Clear: Y: ✓ N: Depth to Product (ft btoc): NA

Length of Water Column in Well (ft): 6.89 Exterior Seal Good: Y: ✓ N: Product Thickness (ft): NA

Diameter of Well Casing (in): 2 Pooled water in Head: Y: N: ✓ Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 4.13 Volume Purged (liters): 6.0

Purge Method: Peristaltic/Submersible/Bailer/Other: Date Well Purged: 12/7/21

Water Sample Data 12/7/2021

Sample ID: GW-21-046 Type: Env Date: ~~12/7/21~~ BH Time: 0945 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: BH

Remarks (color, odor, etc.): cloudy, no odor

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
0859	—	5.53	Initial Depth to Water (pre-pumping)							
0910	Begin	Purge	Set flow to 0.2 L/min							NA
0915	1.0	5.53	11.3	6.66	0.7	0.556	73.32	0.90	0.27	
0920	2.0	5.53	11.5	6.70	12.5	0.548	27.93	0.66	0.27	
0925	3.0	5.53	11.5	6.75	18.1	0.545	21.47	0.55	0.27	
0930	4.0	5.53	11.3	6.76	21.2	0.546	6.73	0.47	0.27	
0935	5.0	5.53	11.3	6.76	23.0	0.546	9.69	0.44	0.27	
0940	6.0	5.53	11.5	6.73	25.0	0.546	8.77	0.41	0.27	
0945	Collect	Sample								

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
2" → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: B. Haines Date: 12/7/21

Reviewed by: H. Davis Date: 12/8/21

Meter Model: YSI ProDSS #446508

EA Engineering, Science, and Technology, Inc., PBC

2200 6th Ave, Suite 707 Seattle, WA 98121

Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: 21FA076 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: MW1-58 (channel 2) Well Head Locked: Y: ✓ N: ___ Depth to Water (ft btoc): 6.43

Total Well Depth (ft btoc): 19.95' Inner Casing Straight and Clear: Y: ✓ N: ___ Depth to Product (ft btoc): NA

Length of Water Column in Well (ft): Multichannel (MC) Exterior Seal Good: Y: ✓ N: ___ Product Thickness (ft): NA

Diameter of Well Casing (in): MC Pooled water in Head: Y: ___ N: ✓ Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): MC Well Volume (liters): MC Volume Purged (liters): 6.6

Purge Method: Peristaltic/Submersible/Bailer/Other: Low flow Date Well Purged: 12-7-21

Water Sample Data

Sample ID: GW-21-048 Type: ENV Date: 12-7-21 Time: 1104 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: S. Kettlewell

Remarks (color, odor, etc.): Cloudy, Slight petroleum smell

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1030	0.2	6.43	Initial Depth to Water (pre-pumping)							
1035	1.0	6.43	12.9	6.65	-20.9	0.318	66.34	3.90	0.15	
1040	2.0	6.43	13.0	6.63	-36.2	0.318	96.29	4.14	0.15	
1045	3.0	6.43	13.1	6.61	-47.6	0.319	~~57.57~~	3.74	0.15	Turbidity (57.57)
1050	4.0	6.43	13.2	6.63	-53.7	0.318	57.16	3.55	0.15	
1055	5.0	6.43	13.2	6.60	-59.2	0.319	60.27	3.54	0.15	
1100	6.0	6.43	13.1	6.60	-59.5	0.319	64.99	3.52	0.15	
1104	Sample collected									

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
2" → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: S. Kettlewell Date: 12-7-21

Reviewed by: H. Dennis Date: 12/7/21

Meter Model: PRODSS 20E0032

Filename: Well Inspection, Purging, and Field Measurement Form.docx

	EA Engineering, Science, and Technology, Inc., PBC 2200 6th Ave, Suite 707 Seattle, WA 98121	Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6001 Task Order: 24F4076 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: MW1-58 (Channel 1) Well Head Locked: Y: ✓ N: ___ Depth to Water (ft btoc): 6.50'

Total Well Depth (ft btoc): 9.86' Inner Casing Straight and Clear: Y: ✓ N: ___ Depth to Product (ft btoc): NA

Length of Water Column in Well (ft): Multichannel (MC) Exterior Seal Good: Y: ✓ N: ___ Product Thickness (ft): NA

Diameter of Well Casing (in): MC Pooled water in Head: Y: ___ N: ✓ Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): MC Well Volume (liters): MC Volume Purged (liters): 1.0

Purge Method: (Peristaltic)/Submersible/Bailer/Other: Low flow Date Well Purged: 12-7-21

Water Sample Data

Sample ID: GW-21-049 Type: ENV Date: 12-7-21 Time: 13:20 # Containers: 3

QC Sample ID: ——— Type: ——— Date: ——— Time: ——— # Containers: ———

Sampling Personnel: S. Kettwell

Remarks (color, odor, etc.): Very turbid, No odor

Well purged dry. Recharged to sample. Collected parameters following sample

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or (ppt))	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1120	0.2	6.50'	Initial Depth to Water (pre-pumping)							
1134	Well	Dry								Parameters collected after sample due to well going dry.
1320	—	6.49'	- Collected sample - well							
1339	—	—	11.7	6.65	178.0	0.899	549.63	6.67	0.44	
1342	—	—	11.6	6.36	158.1	0.891	541.34	7.49	0.44	
1344	Well	Dry								

SM

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
2" → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: S. Kettwell Date: 12-7-21 Page 1 of 1 Meter Model: PRODSS 20F103?

Reviewed by: A. Dennis Date: 12/7/21

EA Engineering, Science, and Technology, Inc., PBC
2200 6th Ave, Suite 707 Seattle, WA 98121

Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: 24F076 Naval Installation: Keyport Site Name: OU 1

Well Data

Well ID: MW1-58 (Channel 0) Well Head Locked: Y: ✓ N: ___ Depth to Water (ft btoc): 6.05'

Total Well Depth (ft btoc): 38.12' Inner Casing Straight and Clear: Y: ✓ N: ___ Depth to Product (ft btoc): NA

Length of Water Column in Well (ft): 32.07 Exterior Seal Good: Y: ✓ N: ___ Product Thickness (ft): NA

Diameter of Well Casing (in): Multichannel (MC) Pooled water in Head: Y: ___ N: ✓ Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): MC Well Volume (liters): MC Volume Purged (liters): 8.0

Purge Method: (Peristaltic)/Submersible/Bailer/Other: Low Flow - Multichannel Well Date Well Purged: 12-7-21

Water Sample Data

Sample ID: ~~[illegible]~~ GM-21-050 Type: ENV Date: 12-7-21 Time: 1003 # Containers: 3

QC Sample ID: — Type: ___ Date: — Time: — # Containers: —

Sampling Personnel: S Kettlewell

Remarks (color, odor, etc.): Turbid (cloudy black), slight petroleum odor

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
0920	0.2	6.05	Initial Depth to Water (pre-pumping)							
0925	1.0	6.05	12.2	7.19	6.6	0.323	315.77	3.81	0.16	
0930	2.0	6.05	12.0	7.17	-68.7	0.322	219.95	3.78	0.15	
0935	3.0	6.05	12.3	7.16	-86.6	0.323	97.84	3.71	0.15	
0940	4.0	6.05	12.4	7.16	-98.9	0.323	96.14	3.70	0.15	
0945	5.0	6.05	12.5	7.19	-112.1	0.322	50.92	3.68	0.15	
0950	6.0	6.05	12.4	7.18	-118.9	0.322	47.56	3.68	0.15	
0955	7.0	6.05	12.2	7.20	-124.2	0.322	48.36	3.70	0.15	
1000	8.0	6.05	12.4	7.20	-127.0	0.322	44.50	3.67	0.15	
1003	Collect Sample									

SK

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
2" → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: S. Kettlewell Date: 12-7-21 Page 1 of 1 Meter Model: PRO DSS 20F00372

Reviewed by: H. Dennis Date: 12/7/21

EA Engineering, Science, and Technology, Inc., PBC

2200 6th Ave, Suite 707 Seattle, WA 98121

Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: N4425521FA076 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: MW1-59
Well Head Locked: Y: ✓ N: —
Depth to Water (ft btoc): 1.15
Total Well Depth (ft btoc): 74.30
Inner Casing Straight and Clear: Y: ✓ N: —
Depth to Product (ft btoc): NA
Length of Water Column in Well (ft): 73.15
Exterior Seal Good: Y: — N: ✓
Product Thickness (ft): NA
Diameter of Well Casing (in): 2"
Pooled water in Head: Y: ✓ N: —
Purge Rate (liters/min): 0.2
Well Casing Volume (liters/ft): 0.6
Well Volume (liters): 43.89
Volume Purged (liters): 5.0
Purge Method: Peristaltic/Submersible/Bailer/Other: —
Date Well Purged: 12/7/21

Water Sample Data

Sample ID: GM-21-051 Type: Env Date: 12/7/21 Time: 1215 # Containers: 3
QC Sample ID: — Type: — Date: — Time: — # Containers: —
Sampling Personnel: BH
Remarks (color, odor, etc.): clear, no odor

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1122	—	1.15	Initial Depth to Water (pre-pumping)							
1145	Begin Purge, Set flow to 0.2 L/min									
1150	1.0	1.15	10.1	7.62	34.6	0.243	25.48	0.98	0.12	NA
1155	2.0	1.15	10.1	7.57	79.5	0.243	26.88	0.57	0.12	
1200	3.0	1.15	10.2	7.53	95.6	0.243	29.71	0.45	0.12	
1205	4.0	1.15	10.1	7.54	100.2	0.243	28.69	0.39	0.12	
1210	5.0	1.15	10.1	7.54	103.8	0.243	30.12	0.37	0.12	
1215	Collect Sample									

BH

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft): (2") → 0.6 4" → 2.5 6" → 5.5

Discharge tubing diameter (in) → Discharge tubing volume (liters/ft): 1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: B. Haines Date: 12/7/21
Reviewed by: N. Deans Date: 12/8/21

Meter Model: YSI Pro DSS #44500

Filename: Well Inspection, Purging, and Field Measurement Form.docx

EA Engineering, Science, and Technology, Inc., PBC

2200 6th Ave, Suite 707 Seattle, WA 98121

Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: 2F4076 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: MW1-60 Well Head Locked: Y: ✓ N: ___ Depth to Water (ft btoc): 9.38

Total Well Depth (ft btoc): 27.97 Inner Casing Straight and Clear: Y: ✓ N: ___ Depth to Product (ft btoc): NA

Length of Water Column in Well (ft): 18.59 Exterior Seal Good: Y: ✓ N: ___ Product Thickness (ft): NA

Diameter of Well Casing (in): 2" Pooled water in Head: Y: ___ N: ✓ Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 11.15 Volume Purged (liters): 5.0

Purge Method: Peristaltic/Submersible/Bailer/Other: ___ Date Well Purged: 12/8/21

Water Sample Data

Sample ID: GM-21-052 Type: ENV Date: 12/8/21 Time: 1231 # Containers: 3

QC Sample ID: GM-21-053 Type: FD Date: 12/8/21 Time: 1236 # Containers: 3

Sampling Personnel: BH

Remarks (color, odor, etc.): clear, no odor

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1147	—	9.38	Initial Depth to Water (pre-pumping)							
1201	Begin	Purge.	Set	Flow	to 0.2	L/min				NA
1206	1.0	9.40	11.7	7.70	94.1	0.306	20.74	1.19	0.14	
1211	2.0	9.40	11.8	7.72	109.8	0.298	20.81	0.79	0.14	
1216	3.0	9.40	11.7	7.69	114.2	0.300	21.12	0.64	0.14	
1221	4.0	9.40	11.7	7.68	115.5	0.300	20.04	0.61	0.14	
1226	5.0	9.40	11.6	7.66	116.1	0.300	21.87	0.58	0.14	
1231	collect	sample								
									BH	

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
(2") → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: B. Haines Date: 12/8/21

Reviewed by: H. Dennis Date: 12/9/2021

Meter Model: YSI PRO DSS #04506

Filename: Well Inspection, Purging, and Field Measurement Form.docx

EA Engineering, Science, and Technology, Inc., PBC

2200 6th Ave, Suite 707 Seattle, WA 98121

Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: 21F4076 Naval Installation: Keyport Site Name: ~~Ke~~ OU1 (HH 12/6/2021)

Well Data

Well ID: MW1-61 Well Head Locked: Y: ✓ N: ___ Depth to Water (ft btoc): 4.82

Total Well Depth (ft btoc): 12.94 Inner Casing Straight and Clear: Y: ✓ N: ___ Depth to Product (ft btoc): NP

Length of Water Column in Well (ft): 8.12 Exterior Seal Good: Y: ✓ N: ___ Product Thickness (ft): ———

Diameter of Well Casing (in): 2 Pooled water in Head: Y: ___ N: ✓ Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 4.872 Volume Purged (liters): 13.0

Purge Method: (Peristaltic)/Submersible/Bailer/Other: ___ Date Well Purged: 12/6/2021

Water Sample Data

Sample ID: GM-21-054 Type: ENV Date: 12/6/2021 Time: 1140 # Containers: 3

QC Sample ID: ——— Type: ——— Date: ——— Time: ——— # Containers: ———

Sampling Personnel: H. Hajek

Remarks (color, odor, etc.): egg-like odor upon opening well, clear, colorless, bubbles in flow cell Peri Pump stopped working at 1058, ~~restarted~~ continued w/new pump at 1110 (HH 12/6/21)

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or (ppt))	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1006		4.82	Initial Depth to Water (pre-pumping)							
1020	Begin Purge		Set Purge Rate @ 0.2 L/min							
1025	1.0	4.90	14.4	6.85	182.0	0.397	13.21	1.69	0.19	NA
1030	2.0	4.91	14.4	6.92	177.8	0.394	12.83	2.05	0.19	
1035	3.0	4.91	14.4	6.96	157.0	0.392	12.86	1.74	0.19	
1040	4.0	4.91	14.2	7.00	130.7	0.391	12.71	1.38	0.19	
1045	5.0	4.91	14.4	7.00	121.5	0.391	12.75	1.23	0.19	
1050	6.0	4.91	14.0	7.01	98.7	0.390	7.98	1.03	0.19	
1055	7.0	4.91	14.0	7.01	77.3	0.390	8.33	0.85	0.19	
~~1100~~	~~8.0~~	~~4.91~~	Peri Pump died, switched to new pump							
~~1105~~	~~9.0~~	~~4.91~~							HH 12/6/2021	
1110	8.0	4.91	13.9	7.02	55.7	0.390	11.97	0.76	0.19	
1115	9.0	4.91	14.3	7.02	44.9	0.391	13.83	0.63	0.19	
1120	10.0	4.91	14.4	7.03	30.5	0.392	11.65	0.54	0.19	
1125	11.0	4.91	14.4	7.04	12.1	0.391	3.24	0.47	0.19	

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
(2" → 0.6) 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: H. Hajek Date: 12/6/2021 Page 1 of 2 Meter Model: YSI PRO DSS

Reviewed by: H. Dennis Date: 12/7/2021

EA Engineering, Science, and Technology, Inc., PBC

2200 6th Ave, Suite 707 Seattle, WA 98121

Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: 21F4076 Naval Installation: Keyport Site Name: DU1

Well Data

Well ID: MW1-61 (CONT) Well Head Locked: Y: ✓ N: Depth to Water (ft btoc): 4.82

Total Well Depth (ft btoc): 12.94 Inner Casing Straight and Clear: Y: ✓ N: Depth to Product (ft btoc): NP

Length of Water Column in Well (ft): 8.12 Exterior Seal Good: Y: ✓ N: Product Thickness (ft): —

Diameter of Well Casing (in): 2 Pooled water in Head: Y: N: ✓ Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 4.872 Volume Purged (liters): 13.0

Purge Method: (Peristaltic)/Submersible/Bailer/Other: Date Well Purged: 12/6/2021

Water Sample Data

Sample ID: GM-21-054 Type: ENV Date: 12/6/2021 Time: 1140 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: H. Hajek

Remarks (color, odor, etc.): egg-like odor upon opening, clear, colorless, bubbles in flowcell

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1006		4.82	Initial Depth to Water (pre-pumping)							
1130	12.0	4.91	14.4	7.03	8.9	0.390	3.43	0.47	0.19	
1135	13.0	4.91	14.3	7.03	5.7	0.390	5.22	0.48	0.19	
STABILIZED										
				HH 12/6/2021						

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
2" → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: H. Hajek Date: 12/6/2021

Reviewed by: HDennis Date: 12/7/2021

Meter Model: YSI PRODSS

Filename: Well Inspection, Purging, and Field Measurement Form.docx

EA Engineering, Science, and Technology, Inc., PBC

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: T021F4076 Naval Installation: NEXPORT Site Name: OU1

Well Data

Well ID: MW1-02

Well Head Locked: Y: ✓ N: ___

Depth to Water (ft btoc): 9.38

Total Well Depth (ft btoc): 43.88

Inner Casing Straight and Clear: Y: ✓ N: ___

Depth to Product (ft btoc): —

Length of Water Column in Well (ft): 34.5

Exterior Seal Good: Y: ✓ N: ___

Product Thickness (ft): —

Diameter of Well Casing (in): 2

Pooled water in Head: Y: ___ N: ✓

Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 0.6

Well Volume (liters): 20.7

Volume Purged (liters): 6.4

Purge Method: Peristaltic/Submersible/Bailer/Other: ___

Date Well Purged: 12/7/21

Water Sample Data

Sample ID: GM-21-055 Type: ENV Date: 12/7/21 Time: 1054 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: IC. Hopper

Remarks (color, odor, etc.): Odorless, soft brown fowling slightly cloudy

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1015	—	9.38	Initial Depth to Water (pre-pumping)							
1018	Begin	purge	@	200	mL/min					NA
1023	1.0	9.42	13.5	6.73	24.5	0.521	24.72	0.82	0.25	
1027	1.8	9.44	13.4	6.73	22.6	0.527	30.33	0.27	0.25	
1031	2.4	9.44	13.9	6.72	23.7	0.530	25.30	0.24	0.26	
1035	3.2	9.44	13.6	6.70	23.1	0.527	22.91	0.32	0.26	
1039	4.0	9.40	13.5	6.70	23.2	0.524	19.87	0.21	0.25	
1043	4.8	9.40	13.6	6.67	22.3	0.522	16.00	0.15	0.25	
1047	5.6	9.40	13.7	6.67	21.7	0.521	16.50	0.14	0.25	
1051	6.4	9.40	13.7	6.67	19.8	0.520	16.03	0.12	0.25	
1055 last 12/7	Stabilized	—								

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
2" → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: IC. Hopper Date: 12/7/21

Reviewed by: H. Dennis Date: 12/7/21

Meter Model: YSI Pro DSS

Filename: Well Inspection, Purging, and Field Measurement Form.docx

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: TO 14076 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: MW1-63 Well Head Locked: Y: ✓ N: __ Depth to Water (ft btoc): 8.31

Total Well Depth (ft btoc): 43.12 Inner Casing Straight and Clear: Y: ✓ N: __ Depth to Product (ft btoc): —

Length of Water Column in Well (ft): 34.81 Exterior Seal Good: Y: ✓ N: __ Product Thickness (ft): —

Diameter of Well Casing (in): 2 Pooled water in Head: Y: __ N: ✓ Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 20.89 Volume Purged (liters): 8.8

Purge Method: Peristaltic/Submersible/Bailer/Other: _____ Date Well Purged: 12/7/21

Water Sample Data

Sample ID: GM-21-056 Type: MS/MSD Date: 12/7/21 Time: 1330 # Containers: 7

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: K. Hopper

Remarks (color, odor, etc.): Colorless, odorless

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1238	—	8.31	Initial Depth to Water (pre-pumping)							
1242	Begin purge @ 200 mL/min									
1247	1.0	8.35	12.6	6.71	70.1	0.861	28.20	0.66	0.43	
1251	1.8	8.33	12.6	6.71	31.7	0.874	29.80	0.34	0.43	
1255	2.4	8.31	12.7	6.71	16.7	0.875	29.44	0.27	0.43	
1259	3.2	8.33	12.7	6.71	-1.6	0.880	26.66	0.19	0.44	
1303	4.0	8.36	12.8	6.70	-10.5	0.893	26.72	0.14	0.44	
1307	4.8	8.36	12.8	6.70	-14.7 KA 12/9/21	0.929	16.59	0.13	0.46	ORP=-14.0
1311	5.6	8.39	12.9	6.70	-16.1	0.936	18.47	0.11	0.46	
1315	6.4	8.40	12.9	6.70	-17.6	0.942	12.10	0.11	0.47	
1319	7.2	8.40	13.0	6.70	-19.5	0.949	10.50	0.09	0.47	
1323	8.0	8.40	13.0	6.70	-20.2	0.950	11.03	0.08	0.47	
1327	8.8	8.40	13.0	6.70	-21.0	0.950	10.07	0.08	0.47	
Stabilized										

KA 12/9/21

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
2" → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: K. Hopper Date: 12/7/21

Reviewed by: A. Quinn Date: 12/9/21

Meter Model: YSI Pro DSS

EA Engineering, Science, and Technology, Inc., PBC

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6000 Task Order: T021F40? Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: MW1-64

Well Head Locked: Y: ✓ N: __

Depth to Water (ft btoc): 7.49

Total Well Depth (ft btoc): 57.75

Inner Casing Straight and Clear: Y: ✓ N: __

Depth to Product (ft btoc): —

Length of Water Column in Well (ft): 50.26

Exterior Seal Good: Y: ✓ N: __

Product Thickness (ft): —

Diameter of Well Casing (in): 2

Pooled water in Head: Y: __ N: ✓

Purge Rate (liters/min): 0.25

Well Casing Volume (liters/ft): 0.6

Well Volume (liters): 30.16

Volume Purged (liters): 10.0

Purge Method: (Peristaltic)/Submersible/Bailer/Other:

Date Well Purged: 12/8/21

Water Sample Data

Sample ID: GM-21-067 Type: ENV Date: 12/8/21 Time: 0950 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: K. Hopper

Remarks (color, odor, etc.): Colorless, Sulfur odor

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or (ppt))	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
0900	—	7.49	Initial Depth to Water (pre-pumping)							
0907	Begin	purge	@	250 mL/min						
0911	1.0	7.49	11.2	6.70	93.8	0.897	11.25	0.86	0.44	N.A
0915	2.0	7.49	11.4	6.73	63.0	0.883	10.39	0.35	0.44	
0919	3.0	7.49	11.5	6.73	44.6	0.882	8.13	0.35	0.44	
0923	4.0	7.49	11.5	6.72	36.1	0.883	7.18	0.25	0.44	
0927	5.0	7.49	11.5	6.72	21.2	0.883	7.12	0.22	0.44	
0931	6.0	7.49	11.6	6.70	12.2	0.883	7.12	0.17	0.44	
0935	7.0	7.49	11.6	6.70	3.1	0.883	8.74	0.15	0.44	
0939	8.0	7.49	11.6	6.69	-4.7	0.883	8.43	0.13	0.44	
0943	9.0	7.49	11.5	6.69	-8.6	0.883	7.00	0.10	0.44	
0947	10.0	7.49	11.5	6.69	-11.2	0.883	6.00	0.09	0.44	
Stabilized				6.69	-11.2	0.883	6.64	0.09	0.44	
				12/8/21						

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
2" → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: K. Hopper Date: 12/8/21

Reviewed by: H. Deans Date: 12/8/21

Page 1 of 1

Meter Model: YSI Pro DSS

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: 21F4076 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: MW1-65 Well Head Locked: Y: ✓ N: Depth to Water (ft btoc): 7.11

Total Well Depth (ft btoc): 66.14 Inner Casing Straight and Clear: Y: N: Depth to Product (ft btoc): NP

Length of Water Column in Well (ft): 59.03 Exterior Seal Good: Y: ✓ N: Product Thickness (ft): —

Diameter of Well Casing (in): 2 Pooled water in Head: Y: N: ✓ Purge Rate (liters/min): 0.2

Well Casing Volume (liters/ft): 0.6 Well Volume (liters): 35.418 Volume Purged (liters): 10.6

Purge Method: Peristaltic/Submersible/Bailer/Other: Date Well Purged: 12/8/2021

Water Sample Data

Sample ID: GM-21-058 Type: ENV Date: 12/8/2021 Time: 1012 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: H. Hajek

Remarks (color, odor, etc.): cloudy initially, colorless, odorless soft bottom

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
0900		7.11	Initial Depth to Water (pre-pumping)							
0914	Begin	Purge	Set	Purge Rate @ 0.2 L/min						
0919	1.0	7.11	11.1	6.41	169.5	0.568	35.49	1.22	0.28	NA
0923	1.8	7.11	11.3	6.66	135.8	0.724	37.67	0.86	0.36	
0927	2.6	7.11	11.4	6.78	97.1	0.743	26.77	0.74	0.37	
0931	3.4	7.11	11.4	6.72	73.4	0.712	25.70	0.69	0.35	
0935	4.2	7.11	11.4	6.71	40.1	0.730	18.05	0.62	0.36	
0939	5.0	7.11	11.5	6.72	31.4	0.739	18.55	0.60	0.36	
0943	5.8	7.11	11.5	6.71	6.1	0.758	14.00	0.56	0.37	
0947	6.6	7.11	11.5	6.71	-0.4	0.770	13.53	0.54	0.38	
0951	7.4	7.11	11.6	6.73	-11.9	0.776	9.46	0.53	0.38	
0955	8.2	7.11	11.5	6.73	-20.9	0.786	8.84	0.51	0.39	
0959	9.0	7.11	11.6	6.73	-28.5	0.794	8.57	0.49	0.39	
1003	9.8	7.11	11.6	6.74	-31.3	0.808	7.84	0.48	0.40	
1007	10.6	7.11	11.6	6.74	-35.9	0.804	8.54	0.47	0.40	

STABILIZED

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
2" → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: H. Hajek Date: 12/8/2021

Reviewed by: H. Dennis Date: 12/9/2021

Meter Model: YSI PRO DSS

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: 21F4076 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: MW1-67
Total Well Depth (ft btoc): 17.32
Length of Water Column in Well (ft): 9.28
Diameter of Well Casing (in): 2
Well Casing Volume (liters/ft): 0.6
Purge Method: Peristaltic/Submersible/Bailer/Other:

Well Head Locked: Y: ✓ N:
Inner Casing Straight and Clear: Y: ✓ N:
Exterior Seal Good: Y: ✓ N:
Pooled water in Head: Y: N: ✓
Well Volume (liters): 5.568

Depth to Water (ft btoc): 8.04
Depth to Product (ft btoc): NP
Product Thickness (ft): —
Purge Rate (liters/min): 0.2
Volume Purged (liters): 5.2
Date Well Purged: 12/8/2021

Water Sample Data

Sample ID: GM-21-059 Type: ENV Date: 12/8/2021 Time: 1049 # Containers: 3
QC Sample ID: — Type: — Date: — Time: — # Containers: —
Sampling Personnel: H. Hajek
Remarks (color, odor, etc.): clear, colorless, odorless
Bubbles in flow cell

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (‰ or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1016		8.04	Initial Depth to Water (pre-pumping)							
1018		Begin Purge	Set Purge Rate @ 0.2 L/min							
1023	1.0	8.30	11.1	6.77	-28.9	0.868	10.07	0.77	0.43	NH
1026	1.6	8.32	11.1	6.77	-36.9	0.858	12.15	0.66	0.42	
1029	2.2	8.33	11.1	6.78	-44.8	0.857	14.21	0.66	0.42	
1032	2.8	8.33	11.0	6.78	-53.5	0.855	15.51	0.66	0.42	
1035	3.4	8.33	11.1	6.78	-61.9	0.857	10.49	0.62	0.42	
1038	4.0	8.33	11.1	6.79	-70.5	0.854	6.48	0.54	0.42	
1041	4.6	8.33	11.1	6.79	-76.4	0.851	6.73	0.52	0.42	
1044	5.2	8.33	11.0	6.79	-78.4	0.851	4.24	0.50	0.42	
STABILIZED										
			HH 12/8/21							

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft): (2" → 0.6) 4" → 2.5 6" → 5.5

Discharge tubing diameter (in) → Discharge tubing volume (liters/ft): 1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: H. Hajek Date: 12/8/2021
Reviewed by: H. Dennis Date: 12/8/2021

Meter Model: YSI PRO DSS

Filename: Well Inspection, Purging, and Field Measurement Form.docx

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6004 Task Order: 2F4076 Naval Installation: Keyport Site Name: ~~Keyport~~ OU1

Well Data

Well ID: MW1-68
Well Head Locked: Y: ✓ N: ___
Depth to Water (ft btoc): 2.76'
Total Well Depth (ft btoc): 50.17
Inner Casing Straight and Clear: Y: ✓ N: ___
Depth to Product (ft btoc): NA
Length of Water Column in Well (ft): 47.41
Exterior Seal Good: Y: ✓ N: ___
Product Thickness (ft): NA
Diameter of Well Casing (in): 2"
Pooled water in Head: Y: ✓ N: ___
Purge Rate (liters/min): 0.2
Well Casing Volume (liters/ft): ~~28.446~~ 0.6
Well Volume (liters): 28.4466
Volume Purged (liters): 9.0
Purge Method: Peristaltic/Submersible/Bailer/Other: Low Flow
Date Well Purged: 12-6-21

Water Sample Data

GM-21-060

Sample ID: ~~MW1-68SR~~ Type: ENV Date: 12-6-21 Time: 1057 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: S. Kettlewell

Remarks (color, odor, etc.): Turbid. No odor

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1010	0.2	2.81	Initial Depth to Water (pre-pumping)							
1015	1.0	2.84	12.1	6.51	72.4	0.272	93.56	4.13	0.13	
1020	2.0	2.84	12.1	6.67	35.8	0.272	66.77	3.96	0.13	
1025	3.0	2.84	12.2	6.92	-24.3	0.273	254.03	3.89	0.13	
1030	4.0	2.84	12.2	7.02	-41.9	0.277	261.98	3.86	0.13	
1035	5.0	2.84	12.2	7.11	-85.4	0.278	231.2	3.85	0.13	
1040	6.0	2.84	12.2	7.19	-103.5	0.277	183.06	3.83	0.13	
1045	7.0	2.84	12.1	7.21	-114.5	0.276	135.10	3.81	0.13	
1050	8.0	2.84	12.2	7.23	-116.2	0.276	~~133.92~~ 133.92 NTU	3.81	0.13	(133.92 NTU)
1055	9.0	2.84	12.2	7.24	-118.9	0.275	131.28	3.82	0.13	
1057	Sample collected									

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)			Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)		
2" → 0.6	4" → 2.5	6" → 5.5	1/4" → 0.010	3/8" → 0.022	1/2" → 0.039

Recorded by: S. Kettlewell Date: 12-6-21

Reviewed by: H. Dennis Date: 12/7/2021

Meter Model: Pro DSS 20F0031

Filename: Well Inspection, Purging, and Field Measurement Form.docx

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Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: T021F4076 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: PI-01 Well Head Locked: Y: ✓ N: — Depth to Water (ft btoc): 7.09

Total Well Depth (ft btoc): 17.13 Inner Casing Straight and Clear: Y: ✓ N: — Depth to Product (ft btoc): —

Length of Water Column in Well (ft): 10.04 Exterior Seal Good: Y: ✓ N: — Product Thickness (ft): —

Diameter of Well Casing (in): 1 Pooled water in Head: Y: — N: ✓ Purge Rate (liters/min): 0.1

Well Casing Volume (liters/ft): 0.15 Well Volume (liters): 1.51 3x Casing = 4.53 Volume Purged (liters): 3.4

Purge Method: Peristaltic/Submersible/Bailer/Other: — Date Well Purged: 12/8/21

Water Sample Data

Sample ID: GM-21-061 Type: ENV Date: 12/8/21 Time: 1132 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: K. Hopper

Remarks (color, odor, etc.): Odorless, Soft light brown-tan clay

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1050	—	7.09	Initial Depth to Water (pre-pumping)							
1054	Begin	Purge @	1000	mL/min	Closest	possible	rate)			NA
1104	1.0	7.70	11.5	6.26	-16.5	0.815	41.06	0.35	0.40	
1108	1.4	7.65	11.5	6.32	-28.6	0.812	27.80	0.23	0.40	
1112	1.8	7.70	11.6	6.37	-35.3	0.828	31.78	0.15	0.41	
1116	2.2	7.70	11.9	6.38	-38.7	0.830	17.03	0.13	0.41	
1120	2.6	7.70	12.1	6.43	-44.1	0.833	14.53	0.10	0.41	
1124	3.0	7.73	12.0	6.44	-46.2	0.834	14.81	0.08	0.41	
1128	3.4	7.75	11.9	6.36	-44.3	0.831	13.89	0.06	0.41	
Stabalized	—	—	—	—	—	—	—	—	—	—

12/8/21

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
2" → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: K. Hopper Date: 12/8/21

Reviewed by: H. Dennis Date: 12/8/21

Meter Model: YSI Pro DSS

Filename: Well Inspection, Purging, and Field Measurement Form.docx

EA Engineering, Science, and Technology, Inc., PBC
2200 6th Ave, Suite 707 Seattle, WA 98121

Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6006 Task Order: T021F4076 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: P1-02

Total Well Depth (ft btoc): 17.61

Length of Water Column in Well (ft): 9.95

Diameter of Well Casing (in): 1

Well Casing Volume (liters/ft): 0.15

Purge Method: (Peristaltic)/Submersible/Bailer/Other:

Well Head Locked: Y: ✓ N:

Inner Casing Straight and Clear: Y: ✓ N:

Exterior Seal Good: Y: ✓ N:

Pooled water in Head: Y: N: ✓

Well Volume (liters): 1.49

Depth to Water (ft btoc): 7.66

Depth to Product (ft btoc): —

Product Thickness (ft): —

Purge Rate (liters/min): 0.15

Volume Purged (liters): 4.2

Date Well Purged: 12/7/21

Water Sample Data

Sample ID: GM-21-062 Type: ENV Date: 12/7/21 Time: 1610 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: K. Hopper

Remarks (color, odor, etc.): Orange soft fouling, grey cloudy water, odorless

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or (ppt))	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1459	—	7.66	Initial Depth to Water (pre-pumping)							
1501	Begin	purge	@ 150mL/min							
1509	1.2	—	12.5	6.39	-23.4	1.617	43.43	0.14	0.82	
1513	2.4	Unable	to take	DTW, pause	purge to	troubleshoot	probe			
1540 ~~1536~~	Resolve	issues	w/ DTW	meter, resume	purge	@125mL/min	(lowest possible rate)			
1544	2.9	11.18	11.8	6.35	-10.4	1.539	24.42	0.14	0.78	
1548	3.4	12.44	11.8	6.37	-15.5	1.585	32.83	0.13	0.81	
1552	3.9	12.80	11.8	6.39	-22.5	1.746	30.33	0.07	0.89	
1556	4.4	13.07	11.8	6.42	-23.4	1.734	32.83	0.06	0.88	
1600	4.9	13.10	11.7	6.41	-24.4	1.707	33.41	0.04	0.87	
1604	5.4	13.15	11.5	6.38	-23.0	1.717	32.23	0.05	0.87	
Parameters	Stabilize	+ purged	3x well	casing vol						
			KH	12/7/21						

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
2" → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: K. Hopper Date: 12/7/21

Reviewed by: A. Dennis Date: 12/8/21

Meter Model: YSI Pro DSS

EA Engineering, Science, and Technology, Inc., PBC

2200 6th Ave, Suite 707 Seattle, WA 98121

Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6002 Task Order: T021F4076 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: PI-03

Well Head Locked: Y: ✓ N: ___

Inner Casing Straight and Clear: Y: ✓ N: ___

Exterior Seal Good: Y: ✓ N: ___

Pooled water in Head: Y: ___ N: ✓

Total Well Depth (ft btoc): 18.00

Length of Water Column in Well (ft): 10.35

Diameter of Well Casing (in): 1

Well Casing Volume (liters/ft): 0.15

Well Volume (liters): 1.56

Purge Method: Peristaltic/Submersible/Bailer/Other: ___

Depth to Water (ft btoc): 7.65

Depth to Product (ft btoc): —

Product Thickness (ft): —

Purge Rate (liters/min): 0.15

Volume Purged (liters): 3.8

Date Well Purged: 12/7/21

Water Sample Data

Sample ID: GM-21-063 Type: ENV Date: 12/7/21 Time: 1433 # Containers: 3

QC Sample ID: GM-21-064 Type: FD Date: 12/7/21 Time: 1443 # Containers: 3

Sampling Personnel: K. Hopper

Remarks (color, odor, etc.): Colorless, odorless

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1401	—	7.65	Initial Depth to Water (pre-pumping)							
1405	Begin purge @ 150 mL/min									
1413	1.2	7.75	13.2	6.36	-13.3	0.776	2.67	0.25	0.38	NA
1417	1.8	7.75	13.0	6.36	-18.8	0.777	4.45	0.18	0.38	
1421	2.4	7.73	13.0	6.34	-24.3	0.780	3.37	0.13	0.38	
1425	3.2	7.73	13.1	6.33	-24.2	0.781	3.32	0.10	0.38	
1429	3.8	7.73	13.1	6.34	-25.0	0.781	4.11	0.09	0.38	
Stabilized	—									

12/7/21

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
2" → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: K. Hopper Date: 12/7/21

Reviewed by: A. Kmas Date: 12/8/21

Meter Model: YSI ProDSS

Filename: Well Inspection, Purging, and Field Measurement Form.docx

EA Engineering, Science, and Technology, Inc., PBC

2200 6th Ave, Suite 707 Seattle, WA 98121

Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6201 Task Order: T021 F4076 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: P1-04

Well Head Locked: Y: ✓ N: ___

Inner Casing Straight and Clear: Y: ✓ N: ___

Exterior Seal Good: Y: ✓ N: ___

Pooled water in Head: Y: ___ N: ✓

Total Well Depth (ft btoc): 16.80

Length of Water Column in Well (ft): 10.35

Diameter of Well Casing (in): 1

Well Casing Volume (liters/ft): 0.15

Well Volume (liters): 1.56

Purge Method: (Peristaltic)/Submersible/Bailer/Other: ___

Depth to Water (ft btoc): 6.45

Depth to Product (ft btoc): —

Product Thickness (ft): —

Purge Rate (liters/min): 0.15

Volume Purged (liters): 3.6

Date Well Purged: 12/7/21

Water Sample Data

Sample ID: GM-21-065 Type: EMV Date: 12/7/21 Time: 1144 # Containers: 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: K. Hopper

Remarks (color, odor, etc.): Colorless, odorless

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1120	—	6.45	Initial Depth to Water (pre-pumping)							
1125	Begin pumping @ 450 mL/min									
1133	1.2	6.51	12.6	6.79	-15.4	0.671	24.44	0.26	0.33	NM
1137	1.8	6.57	12.7	6.79	-18.5	0.672	18.80	0.21	0.33	
1141	2.4	6.59	12.7	6.80	-22.6	0.673	7.97	0.17	0.33	
1145	3.0	6.59	12.9	6.83	-26.3	0.674	4.98	0.15	0.33	
1149	3.6	7.00	13.0	6.84	-28.9	0.675	4.20	0.13	0.33	
Stabilized	—									

12/7/21

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)	Discharge tubing diameter (in) → Discharge tubing volume (liters/ft)
2" → 0.6 4" → 2.5 6" → 5.5	1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: K. Hopper Date: 12/7/21

Reviewed by: H. Dunbar Date: 12/7/21

Meter Model: YSI Pro DSS

Filename: Well Inspection, Purging, and Field Measurement Form.docx

EA Engineering, Science, and Technology, Inc., PBC

2200 6th Ave, Suite 707 Seattle, WA 98121

Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-20-D-6004 Task Order: 25407R0 Naval Installation: Keyport Site Name: OU1

Well Data

Well ID: P1-09

Well Head Locked: Y: ✓ N: ___

Total Well Depth (ft btoc): 16.37

Inner Casing Straight and Clear: Y: ✓ N: ___

Length of Water Column in Well (ft): 10.15

Exterior Seal Good: Y: ✓ N: ___

Diameter of Well Casing (in): 1"

Pooled water in Head: Y: ___ N: ✓

Well Casing Volume (liters/ft): 0.15

Well Volume (liters): 1.52

Purge Method: Peristaltic/Submersible/Bailer/Other: ___

Depth to Water (ft btoc): 6.22

Depth to Product (ft btoc): NA

Product Thickness (ft): NA

Purge Rate (liters/min): 0.2

Volume Purged (liters): 8.0

Date Well Purged: 12/6/21

Water Sample Data

Sample ID: GM-21-066 Type: ENV Date: 12/6/21 Time: 1554 # Containers: BH 2 3

QC Sample ID: — Type: — Date: — Time: — # Containers: —

Sampling Personnel: B. Haines

Remarks (color, odor, etc.): clear, no odor

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	Temp. (°C)	pH	ORP (mv)	Spec. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (% or ppt)	Notes
Stabilization Requirements			(± 10%)	(± 0.2 units)	(± 10)	(± 10%)	(± 10% or <10)	(± 10% or ± 0.1)	(± 10%)	
1407	—	6.22	Initial Depth to Water (pre-pumping)							
1509	Begin	purge.	set	flow	to 0.2	L/min				
1514	1.0	6.22	11.6	7.89	31.1	0.245	0.15	0.45	0.12	Pump not
1519	2.0	6.22	11.6	8.06	30.6	0.250	0.17	0.36	0.12	working.
1524	3.0	6.22	11.4	8.11	37.7	0253	0.12	0.35	0.12	Tested Several
1529	4.0	6.22	11.4	8.09	45.2	0.257	0.10	0.34	0.12	batteries
1534	5.0	6.22	11.4	8.08	55.7	0.259	0.21	0.33	0.12	before using
1539	6.0	6.22	11.4	8.07	63.9	0.260	0.19	0.32	0.12	new pump.
1544	7.0	6.22	11.4	8.07	68.3	0.261	0.17	0.32	0.12	
1549	8.0	6.22	11.4	8.06	70.1	0.261	0.18	0.31	0.12	
1554	collect	sample								
									BH	

Volume Calculations for Well Casings or Discharge Tubing

Volume (liters) = [Casing/tubing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft): (1") 2" → 0.6 4" → 2.5 6" → 5.5

Discharge tubing diameter (in) → Discharge tubing volume (liters/ft): 1/4" → 0.010 3/8" → 0.022 1/2" → 0.039

Recorded by: B. Haines Date: 12/6/21

Reviewed by: H. Dennis Date: 12/7/21

Meter Model: YSI ProDSS #445000

Filename: Well Inspection, Purging, and Field Measurement Form.docx

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Keyport PFAS SAMPLING 2021

12/6/2021

0830 S. Kettlewell, B. Haines, H. Dennis, K. Hepper
H. Hajek Onsite Keyport

0839 YSI Calibration #46376 Serial 19D104139

parameter	Morn	Noon	Evening
pH7	7.0	6.98	7.09
ORP	226.3 → 240 mV	240.5	243.3
COND	1.421 → 1.413 mS/cm	1.363	1.493
Temp	17.0°C	7.5°C	7.2°C
pH4	3.95→4.00		
pH10	9.91→10.00		
Turb	1.7 → 0.0 NTU		
DO	0.00 mg/L		

HH 12/6/2021

0920 H&S Briefing by SSHO
Weather: 37°F, partly cloudy
Topics: ppe, weather, contaminants, traffic

1006 Arrive MW1-61
DTW = 4.82' BTOC

1020 Begin Purge, Peri pump stopped @ 1058, resumed @ 1110

1135 Parameters Stabilized
Temp = 14.3°C Turb = 5.22 NTU
pH = 7.03 DO = 0.48 mg/L
ORP = 5.7 mV Sal = 0.19 ppt
Spec Cond = 0.390 mS/cm

1140 Collect Sample GM-21-054
• x1 Centrifuge tube, x2 250mL HP HDPE PFAS per SAP

Scale: 1 square = _____ HH 12/6/2021 Rite in the Rain ①

12/6/2021 Keyport PFAS Sampling 2021

1148 Decon YSI

1154 Arrive at MW1-48

DTW = 5.35' BTOC

1203 Begin Purge

1243 Parameters Stabilized

Temp = 15.7°C Turb = 28.83 NTU

pH = 6.32 DO = 0.37 mg/L

ORP = -40.1 mV Sal = 0.35 ppt

SpecCond = 0.705 mS/cm

1248 Collect Sample GM-21-037

• x1 Centrifuge tube UP, x2 250mL UP HDPE for PFAS per SAP

1254 Decon YSI and Probe

1256 YSI Midday Cal check

~~1358~~ 1258 HH 12/6/21 Onsite MW1-44

[DTW = 3.56 BTOC]

[DTB = 27.65' BTOC]

~~1303~~ ~~HH 12/6/21~~ ~~1403~~ Begin purge @ 150 mL/min

~~1443~~ 1343 HH 12/6/21 Parameters Stabilized

Temp = 12.9°C Turb = 3.00 NTU

pH = 8.65 DO = 0.43 mg/L

ORP = -59.5 mV Sal = 0.86 ppt

1347 HH 12/6/21 Sp. Cond = 1.690 mS/cm

~~1447~~ Collect Sample GM-21-032

1x Centrifuge NP, x2 250mL NP HDPE PFAS per SAP

12/6/21

Scale: 1 square =

12/6/21 Keyport PFAS Sampling 2021

~~1350~~ 1450 HH 12/6/21 Decon YSI + Probe

~~1403~~ 1356 Arrive MW1-17

1403 Begin Purge

1448 Parameters Stabilized

Temp = 11.3°C Turb = 7.37 NTU

pH = 6.82 Do = 0.38 mg/L

ORP = -80.9 mV Sal = 0.22 ppt

SpecCond = 0.459 mS/cm

1453 Collect Sample GM-21-015

• x1 Centrifuge tube UP, x2 UP 250mL HDPE

1456 PFAS per SAP

~~1458~~ 1458 12/6/21 Decon YSI and probe

1457 Arrive MW1-43

DTW = [3.60' btoc]

DTB = [25.39' btoc]

1459 Begin purge @ 150 mL/min

1527 Parameters Stabilize

Temp = 12.7°C Turb = 7.34 NTU

pH = 7.65 DO = 0.45 mg/L

ORP = -116.2 mV Sal = 1.02 ppt

Sp. Cond = 1.962 mS/cm

1531 Collect Sample GM-21-031

• 1x Centrifuge tube NP, 2x 250mL HDPE PFAS per SAP

1535 Decon YSI + Probe

12/6/21

Scale: 1 square =

Rite in the Rain

12/6/21 Keyport PFAS Sampling 2021

1551 YSI end of day cal check

1600 Onsite Shed to Dendra

1700 Crew offsite, end of day

HH 12/6/2021

(4)

Scale: 1 square = _____

Keyport PFAS Sampling 2021 12/7/2021

0800 H. Hajek, K. Hopper, S. Kettlewell, B. Haines, H. Dennis onsite

0817 YSI Calibration

Parameter	Morn	Noon	Night
Temp	6.7°C	8.0°C	8.6°C
pH	7.08	7.13	7.08
ORP	241.0mV	229.9mV	187→220mV
COND	1.891→0.996 ms/cm	0.896 ms/cm	0.224→1.099 ms/cm

0840 H&S Briefing - Topics: ppe, traffic, animals

weather: mist, cloudy, 41°F

0904 Arrive MW1-42

DTW = 3.36' BTOC, DTB = 24.28' BTOC

0917 Begin Purge

1002 Parameters Stabilized

Temp = 15.0°C Turb = 3.95 NTU

pH = 7.40 DO = 0.46 mg/L

ORP = -84.5mV Sal = 0.18 ppt

SpCond = 0.376 ms/cm

1007 Collect Sample GM-21-030

- x1 centrifuge tube, x2 HDPE 125mL PFAS per SAP

1014 Decon YSI & Probe, dump purge water in drum

1026 Arrive MW1-45

DTW = 5.16' BTOC, DTB = 25.03' BTOC

1040 Begin Purge

1117 Parameters Stabilized

(5)

Scale: 1 square = _____ HH 12/7/2021

12/7/2021 Keyport PFAS Sampling 2021

Temp=14.2°C Turb=6.66 NTU
pH=8.95 DO=0.42 mg/L
ORP=-82.5 mV Sal=0.36 ppt
SpecCond=0.725 mS/cm

1122 Collect Sample GM-21-033
*x1 Centrifuge, x2 250mL HDPE UP PFAS per SAP

1127 Collect Sample GM-21-034 Dup
*x1 centrifuge, x2 250mL HDPE UP, PFAS per SAP

1133 Decon YSI + Probe, dump purge water in drum

1138 Midday YSI Cal Check

1154 Arrive MW1-47
DTW=6.11'BTOC DTB=24.32'BTOC

1210 Begin Purge

1243 Parameters Stabilized
Temp=15.0°C Turb=6.00 NTU
pH=6.26 DO=0.46 mg/L
ORP=-29.1 mV Sal=0.29 ppt
SpecCond=0.592 mS/cm

1248 Collect Sample GM-21-036
*x1 Centrifuge, x2 250mL UP HDPE PFAS per SAP

1255 Decon YSI + Probe, dump purge water

Scale: 1 square = _____ HH 12/7/2021

1317 Arrive MW1-46
DTW=7.02'BTOC DTB=32.74'BTOC

1334 Begin Purge

1403 Parameters Stabilized
Temp=15.6°C Turb=1.68 NTU
pH=7.13 DO=0.47 mg/L
ORP=-58.4 mV Sal=0.59 ppt
SpecCond=1.179 mS/cm

1408 Collect Sample GM-21-035
*x1 centrifuge tube, x2 250mL HDPE UP PFAS per SAP

1414 Decon YSI + Probe, dump purge water

1434 Arrive MW1-15
DTW=6.02'BTOC DTB=12.78'BTOC

1447 Begin Purge

1527 Parameters Stabilized
Temp=16.7°C Turb=1.88 NTU
pH=6.20 DO=0.41 mg/L
ORP=-36.0 mV Sal=0.32 ppt
SpecCond=0.661 mS/cm

1532 Collect Sample GM-21-014
*x1 Centrifuge tube, x2 UP 250mL HDPE PFAS per SAP

1543 Decon YSI + probe, dump purge water

1557 YSI end of day cal check

Scale: 1 square = _____ HH 12/7/2021 Rite in the Rain

12/7/2021 Keyport PFAS Sampling 2021

1650 end of day, crew off site

HH 12/7/2021

Scale: 1 square = _____

Keyport PFAS Sampling 2021 12/8/2021

0800 H. Hajek, K. Hopper, S. Kettlewell, H. Dennis, B. Haines on site

0811 YSI Calibration

Parameter	Morn	Noon	evening
Temp	7.6°C	8.4	8.3°C
ORP	252→220mV	214.6	~~220mV~~ 220.6mV
COND	1.106 ms/cm	1.045→1.413	1.452 ms/cm
pH7	7.18	7.15	7.16

HH 12/8/2021

0830 H&S Briefing weather: rain, 43°F, Topics: weather, PPE, SIMOPS

0900 Arrive MW1-65

DTW=7.11' BTOC DTB=66.14' BTOC

0914 Begin Purge

1007 Parameters Stabilized

Temp=11.6°C Turb=8.54 NTU

pH=6.74 DO=0.47 mg/L

ORP=-35.9mV Sal=0.40 ppt

SpecCond=0.804 ms/cm

1012 Collect Sample GM-21-058

*x1 Centrifuge, x2 UP HDPE 250mL PFAS per SAP

1015 Decon YSI & Probe

1016 Arrive MW1-67

DTW=8.04' BTOC DTB=17.32' BTOC

1018 Begin Purge

1044 Parameters stabilized

Scale: 1 square = _____ HH 12/8/2021

Rite in the Rain

12/8/2021 Keyport PFAS Sampling 2021

Temp=11.0°C Twb=4.24 NTU
pH=6.79 DO=0.50 mg/L
ORP=-78.4mV Sal=0.42 ppt
SpeCond=0.851 mS/cm

1049 Collect Sample GM-21-059
- x1 Centrifuge, x2 250mL HDPE UP PFAS per SAP

1054 Decon YSI & Probe
1058 Arrive MW1-14
DTW=7.15' BTOC DTB=15.59' BTOC
1105 Begin Purge
1158 Parameters Stabilized
Temp=11.6°C Twb=12.97 NTU
pH=6.28 DO=0.48 mg/L
ORP=-30.4mV Sal=0.32 ppt
SpeCond=0.650 mS/cm

1203 Collect Sample GM-21-013
- x1 centrifuge, x2 250mL HDPE UP PFAS Per SAP

1207 Decon YSI & Probe, dump purge water
1212 YSI Midday cal check
1253 Arrive MW1-25
DTW=7.27 BTOC DTB=51.24' BTOC
1305 Begin Purge
Parameters Stabilized
Temp=12.1°C Twb=2.23 NTU
pH=6.79 DO=0.49 mg/L

Scale: 1 square = _____

HH 12/8/2021

ORP=13.7mV Sal=0.49 ppt
SpeCond=0.994 mS/cm

1347 Collect Sample GM-21-022
- x1 centrifuge, x2 250mL HDPE UP
PFAS per SAP

1351 Decon YSI & probe
1358 YSI end of day cal check
1510 End of day, crew offsite

HH 12/8/2021

Scale: 1 square = _____

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Keyport PFAS Sampling 2021 12/6/21

0815 - Arrive onsite, 39°, Cloudy

0830 - Calibrate / Bump check YSI

pH 10 10.09 → 10.00 SPC 1.249 → 1.413

pH 7 7.05 → 7.09 Turb. 0.141 → 0.126

pH 4 4.09 → 4.00 Temp 4.6°C

ORP 248.2 → 240 mv

0920 - Safety Meeting, B. Haines, S. Kethineni, H. Hulick, K. Hopper, H. Dennis

0945 - Arrive @ MW1-68

DTW 2.76' BTOC

DTB 50.17' BTOC - soft bottom

1010 Begin purge

1055 - Well Stabilized Final Reading

Temp 12.2°C Turb. 13.28 NTU

pH 7.24 DO 3.82 mg/L

ORP -118.9 mv Sal 0.13 ppt

SPC 0.275 mS/cm

1057 MW1-68 (GM-81-060) sample collection

[2x HDPE 250mL ; 1x centrifuge]

1125 - Arrive @ MW1-52

DTW - 7.89' BTOC

DTB - 19.89' BTOC

1140 - Begin purge

1220 - Well Stabilized - Final Reading

(Next page)

Scale: 1 square = _____

Rite in the Rain

12-6-21

OU1 Keyport 2021 PFAS Sampl

Final Ready MW1-53

Temp 11.0 | Turb 6.96 NTU
pH 8.52 | DO 3.98 mg/L
ORP -43.2 mV | Sal 0.15 ppt
SPC 0.302 mS/cm

1223 - Sample Collection GM-21-041
[2x HDPE 250mL, 1x centrifuge]

1238 Arrive @ MW1-53
~~1245~~ B DTW - 4.30' BTOC
DTB - 15.29' BTOC

1245 - Begin purge
1305 - Well Stabilized - Final Readings
Temp 11.5°C | Turb 7.85 NTU
pH - 8.04 | DO 3.93 mg/L
ORP 17.6mV | Sal - 0.17 ppt
SPC 0.350 mS/cm

1308 Sample Collected GM-21-042
[2x HDPE 250mL, 1x centrifuge]

1315 Arrive @ MW1-51
DTW - 8.15' BTOC
DTB 23.06 BTOC

1320 - Begin purge
1345 Well Stabilized - Final Ready
Temp 11.4°C | SPC - 0.285 mS/cm Sal 0.14 ppt
pH - 8.55 N | TURB - 3.59 NTU
ORP - 10.5 mV | DO - 3.86 mg/L

Scale: 1 square = 5

12/6/21

OU1 Keyport 2021 PFAS Sampl

1346 / 1352 40 Mid Day Cal Check of MS1

	Mid-day	End of Day
pH	7.24 → 7.0	7.14 → 7.0
Spec Cond	~~232.4~~ 1.458	1.463 mS/cm
ORP	232.4 mV	225 → 240 mV
Temp	7.0°C	4.5°C

1348 Sample Collected GM-21-040
[2x HDPE 250mL, 1x centrifuge]

1405 Arrive @ MW1-5
DTW - 8.20' BTOC
DTB - 14.25' BTOC

1425 - Begin purge
1450 - Well Stabilized - Final Ready
Temp - 11.6°C | Turb - 36.34 NTU
pH - 6.39 | DO - 3.87 mg/L
ORP - -46.9 mV | Sal - 0.15
SPC - 0.322 mS/cm

1455 Sample collected GW-21-007
[2x HDPE 250mL, 1x centrifuge]

1510 - Arrive @ MW1-49
DTW - 5.81' BTOC
DTP - 17.85' BTOC

1540 - Begin purge
- Well Stabilized - Final Reading
(Next page)

Scale: 1 square = 5

12-6-21

OU1 Keyport 2021 PFAS Sampling

Final Reading MW1-49

Temp. 11.7°C Turb - 2.84 NTU

pH - 7.38 DO - 3.88 mg/L

ORP - -28.4 mV Sal - 0.12 ppt

SPC. 0.256 mS/cm

1412 Collect Sample GW-21-038

[2x HDPE 250mL, 1x centrifuge]

1700 - End of day, Offsite

SH 12/6/21

Scale: 1 square = _____

12-7-21

OU1 Keyport 2021 PFAS Sampling

0800 - Onsite - S. Kettlewell, B. Haines, K. Copen, H. Dennis, H. Hajek.

-41°, Cloudy

Calibration check

	0820 Morning	1230 Midday	Evening
pH 7	6.98	6.68 → 7.00	7.08
SPC	1413	1.559 → 1.413	1.162 mS/cm
ORP	229-240	237.6 mV	224.7 mV
Temp.		8.5°C	9.0°C

0840 - Safety Meeting

0900 - Arrive @ MW1-58

Channel 0 - DTW - 6.05' BTOC

DTB - 38.12' BTOC

0920 - Begin purge

1000 - Final Reading - Well Stabilized

Temp. - 12.4°C Turb - 46.50 NTU

pH - 7.20 DO - 3.67 mg/L

ORP - -127.0 mV Sal - 0.15 ppt

SPC - 0.322 mS/cm

1008 - Collect Sample GW-21-050

[2x HDPE 250mL, 1x centrifuge]

1020 - Arrive @ MW1-58, Channel 2

DTW - 6.43' BTOC

DTB - 19.95' BTOC

SH

Scale: 1 square = _____

Rite in the Rain

12-1-21

OVI Keyport 2021 PFAS Sampling

1030 - Begin purge (MW1-58, channel 2)

1100 - Well Stabilized - Final Reading

Temp - 15.2°C Turb - 6497 NTU

pH - 6.60 DO - 3.52 mg/L

ORP - -59.5 mV Sal - 0.15 ppt

SPC - 0.319 mS/cm

1104 - Sample Collected GW-21-048

[2x HDPE 250mL, 1x centrifuge]

1115 - Arrive @ MW1-58, Channel

DTW - 6.50' BTOC

DTB - 9.56' BTOC

1120 - Begin purge

- purging black mud - had to lower tubing because went dry @ 7'. Continued lowering tubing

1134 - Well dry - could not take reading - Turbidity was ~ 1480

1140 - Arrive @ MW1-20

- well has water in above well head

- Bailed well

- DTW ~ 3.63' BTOC

DTB - 16.05' BTOC

1210 - Begin purge

0.2 purge rate

12-1-21

OVI Keyport 2021 PFAS Sampling

(continued MW1-20)

1245 - Well Stabilized - Final Reading

temp - 14.3°C Turb - 11.77 NTU

pH - 6.45 DO - 3.44 mg/L

ORP - 11.6 mV Sal - 0.23 ppt

SPC - 0.499 mS/cm

1248 - Collect Sample GW-21-018

[2x HDPE 250mL, 1x centrifuge]

1315 - Arrive @ MW1-58 channel 1

well recharged enough to collect sample.

1320 Collect sample GW-21-049

[2x HDPE 250mL 1x centrifuge]

1342 - Collect Final Reading

temp - 11.6°C Turb - 541.34 NTU

pH - 6.36 DO - 7.49 mg/L

ORP - 158.1 mV Sal - 0.44 ppt

SPC - 0.89 mS/cm

1416 - Arrive @ MW1-27

DTW - 2.91' BTOC

DTB - 11.03' BTOC

1425 Begin purge

1545 - Well Stabilized / Final Reading

Temp - 14.3°C ORP - 40.8 mV Turb. 459 NTU Sal 0.07 ppt

pH - 5.89 SPC 0.140 mS/cm DO 5.19 mg/L

1548 - Collect sample GW-21-023

Scale: 1 square = _____

10-7-21

OU1 Keyport 2021 PFAS Sampling

1450 - Arrive @ MW1-27
DTW - 4.60' BTOC
DTB - 29.88' BTOC

1500 - Begin purge

15' Well Stabilized / Final Reading

temp - 15.2 °C	Turb - 2.51 NTU
pH - 6.76	DO - 3.20 mg/L
ORP - -81.4 mV	Sal - 0.08 ppt
SPC - 0.164 ms/cm	

1548 - Sample Collected | GW-21-023
↳ MS/MSD
[6x HDPE 250mL, 1 centrifuge]

1650 - Crew off site

10-7-21

Scale: 1 square = _____

12/8/21

Keyport 2021 PFAS sampling

0800 Arrive onsite, Personnel: S. McHenry, B. Haines, H. Hajek, H. Dennis, K. Hopper.
weather: 42°, raining

0817 Cal. check YSI # 20F000312

	morning	midday	evening
pH	7.13	7.09	7.16
ORP	221	224.1	222.4
SPC	1.266→1.413	1.162	1.413
Temp	9.2°C	8.5°C	8°C

0830 Safety Meeting

0900 - Arrive @ MW1-33.
DTW - 2.30' BTOC
DTB - 50.25' BTOC

0920. Begin purge

1005 - Well Stabilized / Final Reading

Temp - 13.4	Turb - 14.21 NTU
pH - 7.66	DO - 3.34 mg/L
ORP - -106.5 mV	Sal - 0.37 ppt
SPC - 0.761 ms/cm	

1008 - Sample Collected - GW-21-027
[2x HDPE 250mL, 1x centrifuge]

~~Arrive @ SH~~
~~@ SH 12.8.21~~

Scale: 1 square = _____

12-8-21 OVI Keyport 2021 PFAS Sampling

1030 - Arrive @ MW1-24
DTW - 4.84' BTOC
DTB - 29.30' BTOC

1050 - Begin purge
- Well Stabilized / Final Reading

Temp - 14.6°C Turb - 16.76 NTU
pH - 7.0 DO - 3.18 mg/L
ORP - 95.4 mV Sal - 0.11 ppt
SPC - 0.222 mS/cm

1123 - Sample Collected GM-21-020
[2x HDPE 250mL, 1 centrifuge]

1126 - Sample Collected GM-21-021-DUP
[2x HDPE 250mL, 1 centrifuge]

1145 - Arrive @ MW1-10
DTW - 4.71' BTOC
DTB - 16.80' BTOC

1155 - Begin purge

1220 - Well Stabilized

Temp - 12.1°C Turb - 31.12 NTU
pH - 6.27 DO - 9.87 mg/L
ORP - 38.3mV Sal - 0.09 ppt
SPC - 0.201 mS/cm

1223 - Collect Sample GM-21-010
[2x HDPE 250mL, 1x centrifuge]

10

Scale: 1 square = _____

12-8-21 OVI Keyport 2021 PFAS Sampling

1228 - Arrive @ MW1-09
DTB - 60.88' BTOC
DTW - 6.05' BTOC

1230 - Begin purge

1305 - Well Stabilized / Final Reading

Temp - 12.1°C Turb - 55.49 NTU
pH - 7.03 DO - 3.47 mg/L
ORP - -89.2 mV Sal - 0.38 ppt
SPC - 0.764 mS/cm

1308 - Collect Sample GM-21-009
[2x HDPE 250mL, 1x centrifuge]

1316 - Arrive @ MW1-29
DTW - 8.45' BTOC
DTB - 39.63' BTOC

1328 - Begin Purge

1408 - Well Stabilized / Final Reading

Temp - 11.9°C Turb - 10.01 NTU
pH - 7.20 DO - 3.46 mg/L
ORP - -68.6 mV Sal - 1.11 ppt
SPC - 2.148 mS/cm

1411 - Sample Collected GM-21-025
[2x HDPE 250mL, 1x centrifuge]

1515 - Pack Samples - left site

JC 12-8-21

11

Scale: 1 square = _____

Rite in the Rain

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Keyport OU1 PFAS Sampling 2021 12/6/21

0900 K. Hopper on site joining B. Haines, H. Dennis, S. Kettlewell, M. Hajek

0905 Cal check Whidbey YSI

Parameter	Morning	Mid-day	End of day
Temp (°C)	4.8		5.8
pH	7.04		7.08
Turb (NTU)	0.05		0.10
ORP (mV)	239.5		236.2
Spcond (mS/cm)	1.413		1.363

12/6/21

0920 H+S brief, see sign in sheet for topics + weather

0954 Onsite well MW1-6

DTW = [8.19' btoc] DTB = [16.02' btoc]

1004 Begin purge @ 200mL/min

Parameters Stabalize

Temp (°C) = 13.5, pH = 6.37, ORP (mV) = 39.8

Spcond (mS/cm) = 0.762 Turb (NTU) = 33.46 DO (mg/L) = 0.11

Sal (ppt) = 0.38

1045 Collect Sample GM-21-008

- 2x 250mL HDPE, NP - PFAS
- 1x Centrifuge tube, NP -

1049 Decon YSI + DTW probe

1144 Onsite well MW1-4

DTW = [3.56' btoc]

DTB = [27.65' btoc]

Scale: 1 square = _____ Rite in the Rain

Keyport PFAS Sampling 2021 12/6/21

1154 Begin purge 150mL/min

1200 Peristaltic Pump failed, troubleshoot; contact PINE PINE to replace pump by end of day, K. Hepper to assist H. Hajek rest of day

1CH 12/6/21

1230 YSI end of day Cal check

1700 End of day crew offsite

HHH 12/6/2021

Scale: 1 square = _____

Keyport PFAS Sampling 2021 12/7/21

0800 H. Dennis, H. Hajek, S. Kathenell, K. Hepper, B. Haines, onsite begin make

0815 Cal Check Whidbey YSI

Parameter	Morning	Mid-day	Evening
Temp (°C)	6.8	8.2	9.0°C
pH	7.08	7.08	7.10
ORP (mV)	240.7	233.9	230.2mV
Sp Cond (mS/cm)	~~1.067~~ 1.383 12H 12/7	1.414	1.334 mS/cm

0840 HHS brief, see sign in sheet for topics tweather

0902 Onsite well MW1-1

DTW = [5.00 50 btoc]

DTB = [17.43' btoc]

0905 Begin purge @ 150mL/min

0941 Parameters Stabalize

Temp = 12.8°C pH = 6.15

ORP = -3.2mV SpCond = 0.243 mS/cm

Turb = 7.97 NTU DO = 0.16 mg/L

Sal = 0.12 ppt

0945 Collect Sample GM-21-001

1x Centrifuge MP, 6 X 250mL HDPE MP

(MS/MSD) PFAS per SAP

0952 Decon YSI + Probe

12/7/21

Scale: 1 square = _____

Rite in the Rain

Keyport PFAS Sampling 2021 12/7/21

1015 Onsite well MW1-62
DTW = [9.38 'btoc]
DTB = [43.88 'btoc]
1018 Begin purge @ 200mL/min
1051 Parameters Stabalize
Temp = 13.7°C pH = 6.67
ORP = 19.8mV SpCond = 0.520 mS/cm
Turb = 16.03 NTU DO = 0.12 mg/L
Sal = 0.25 ppt
1054 Collect Sample GM-21-055
• 1x Centrifuge NP 2x 250mL HDPE NP
PFAS per SAP
Decon YSI + probe
1100 Onsite well P1-04
DTW = [6.45 'btoc]
DTB = [16.80 'btoc]
1125 Begin purge @ 150mL/min
1149 Parameters Stabalize
Temp = 13.0°C pH = 6.84
ORP = -78.9 mV SpCond = 0.675 mS/cm
Turb = 4.20 NTU DO = 0.13 mg/L
Sal = 0.33 ppt
1144 Collect Sample GM-21-065
• 1x Centrifuge NP 2x 250mL HDPE NP
PFAS per SAP

Scale: 1 square = 12/7/21

Keyport PFAS Sampling 2021 12/7/21

1154 Decon YSI + Probe
1210 YSI mid-day check
1238 Onsite well MW1-63
[DTW = 8.31 ' btoc]
[DTB = 43.12' btoc]
1242 Begin purge @ 200mL/min
Parameters Stabilize
Temp = 13.0°C pH = 6.7
ORP = -21.0 mV SpCond = 0.950 mS/cm
Turb = 10.07 NTU DO = 0.08 mg/L
Sal = ~~0.47 ppt~~ 0.47 ppt (entered)
1330 Collect Sample GM-21-056
• 1x Centrifuge NP, 6x 250mL HDPE NP
PFAS per SAP (MS/MSD)
1335 Decon YSI + Probe
1401 Onsite well P1-03
DTW = [7.65 'btoc]
DTB = [18.00 'btoc]
1405 Begin purge @ 200mL/min
1429 Parameters Stabilize
Temp = 13.1°C pH = 6.34
ORP = -25.0 mV SpCond = 0.781 mS/cm
Turb = 4.11 NTU DO = 0.09 mg/L Sal = 0.38 ppt
1433 Collect Sample GM-21-063
• 1x Centrifuge NP, 2x 250mL HDPE NP
PFAS per SAP

Scale: 1 square = Kite in the Rain

Keyport PFAS Sampling 2021 12/7/21

Decon YSI + Probe, 1641217

1443 Collect Sample GM-21-064
- 1x Centrifuge NP - 2x 250mL HDPE NP
PFAS per SAP (Field Duplicate)

1447 Decon YSI + probe

1459 Onsite well PI-02
DTW = [7.66' btoc]
DTB = [17.61' btoc]

1501 Begin Purge @ 150mL/min

1604 Parameters Stabilize + 3x Casing
Temp = 11.5°C pH = 6.38
ORP = -23.0mV SpCond = 1.717 mS/cm
Turb = 32.23 NTU DO = 0.03 mg/L
Sal = 0.97 ppt

1610 Collect Sample GM-21-062
- 1x Centrifuge NP 2x 250mL HDPE NP
PFAS per SAP

1630 YSI end of day cal check

1650 End of day offsite

12/7/21

Scale: 1 square =

Keyport PFAS Sampling 2021 12/8/21

0800 H. Hajek, K. Hopper, S. Kettlewell
H. Dennis, B. Haines onsite

0810 YSI Calibration, windbury

Parameter	Morn	Noon	Evening
Temp (°C)	7.6°C	8.3	8.1
ORP (mV)	231.7 220 mV	214.7	219.8
COND (mS/cm)	1.307 mS/cm	1.349	1.352
PH 7	7.15	7.14	7.12

0830 HTS briefing, see Signin Sheet for topics + weather

0900 Onsite well MW-64
DTW = [7.49' btoc]
DTB = [57.75' btoc]

0907 Begin purge @ 200mL/min

0947 Parameters Stabilize
Temp = 11.5°C pH = 6.69
ORP = -11.2mV SpCond = 0.883 mS/cm
Turb = 6.64 NTU DO = 0.09 mg/L
Sal = 0.44 ppt

0950 Collect Sample GM-21-057
- 1x Centrifuge NP, 2x 250mL HDPE NP
PFAS per SAP

0954 Decon YSI + probe

12/8/21

Scale: 1 square =

Rite in the Rain

0956 Onsite well MW1-2
DTW = [6.95 'btoc]
DTB = [21.00 'btoc]
0958 Begin purge @ 200 mL/min
1026 Parameters Stabilize
Temp = 11.5°C pH = 6.78
ORP = 14.1 mV Sp Cond = 0.671 mS/cm
Turb = 14.26 NTU DO = 0.33 mg/L
Sal = 0.33 ppt
1028 Collect Sample GM-21-004
• 1x Centrifuge NP 2x 250mL HDPE NP
PFAS per SAP
1034 Decon YSI + Probe
1050 Onsite well PI-01
DTW = [7.09 ' btoc]
DTB = [17.13 ' btoc]
1054 Begin purge @ 100mL/min
1128 Parameters Stabilize
Temp = 11.9°C pH = 6.36
ORP = -44.3 mV Sp Cond = 0.831 mS/cm
Turb = 13.89 NTU DO = 0.06 mg/L
Sal = 0.41 ppt
1132 Collect Sample GM-21-061
• 1x Centrifuge NP 2x 250mL HDPE
PFAS per SAP

1136 Decon YSI + Probe
1140 Onsite well MW1-41
DTW = [7.42' btoc]
DTB = [17.65' btoc]
1145 Begin purge @ 200mL/min
parameters Stabilize
Temp = 12.3°C pH = 6.40
ORP = -38.0 mV Sp Cond = 0.900 mS/cm
Turb = 5.97 NTU DO = 0.07 mg/L
Sal = 0.45 ppt
1210 Collect Sample GM-21-029
• 1x Centrifuge NP, 2x 250mL HDPE NP
PFAS per SAP
1212 Decon YSI + Probe
1215 YSI Mid-day Check
1253 Onsite well MW1-4
DTW = [6.14 ' btoc]
DTB = [27.60 ' btoc]
1257 Begin purge @ 150mL/min
1329 parameters Stabilize
Temp = 13.0°C pH = 7.03
ORP = -41.9 mV Sp Cond = 0.989 mS/cm
Turb = 4.33 NTU DO = 0.09 mg/L
Sal = 0.49 ppt

12/8/21

Keyport PFAS Sampling 12/8/21

1333 Collect Sample GM-21-002
- 1 x Centrifuge NP, 2x 250mL HDPE NP
PFAS per SAP

1340 Collect Sample GM-21-003
- 1 x Centrifuge NP, 2x 250mL HDPE NP
PFAS per SAP (Field Duplicate)

1341 Decon YSI + Probe

1342 Onsite well MW1-18
DTW = [6.15 btoc]
DTB = [20.45 btoc]

1346 Begin purge @ 150mL/min

1410 Parameters Stabilize
Temp = 10.9°C pH = 6.62
ORP = -17.8mV SpCond = 0.312 ms/cm
Turb = 89.98 NTU DO = 0.15 mg/L
Sal = 0.15 ppt

1415 Collect Sample GM-21-016
- 1 x Centrifuge NP, 2x 250mL HDPE NP
PFAS per SAP

1418 Decon YSI + Probe

1427 Onsite Shed to Demobe

1430 YSI end of day cal check

1455 JC. Hopper + B. Haines offsite to Ship Samples, end of day

12/8/21

10

Scale: 1 square =

Scale: 1 square =

Rite in the Rain

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12/6/21

Report 2021 PFAS Sampling

0830 - Arrive onsite. Personnel:
B. Haines, S. Kettelwell
Weather: 37 °F, partly cloudy
Cal. check YSI # 44500

	Morning	Mid-Day	End of Day
pH	6.91	7.86-07.00	7.01
Second.	1.518 mS/cm	1.574 mS/cm	1.433
ORP	266.2 mV	262.9	248.7
Turbid	121.7 NTU	—	—
Temp	4.2 C°	6.9	5.7

0920 - Health and safety meeting
Topics - Black bears, wildlife, slips/trips, cold, covid-19

0936 BA MW1-56

Ch.2, DTW = 5.58, DTB = 24.94

1057 BH Begin purge

1132 BH Collect Sample ~~MW1-56 Channel 2~~ GMW21-045

X2 250mL - HDPE, no preservative

pH - 7.25, ORP - 121.2mV, SPC - 0.1490 mS/cm

Turb - 38.11 NTU, DO - 0.52 mg/L, SAL - 0.23 PPT

Temp - 12.0 C°

~~Ch1, DTW = 5.60, DTB = 12.88~~

~~Begin Purge~~ BH

Called Dana to clarify MW1-56 channel total depth.

Scale: 1 square = _____

Blue in the Rain

12/6/21

Keyport 2021 PFAS Sampling

1107 ~~1207~~ MW1-55

BH DTW = 41.92 DTB = 34.33

1119 ~~1217~~ BH Begin purge

1139 ~~1239~~ BH collect Sample GM-21-044

X6 250mL HDPE, none preserved

Temp - 11.2 F°, pH - 7.64, ORP - 137.0mV

SPC - 0.252 ms/cm, Turb - 12.14 NTU,

Do - 0.60 mg/L, Sal - 0.12 PPT

1211 MW1-04

DTW = 6.31, DTB = 15.03

1230 Begin purge.

1250 collect Sample GM-21-006

X2 250mL HDPE, unpreserved

Temp - 11.4 F°, pH - 8.46, ORP - 147.0mV,

SPC - 0.256 ms/cm, Turb - 5.48,

Do - 2.89 mg/L, SAL - 0.12 PPT

1302 MW1-54

DTW = 5.31, DTB = ~~39.14~~ BH 41.02

1312 Begin purge

1337 collect Sample GM-21-043

X2 250mL HDPE, no preservative

Temp - 10.9, pH - 7.66, ORP - 158.7mV,

SPC - 0.202 ms/cm, Turb - 10.77 NTU,

Do - 1.47 mg/L, SAL - 0.10 PPT

1407 P1-09

Scale: 1 square = _____ BH

12/6/21

Keyport 2021 PFAS Sampling

DTW = 6.22, DTB = 16.37

1501 ~~1554~~ BH Begin purge

1554 collect Sample GM-21-066

X2 250mL HDPE, no preservative

Temp - 11.4 F° pH - 8.06, ORP - 70.1 mV,

SPC - 0.261 ms/cm Turb - 0.18 NTU,

DO - 0.31 mg/L, SAL - 0.12 PPT

Tried several batteries before switching out pump. Finally was able to get water flow from well.

1700 packed equipment into sled. offsite.

12/6/21

BH in the rain

Scale: 1 square = _____

12/7/21 Keyport 2021 PFAS Sampling

0800 Arrive onsite. personnel: B. Haines, Susan Kefawell, H. Hasek, K. Hopper

0815 calibration check #44500

	morning	mid-day	end of day
pH 7	6.76	6.91	6.89
SPC-10mS	1.422 mS/cm	1.681 mS/cm	1.430 mS/cm
ORP 240	261.9 mV	260.3 mV	255.5 mV

weather - 41°, cloudy

0840 Health and safety meeting
Topics - wild life, black berries, traffic, covid-19

0857 MW1-56 ch.0
DTW = 28.85, DTB = 29.62
Screen interval should 33.75 - 34.25
screen is buried, not enough water to sample

0859 MW1-56, ch.1
DTW = 5.53, DTB = 12.42
Begin purge

0945 collect sample 6m-21-046
X2 250mL HDPE, no preservative
Temp - 11.5 F°, pH - 6.73, ORP - 251.0 mV,
SPC - 0.546 mS/cm, Turb - 8.77 NTU,
DO - 0.41 mg/L, SAL - 0.27 ppt

0950 MW1-56 ch.2

Scale: 1 square = BH

12/7/21 Keyport 2021 PFAS Sampling

DTW = 9.81, DTB = 24.62

1014 Begin purge

1049 collect sample 6m-21-045
X2 250mL HDPE, no preservative
Temp - 12.1, pH - 6.71, ORP - 58.9 mV,
SPC - 0.428 mS/cm, Turb - 11.48 NTU,
DO - 0.30 mg/L, SAL = 0.21 PPT

1122 MW1-59
DTW = 1.15, DTB = 74.30

1145 Begin purge

1215 collect Sample 6m-21-051
X2 HDPE, 250mL, no preservative
Temp - 10.16°, pH - 7.54, ORP - 103.9 mV,
SPC - 0.243 mS/cm, Turb - 30.12 NTU,
DO - 0.37 mg/L, SAL - 0.12 PPT

1227 mid-day cal-check

1232 MW1-50
DTW = 7.85, DTB = 17.19

1233 Begin purge

1309 collect Sample 6m-21-039
X2 250mL HDPE, no preservative
Temp - 11.6°C, pH = 7.45, ORP = 85.8 mV,
SPC - 0.226 mS/cm, Turb = 8.01 NTU
DO = 0.29 mg/L, Sal = 0.11 ppt

Scale: 1 square = BH Rain

12/7/2021 Keyport 2021 PFAS Sampling

1320 Help SK sample at MW1-58

1405 Arrive @ MW1-31

DTW = 4.56' BTOC

DTB = 23.08' BTOC

1417 Pump on. Begin purge

1454 Collect sample: GM1-21-026

2x HDPE, 1x centrifuge tube, no preservative

Temp = 15.6 °C, pH = 6.14, ORP = 35.0 mV

SPC = 0.228 mS/cm Turb = 17.69 NTU

DO = 0.31 mg/L Sal = 0.11 ppt

1510 MW1-11

DTW = 52.51, DTB = 60.77

1517 Begin purge.

1557 collect sample GM-21-011

X 2 HDPE, 250mL unpreservative

1602 collect sample GM-21-012

X2 HDPE, 250mL, unpreservative

Temp = 14.60°, pH = 6.15, ORP = 90.8mV,

SPC = 0.222 mS/cm, Turb = 36.97 NTU,

DO = 0.36 mg/L, Sal = 0.11 PPT

1850 unpacked equipment offsite.

12/7/21 BH

Scale: 1 square = _____

12/8/21

Keyport 2021 PFAS Sampling

0800 - Arrive on site, personnel: B. Hewes, S. Kettlewell, K. Hopper, H. Dennis, H. Heisek

Weather: 42°, raining

0815 calibration check YSI #44500

	morning	mid-day	Evening
pH 7	6.89	6.90	7.06
ORP	266.9	261.2	250.2
SPC	1.694	1.682	1.697
Temp	8.2	7.4	

0830 Health and safety

Topics: traffic, trips/slips, wild life, covid-19

0900 MW1-39

DTW = 2.49, DTB = 33.71

0915 Begin purge

1000 collect sample GM-21-028

X2 HDPE 250mL, unpreserved

Temp - 13.3°C, pH - 8.30, ORP - 75.8 mV,

SPC - 0.370 mS/cm, Turb - 12.22 NTU,

Do - 0.48 mg/L, Sal - 0.18 PPT

1017 MW1-23

DTW = 7.14, DTB = 30.02

1023 Begin purge

1108 collect sample GM-21-019

Scale: 1 square = _____

Return to the office

12/8/21 Keyport 2021 PFAS Sampling

XZ 250mL HDPE unpreserved

Temp-13.2, pH-7.66, ORP-127.7 mV,

SpC-0.258 mS/cm, Turb-20.09 NTU,

Do-0.49 mg/L, SAL-0.13 ppt

1140 mw1-60

DTW=9.38, DTB=27.97

1201 Begin purge

1231 collect Sample Gm-21-052

XZ 250mL HDPE non preserved

1236 collect Sample Gm-21-053

XZ 250mL HDPE non preserved

Temp-11.6°C, pH-7.66, ORP-116.1 mV,

SpC-0.300 mS/cm, Turb-21.87 NTU,

DO-0.58 mg/L, SAL-0.141 ppt

1300 mw1-28

DTW=8.86, DTB=49.00

1311 Begin purge

1351 collect sample Gm-21-024

XZ HDPE 250mL, unpreserved

Temp-11.7°C, pH-7.12, ORP-52.7mV,

SpC-1.403 mS/cm, Turb-12.07 NTU,

DO-0.47 mg/L, SAL-0.71 ppt

1455 Pack Samples. K. Hopper

and B. Haines offsite.

8

BH

Scale: 1 square = _____

Scale: 1 square = _____

Rite in the Rain

Appendix B
Data Quality Assessment Report

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APPENDIX B. DATA QUALITY ASSESSMENT REPORT

The purpose of this Data Quality Assessment Report, presented as an appendix to the 2021 Groundwater Monitoring Report, is to determine whether the data set collected in December 2021 at Naval Base Kitsap Keyport, Washington, meets the data quality objectives outlined in the Tier I Uniform Federal Policy Sampling and Analysis Plan (SAP) (Department of the Navy [DON] 2021).[1]

A quality assurance (QA)/quality control (QC) program was implemented during the field investigation to ensure the generation of data of adequate and defensible quality. The specifications for the QA/QC program are outlined in the SAP (DON 2021).1 The QA/QC program was designed to minimize error, provide early identification and correction of potential problems, control the data acquisition process, and evaluate the performance of the sampling program. The QA/QC procedures were followed in the field as well as at the offsite laboratories.

The data evaluation in this report focuses on environmental samples collected for offsite laboratory analysis. Field data (including measurements of water quality parameters in water) were collected using standard operating procedures and manufacturer-recommended procedures to provide reliable results.

B.1 TEST METHODS AND LABORATORY QUALIFICATIONS

The groundwater and associated QC samples were collected in December 2021 and analyzed by Eurofins Lancaster Laboratories Environmental, LLC (ELLE) in Lancaster, Pennsylvania for per- and polyfluoroalkyl substances (PFAS) using an isotope dilution analytical technique of liquid chromatography with tandem mass spectrometry in compliance with Department of Defense Quality Systems Manual, Version 5.3, Table B-15. The samples collected are presented in Table B-1.

The laboratory holds current accreditation for the scope of testing through the Department of Defense and Washington Department of Ecology Environmental Laboratory Accreditation Programs.

B.2 FIELD QUALITY CONTROL SAMPLES

In accordance with the SAP (DON 2021),[1] applicable field QC samples include field duplicates and field blanks. The required field QC samples were collected. Additional

[1] *Tier I Sampling and Analysis Plan for Groundwater Sampling at Operable Unit 1, Area 1 Former Landfill and Long-Term Monitoring at Operable Unit 2, Area 2 Van Meter Road Spill/Drum Storage Site at Naval Base Kitsap Keyport, Keyport, Washington.* Prepared by EA Engineering, Science, and Technology, Inc., PBC. Final. October 2021.

volumes for the preparation of matrix spike (MS)/matrix spike duplicate (MSD) samples were also collected and are discussed in Section B.3. A description and evaluation of each field QC sample type is presented in the following sections.

B.2.1 Field Duplicates

A field duplicate set consists of two samples (an original and duplicate) of the same matrix collected at the same time and location, to the extent possible, using the same sampling technique. The purpose is to evaluate the precision of the overall sample collection and analysis process by comparing the results for the two samples, including the calculation of the relative percent differences (RPDs) for detected analytes. For the December 2021 sampling event, the following field duplicate sets were collected:

- Primary sample GM-21-002 and field duplicate sample GM-21-003
- Primary sample GM-21-011 and field duplicate sample GM-21-012
- Primary sample GM-21-020 and field duplicate sample GM-21-021
- Primary sample GM-21-033 and field duplicate sample GM-21-034
- Primary sample GM-21-052 and field duplicate sample GM-21-052
- Primary sample GM-21-063 and field duplicate sample GM-21-064

The results for the field duplicate set are summarized in Table B-2. When target analytes were detected at concentrations greater than the limits of quantitation (LOQs), the RPDs for the results of the field duplicate set are within QC limits, with the following exception. For the field duplicate set consisting of samples GM-21-033 and GM-21-034, the RPD for perfluorohexanesulfonic acid was above the QC limit of 30 percent. The detected results for this analyte in the field duplicate set were qualified as “J” during data assessment. The variance in results is attributed to results near the LOQ (more specifically, within a factor of three of the LOQ), where higher RPDs are common.

B.2.2 Field Blanks

Field blanks are samples of analyte-free water opened at the site and exposed to ambient conditions, collected each day and associated with samples collected the same day. Three field blank samples were collected during the 3-day sampling event. The field blank results are summarized in Table B-2. No target analytes were detected in the field blanks; thus, no associated sample results were qualified on the basis of field blank results.

B.3 LABORATORY QUALITY ASSURANCE/QUALITY CONTROL

The chemical analyses were performed in accordance with the SAP (DON 2021)1 by ELLE.

MS/MSD sample pairs were prepared by the analytical laboratory using samples designated on the chain-of-custody records at an appropriate frequency and for each preparatory batch. At the laboratory, known concentrations of target analytes were added to the sample material to prepare the MS/MSD samples. The MS/MSD samples were carried through the preparation and analytical procedures in the same manner as the associated field samples. The percent recoveries (%Rs) and RPDs of the spiked analytes in the MS/MSD samples were used to evaluate the effect of the sample matrix on accuracy and precision.

Additional laboratory QC samples (method blanks and laboratory control samples [LCSs]) were prepared alongside samples and each sample and QC sample was spiked with internal standards during sample preparation and analyzed as required by the Department of Defense Quality Systems Manual, Version 5.3, Table B-15 and as specified within the SAP (DON 2021).1 These samples and spikes were used to perform the internal laboratory QC prior to the delivery of data. The laboratory's evaluation of the QC results includes comparison to the internal statistically generated control charts as well as the project limits presented in the SAP (DON 2021)1 to allow detections of trends or bias in the generated results.

B.4 DATA VALIDATION AND APPLIED DATA QUALIFIERS

Data validation was performed in accordance with the SAP (DON 2021)1 by a third-party, Laboratory Data Consultants in Carlsbad, California, as described in the data validation reports presented in Attachment C-1. A minimum of 10 percent of sample data were validated at Stage 4 and the remaining data were validated at Stage 2B, as defined in the Department of Defense General Data Validation Guidelines (November 2019) and Module 3: Data Validation Procedures for PFAS Analysis by Quality Systems Manual Table B-15 (May 2020).

Associated sample results may be qualified when QC requirements are not achieved to determine the impact to associated sample results. Data were qualified during validation, as described below.

- Extraction and analytical holding times were met for the initial extractions and analyses performed on the samples. However, the 14-day extraction holding time specified in the SAP (DON 2021) [1] for PFAS was exceeded for 19 re-extracted samples. Detected and non-detected results reported from the re-extracted samples have been qualified "J" and "UJ," respectively.
- Perfluorooctanesulfonic acid (PFOS) was detected in two method blanks at a concentration below the limit of detection (LOD). A detectable PFOS result within five times the method blank concentration and equal to or slightly greater than

the LOQ was reported for associated samples GM-21-022, GM-21-026, GM-21-034, GM-21-058, and GM-21-065; these five sample results were qualified "J."

- The ion ratio was outside QC limits for one or more target analytes for several samples. There were 16 occurrences for this issue; impacted detected PFAS results have been qualified "J" on this basis.
- The %R was outside QC limits for one or more extracted internal standards (labeled compounds) for several samples. In accordance with the applicable data validation guidelines, results associated with these labeled compounds in associated samples have been qualified as follows.
  - The "R" qualifier was applied to detected and non-detected results when the %R was below 20%. There were 52 "R" qualifiers applied on this basis. Note the data validation applied "X" qualifiers in these instances; during data assessment these were updated to "R" qualifiers.
  - The "J" qualifier was applied to detected results when the %R was outside QC limits and greater than or equal to 20%. There were 9 occurrences for this issue;
  - The "UJ" qualifier was applied to non-detected results when the %R was less than the lower control limit and greater than or equal to 20%. There were 68 qualifiers applied on this basis.
- For one LCS, the %Rs for two analytes were 69 percent, which was slightly below the applicable lower QC limit. The non-detected results for these analyses in associated samples have been qualified "UJ" on this basis.
- GM-21-023 was used to prepare MS/MSD samples for PFAS. The %Rs for two analytes (perfluorotridecanoic acid and 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid) were below the lower QC limit in the MS and MSD and below 10 percent in the MSD. The non-detected results for these analyses in the primary sample have been qualified "R" on this basis.
- Sample GM-21-044 was used to prepare MS/MSD samples for PFAS. The %Rs for three analytes were slightly below the lower control limit in the MS and/or MSD; these %Rs ranged from 65 percent to 71 percent. The non-detected results for these analyses in the primary sample have been qualified "UJ" on this basis.
- Sample GM-21-056 was used to prepare MS/MSD samples for PFAS. The %Rs for two analytes were below the lower QC limit in the MS. The non-detected results for these analyses in the primary sample have been qualified "UJ" on this basis.

Additional qualifiers were applied during data assessment, as described below.

- Groundwater samples GM-21-033 and GM-21-034 were submitted as a primary and field duplicate pair. The RPD for the primary and field duplicate sample results were outside the QC limit for perfluorohexanesulfonic acid. The detected results for this analyte reported for the primary sample and associated field duplicate sample have been qualified "J."
- For one preparation batch of samples, it was observed that extracted internal standards had %Rs approximately double the expected values. Due to the possibility that the samples were double spiked with internal standards, the associated detected results were qualified as "J" during data assessment. This occurred for 15 detected results.

In addition, more than one analysis was performed and reported by the laboratory for most samples and target analytes. In these cases, the data validator selected a "best" result for each target analyte based on professional judgement. The results not selected as the "best" results in these cases are not discussed in the above bullets and are not presented in the 2021 Groundwater Monitoring Report.

No other qualifiers were added to the analytical results for project samples during validation. The qualifiers added to project data during data validation are summarized below.

- The "J" qualifier indicates that the reported result is an estimated value.
- The "R" qualifier indicates that the result is rejected.
- The "U" qualifier indicates that the analyte is not detected; the associated numerical value is the limit of detection or as qualified during data validation.
- The "UJ" qualifier indicates that the analyte is not detected; the associated numerical value is approximate.

Sample results as qualified are presented in the *2021 Groundwater Monitoring Report*.

B.5 DATA QUALITY INDICATORS

A discussion of data quality indicators for this project in terms of precision, accuracy, representativeness, completeness, comparability, and sensitivity is provided in the following sections.

B.5.1 Precision

Precision is defined as the degree of agreement among repeated measurement of the same parameter. Precision also characterizes the natural variation of the matrix. Precision is evaluated through the use of field duplicate samples and MS/MSD sets to

assess the potential bias of field and laboratory conditions on the results. The quantitative indicator of precision is the RPD between the results of field duplicates and the associated primary samples and the MS/MSD pairs.

Field sample duplicate RPDs are within the SAP (DON 2021)1 QC limits, unless otherwise noted in Section B.2.1 and Section B.4. Field duplicate samples were generally within control limits and overall demonstrate that representative samples were adequately collected during field activities and that the laboratories were capable of evaluating the matrix consistently.

MS/MSD RPDs are within the SAP (DON 2021)1 QC limits, unless otherwise noted in Attachment B-1. No sample results were qualified on the basis of MS/MSD RPD.

B.5.2 Accuracy

An evaluation of accuracy monitors the agreement of measured results with “true values” established by spiking applicable samples with a known quantity of analyte or internal standard; accuracy is measured by the %R for spiked samples (LCS, MS/MSD) and internal standards. LCS and MS/MSD samples were analyzed in accordance with the SAP (DON 2021)1 specifications. LCS, MS/MSD, and internal standard %Rs were within acceptable project-specified QC limits, unless otherwise noted in Attachment B-1 and in Section B.4. In most cases, the project goal for accuracy was met.

B.5.3 Representativeness

Representativeness is a qualitative parameter that expresses the degree to which the sample data are characteristic of a population, parameter, or environmental condition.

Representativeness is most concerned with the proper design of a sampling system and careful selection of sampling locations. Representative data were obtained through selection of sampling locations, sampling procedure collection, handling of samples, and the use of established field and laboratory procedures as described in the SAP (DON 2021)1. These procedures were followed during the sampling event unless otherwise discussed in the 2021 Groundwater Monitoring Report, of which this report is an appendix. An appropriate analytical method was utilized to meet the data quality objectives of the project.

B.5.4 Completeness

Completeness is a measure of the amount of usable data obtained versus the total possible planned data. The evaluation includes a comparison of the number of valid results divided by the possible number of individual results, expressed in a percentage.

The data completeness is defined as the percentage of usable data (usable data divided by the total possible data):

$$\% \text{ completeness} = \frac{100 * \text{number of valid results (i.e., non-R flagged)}}{\text{number of planned results}}$$

Completeness for the data set is less than 100 percent due to the following:

- The sample from well MW1-56 channel 0 (with a screen depth of 33.75 to 34.25 feet below ground surface) was not collected because the well screen was buried and there was no water to collect a sample. Thus, results for 18 PFAS analytes were not obtained.
- A quantity of 52 results were qualified as “R” (i.e., rejected) due to internal standard %R below 20%.
- A quantity of 2 results were qualified as “R” (i.e., rejected) due to %R below 10% for the MSD.

There was a total of 1,224 planned results for 18 PFAS target analytes for samples collected from the 59 well locations, 6 field duplicates, and 3 field blanks. As detailed in the bullets above, there are 1,152 valid results. The % completeness for this data set is 94.1%, which meets the 90% minimal acceptance criteria for completeness specified in the SAP (DON 2021).[1]

B.5.5 Comparability

Comparability is a qualitative parameter expressing the confidence with which one dataset can be compared with another. Sample results should be comparable with other measurements for similar samples and sample conditions. Comparability for the project was achieved by using standard protocols for sampling and analysis.

B.5.6 Sensitivity

Sensitivity was evaluated by comparing the screening levels with the LODs for each sample result. As presented in the SAP (DON 2021)[1] and as reported for the collected sample data, LODs are below the screening levels; therefore, the project goal for sensitivity was met.

B.6 OVERALL ASSESSMENT OF DATA

During data validation and assessment, 54 results were rejected and should not be used for any purpose. The remaining results are acceptable for use as qualified.

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Tables

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TABLE B-1. Sample Summary

Location ID	Field Sample ID	Collected Date	QC Type	Matrix	Primary Sample ID	Laboratory Sample ID	Laboratory
1MW-1	GM-21-001	7-Dec-2021	N	Groundwater	--	410-66194-6	ELLE
1MW-4	GM-21-002	8-Dec-2021	N	Groundwater	--	410-66184-1	ELLE
1MW-4	GM-21-003	8-Dec-2021	FD	Groundwater	GM-21-002	410-66184-2	ELLE
MW1-2	GM-21-004	8-Dec-2021	N	Groundwater	--	410-66173-3	ELLE
MW1-3	GM-21-005	7-Dec-2021	N	Groundwater	--	410-66189-9	ELLE
MW1-04	GM-21-006	6-Dec-2021	N	Groundwater	--	410-66202-11	ELLE
MW1-05	GM-21-007	6-Dec-2021	N	Groundwater	--	410-66202-3	ELLE
MW1-06	GM-21-008	6-Dec-2021	N	Groundwater	--	410-66202-7	ELLE
MW1-09	GM-21-009	8-Dec-2021	N	Groundwater	--	410-66184-3	ELLE
MW1-10	GM-21-010	8-Dec-2021	N	Groundwater	--	410-66184-4	ELLE
MW1-11	GM-21-011	7-Dec-2021	N	Groundwater	--	410-66189-4	ELLE
MW1-11	GM-21-012	7-Dec-2021	FD	Groundwater	GM-21-011	410-66189-5	ELLE
MW1-14	GM-21-013	8-Dec-2021	N	Groundwater	--	410-66173-6	ELLE
MW1-15	GM-21-014	7-Dec-2021	N	Groundwater	--	410-66194-14	ELLE
MW1-17	GM-21-015	6-Dec-2021	N	Groundwater	--	410-66202-13	ELLE
MW1-18	GM-21-016	8-Dec-2021	N	Groundwater	--	410-66184-5	ELLE
MW1-20	GM-21-018	7-Dec-2021	N	Groundwater	--	410-66189-2	ELLE
MW1-23	GM-21-019	8-Dec-2021	N	Groundwater	--	410-66173-5	ELLE
MW1-24	GM-21-020	8-Dec-2021	N	Groundwater	--	410-66184-6	ELLE
MW1-24	GM-21-021	8-Dec-2021	FD	Groundwater	GM-21-020	410-66184-7	ELLE
MW1-25	GM-21-022	8-Dec-2021	N	Groundwater	--	410-66184-8	ELLE
MW1-27	GM-21-023	7-Dec-2021	N	Groundwater	--	410-66189-11	ELLE
MW1-28	GM-21-024	8-Dec-2021	N	Groundwater	--	410-66184-9	ELLE
MW1-29	GM-21-025	8-Dec-2021	N	Groundwater	--	410-66184-10	ELLE
MW1-31	GM-21-026	7-Dec-2021	N	Groundwater	--	410-66194-10	ELLE
MW1-38	GM-21-027	8-Dec-2021	N	Groundwater	--	410-66173-8	ELLE
MW1-39	GM-21-028	8-Dec-2021	N	Groundwater	--	410-66173-4	ELLE
MW1-41	GM-21-029	8-Dec-2021	N	Groundwater	--	410-66173-7	ELLE
MW1-42	GM-21-030	7-Dec-2021	N	Groundwater	--	410-66194-5	ELLE
MW1-43	GM-21-031	6-Dec-2021	N	Groundwater	--	410-66202-15	ELLE
MW1-44	GM-21-032	6-Dec-2021	N	Groundwater	--	410-66202-16	ELLE
MW1-45	GM-21-033	7-Dec-2021	N	Groundwater	--	410-66194-13	ELLE
MW1-45	GM-21-034	7-Dec-2021	FD	Groundwater	GM-21-033	410-66194-8	ELLE
MW1-46	GM-21-035	7-Dec-2021	N	Groundwater	--	410-66194-3	ELLE
MW1-47	GM-21-036	7-Dec-2021	N	Groundwater	--	410-66194-2	ELLE
MW1-48	GM-21-037	6-Dec-2021	N	Groundwater	--	410-66202-2	ELLE
MW1-49	GM-21-038	6-Dec-2021	N	Groundwater	--	410-66202-6	ELLE
MW1-50	GM-21-039	7-Dec-2021	N	Groundwater	--	410-66194-11	ELLE
MW1-51	GM-21-040	6-Dec-2021	N	Groundwater	--	410-66202-17	ELLE
MW1-52	GM-21-041	6-Dec-2021	N	Groundwater	--	410-66202-4	ELLE
MW1-53	GM-21-042	6-Dec-2021	N	Groundwater	--	410-66202-1	ELLE
MW1-54	GM-21-043	6-Dec-2021	N	Groundwater	--	410-66202-8	ELLE
MW1-55	GM-21-044	6-Dec-2021	N	Groundwater	--	410-66202-9	ELLE
MW1-56	GM-21-045	7-Dec-2021	N	Groundwater	--	410-66189-8	ELLE
MW1-56	GM-21-046	7-Dec-2021	N	Groundwater	--	410-66189-3	ELLE
MW1-58	GM-21-048	7-Dec-2021	N	Groundwater	--	410-66189-7	ELLE
MW1-58	GM-21-049	7-Dec-2021	N	Groundwater	--	410-66189-13	ELLE
MW1-58	GM-21-050	7-Dec-2021	N	Groundwater	--	410-66189-1	ELLE

TABLE B-1. Sample Summary

Location ID	Field Sample ID	Collected Date	QC Type	Matrix	Primary Sample ID	Laboratory Sample ID	Laboratory
MW1-59	GM-21-051	7-Dec-2021	N	Groundwater	--	410-66189-6	ELLE
MW1-60	GM-21-052	8-Dec-2021	N	Groundwater	--	410-66184-11	ELLE
MW1-60	GM-21-053	8-Dec-2021	FD	Groundwater	GM-21-052	410-66184-12	ELLE
MW1-61	GM-21-054	6-Dec-2021	N	Groundwater	--	410-66202-14	ELLE
MW1-62	GM-21-055	7-Dec-2021	N	Groundwater	--	410-66194-1	ELLE
MW1-63	GM-21-056	7-Dec-2021	N	Groundwater	--	410-66194-4	ELLE
MW1-64	GM-21-057	8-Dec-2021	N	Groundwater	--	410-66173-9	ELLE
MW1-65	GM-21-058	8-Dec-2021	N	Groundwater	--	410-66173-11	ELLE
MW1-67	GM-21-059	8-Dec-2021	N	Groundwater	--	410-66173-1	ELLE
MW1-68	GM-21-060	6-Dec-2021	N	Groundwater	--	410-66202-5	ELLE
P1-1	GM-21-061	8-Dec-2021	N	Groundwater	--	410-66173-10	ELLE
P1-2	GM-21-062	7-Dec-2021	N	Groundwater	--	410-66189-12	ELLE
P1-3	GM-21-063	7-Dec-2021	N	Groundwater	--	410-66194-9	ELLE
P1-3	GM-21-064	7-Dec-2021	FD	Groundwater	GM-21-063	410-66194-7	ELLE
P1-4	GM-21-065	7-Dec-2021	N	Groundwater	--	410-66194-12	ELLE
P1-9	GM-21-066	6-Dec-2021	N	Groundwater	--	410-66202-12	ELLE
--	FB-120621	6-Dec-2021	FB	Field QC	--	410-66202-10	ELLE
--	FB-120721	7-Dec-2021	FB	Field QC	--	410-66189-10	ELLE
--	FB-120821	8-Dec-2021	FB	Field QC	--	410-66173-2	ELLE

Notes:
ELLE = Eurofins Lancaster Laboratories Environme N = normal (primary sample)
FD = field duplicate QC = quality control
ID = identification

Table B-2. Relative Percent Differences between Results Above the Limit of Quantitation for the Primary Samples and Field Duplicate Pairs

Location		1MW-4		1MW-4		RPD
Field Sample ID		GM-21-002		GM-21-003		
Analyte	Units	Result	Q	Result	Q	
Hexafluoropropylene oxide dimer acid (HFPO-DA)	µg/L	0.00052	J	0.00046	J	NC
N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA)	µg/L	0.00088	U	0.00088	U	NC
N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA)	µg/L	0.0011	U	0.0011	U	NC
Perfluorobutanesulfonic acid (PFBS)	µg/L	0.0011	J	0.0012	J	NC
Perfluorodecanoic acid (PFDA)	µg/L	0.00088	U	0.00088	U	NC
Perfluorododecanoic acid (PFDoA)	µg/L	0.00089	U	0.00088	U	NC
Perfluoroheptanoic acid (PFHpA)	µg/L	0.00099	J	0.00082	J	NC
Perfluorohexanesulfonic acid (PFHxS)	µg/L	0.00067	J	0.00069	J	NC
Perfluorohexanoic acid (PFHxA)	µg/L	0.0023		0.0023		0%
Perfluorononanoic acid (PFNA)	µg/L	0.00088	U	0.00088	U	NC
Perfluorooctanesulfonic acid (PFOS)	µg/L	0.00088	U	0.00088	U	NC
Perfluorooctanoic acid (PFOA)	µg/L	0.0035		0.0037		5.6%
Perfluorotetradecanoic acid (PFTA)	µg/L		R	0.00088	UJ	NC
Perfluorotridecanoic acid (PFTrDA)	µg/L	0.00089	U	0.00088	U	NC
Perfluoroundecanoic acid (PFUnA)	µg/L	0.00088	U	0.00088	U	NC
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonicacid (11Cl-PF3OUdS)	µg/L	0.00088	U	0.00088	U	NC
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)	µg/L	0.00088	U	0.00088	U	NC
4,8-dioxa-3H-perfluorononanoic acid (DONA)	µg/L	0.00088	U	0.00088	U	NC

Notes:

µg/L = microgram(s) per liter

NC - not calculated; one or more of the sample pair results are “U” qualified.

Q = qualifier

RPD - relative percent difference

Data Qualifiers:

J = The reported result is an estimated value.

R = The result is rejected.

U = The analyte is not detected; the associated numerical value is the limit of detection or as qualified during data validation.

UJ = The analyte is not detected; the associated numerical value is approximate.

Table B-2. Relative Percent Differences between Results Above the Limit of Quantitation for the Primary Samples and Field Duplicate Pairs

Location		MW1-11		MW1-11		RPD
Field Sample ID		GM-21-011		GM-21-012		
Analyte	Units	Result	Q	Result	Q	
Hexafluoropropylene oxide dimer acid (HFPO-DA)	µg/L	0.00091	U	0.00054	J	NC
N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA)	µg/L	0.00091	U	0.00093	U	NC
N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA)	µg/L	0.0011	U	0.0011	U	NC
Perfluorobutanesulfonic acid (PFBS)	µg/L	0.00091	U	0.00093	U	NC
Perfluorodecanoic acid (PFDA)	µg/L	0.00091	U	0.00093	U	NC
Perfluorododecanoic acid (PFDoA)	µg/L	0.00091	U	0.00093	UJ	NC
Perfluoroheptanoic acid (PFHpA)	µg/L	0.00091	U	0.00093	U	NC
Perfluorohexanesulfonic acid (PFHxS)	µg/L	0.00091	U	0.00093	U	NC
Perfluorohexanoic acid (PFHxA)	µg/L	0.00091	U	0.00093	U	NC
Perfluorononanoic acid (PFNA)	µg/L	0.00091	U	0.00093	U	NC
Perfluorooctanesulfonic acid (PFOS)	µg/L	0.00088	J	0.00096	J	NC
Perfluorooctanoic acid (PFOA)	µg/L	0.00091	U	0.00093	U	NC
Perfluorotetradecanoic acid (PFTA)	µg/L	0.00091	UJ		R	NC
Perfluorotridecanoic acid (PFTrDA)	µg/L	0.00091	U	0.00093	UJ	NC
Perfluoroundecanoic acid (PFUnA)	µg/L	0.00091	U	0.00093	U	NC
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonicacid (11Cl-PF3OUdS)	µg/L	0.00091	U	0.00093	U	NC
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)	µg/L	0.00091	U	0.00093	U	NC
4,8-dioxa-3H-perfluorononanoic acid (DONA)	µg/L	0.00091	U	0.00093	U	NC

Notes:

µg/L = microgram(s) per liter

NC - not calculated; one or more of the sample pair results are “U” qualified.

Q = qualifier

RPD - relative percent difference

Data Qualifiers:

J = The reported result is an estimated value.

R = The result is rejected.

U = The analyte is not detected; the associated numerical value is the limit of detection or as qualifie

UJ = The analyte is not detected; the associated numerical value is approximate.

Table B-2. Relative Percent Differences between Results Above the Limit of Quantitation for the Primary Samples and Field Duplicate Pairs

Location		MW1-24		MW1-24		RPD
Field Sample ID		GM-21-020		GM-21-021		
Analyte	Units	Result	Q	Result	Q	
Hexafluoropropylene oxide dimer acid (HFPO-DA)	µg/L	0.00086	U	0.00086	U	NC
N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA)	µg/L	0.00086	U	0.00086	U	NC
N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA)	µg/L	0.0010	U	0.0010	U	NC
Perfluorobutanesulfonic acid (PFBS)	µg/L	0.00086	U	0.00086	U	NC
Perfluorodecanoic acid (PFDA)	µg/L	0.00086	U	0.00086	U	NC
Perfluorododecanoic acid (PFDoA)	µg/L	0.00086	U	0.00086	U	NC
Perfluoroheptanoic acid (PFHpA)	µg/L	0.00086	U	0.00086	U	NC
Perfluorohexanesulfonic acid (PFHxS)	µg/L	0.00086	U	0.00086	U	NC
Perfluorohexanoic acid (PFHxA)	µg/L	0.00086	U	0.00086	U	NC
Perfluorononanoic acid (PFNA)	µg/L	0.00086	U	0.00086	U	NC
Perfluorooctanesulfonic acid (PFOS)	µg/L	0.00086	U	0.00086	U	NC
Perfluorooctanoic acid (PFOA)	µg/L	0.00086	U	0.00086	U	NC
Perfluorotetradecanoic acid (PFTA)	µg/L		R	0.00086	UJ	NC
Perfluorotridecanoic acid (PFTrDA)	µg/L	0.00086	U	0.00086	U	NC
Perfluoroundecanoic acid (PFUnA)	µg/L	0.00086	U	0.00086	U	NC
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonicacid (11Cl-PF3OUdS)	µg/L	0.00086	U	0.00086	U	NC
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)	µg/L	0.00086	U	0.00086	U	NC
4,8-dioxa-3H-perfluorononanoic acid (DONA)	µg/L	0.00086	U	0.00086	U	NC

Notes:

µg/L = microgram(s) per liter

NC - not calculated; one or more of the sample pair results are “U” qualified.

Q = qualifier

RPD - relative percent difference

Data Qualifiers:

J = The reported result is an estimated value.

R = The result is rejected.

U = The analyte is not detected; the associated numerical value is the limit of detection or as qualifie

UJ = The analyte is not detected; the associated numerical value is approximate.

Table B-2. Relative Percent Differences between Results Above the Limit of Quantitation for the Primary Samples and Field Duplicate Pairs

Location		MW1-45		MW1-45		RPD
Field Sample ID		GM-21-033		GM-21-034		
Analyte	Units	Result	Q	Result	Q	
Hexafluoropropylene oxide dimer acid (HFPO-DA)	µg/L	0.00096	U	0.00094	UJ	NC
N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA)	µg/L	0.00096	U	0.00094	UJ	NC
N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA)	µg/L	0.0012	U	0.0011	UJ	NC
Perfluorobutanesulfonic acid (PFBS)	µg/L	0.0011	J	0.0015	J	NC
Perfluorodecanoic acid (PFDA)	µg/L	0.00096	U	0.00094	UJ	NC
Perfluorododecanoic acid (PFDoA)	µg/L	0.00096	U	0.00094	UJ	NC
Perfluoroheptanoic acid (PFHpA)	µg/L	0.00068	J	0.00070	J	NC
Perfluorohexanesulfonic acid (PFHxS)	µg/L	0.0026	J	0.0055	J	72%
Perfluorohexanoic acid (PFHxA)	µg/L	0.0011	J	0.0015	J	NC
Perfluorononanoic acid (PFNA)	µg/L	0.00096	U	0.00094	UJ	NC
Perfluorooctanesulfonic acid (PFOS)	µg/L	0.00065	J	0.0026	J	NC
Perfluorooctanoic acid (PFOA)	µg/L	0.0019	J	0.0027	J	NC
Perfluorotetradecanoic acid (PFTA)	µg/L	0.00096	U	0.00094	UJ	NC
Perfluorotridecanoic acid (PFTrDA)	µg/L	0.00096	U	0.00094	UJ	NC
Perfluoroundecanoic acid (PFUnA)	µg/L	0.00096	U	0.00094	UJ	NC
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonicacid (11Cl-PF3OUdS)	µg/L	0.00096	U	0.00095	UJ	NC
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)	µg/L	0.00096	U	0.00094	UJ	NC
4,8-dioxa-3H-perfluorononanoic acid (DONA)	µg/L	0.00096	U	0.00094	UJ	NC

Notes:

µg/L = microgram(s) per liter

NC - not calculated; one or more of the sample pair results are “U” qualified.

Q = qualifier

RPD - relative percent difference

Data Qualifiers:

J = The reported result is an estimated value.

R = The result is rejected.

U = The analyte is not detected; the associated numerical value is the limit of detection or as qualifie

UJ = The analyte is not detected; the associated numerical value is approximate.

Table B-2. Relative Percent Differences between Results Above the Limit of Quantitation for the Primary Samples and Field Duplicate Pairs

Location		MW1-60		MW1-60		RPD
Field Sample ID		GM-21-052		GM-21-053		
Analyte	Units	Result	Q	Result	Q	
Hexafluoropropylene oxide dimer acid (HFPO-DA)	µg/L	0.00092	U	0.00093	U	NC
N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA)	µg/L	0.00092	U	0.00093	UJ	NC
N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA)	µg/L	0.0011	U	0.0011	UJ	NC
Perfluorobutanesulfonic acid (PFBS)	µg/L	0.00092	U	0.00093	U	NC
Perfluorodecanoic acid (PFDA)	µg/L	0.00092	U	0.00093	U	NC
Perfluorododecanoic acid (PFDoA)	µg/L	0.00092	U		R	NC
Perfluoroheptanoic acid (PFHpA)	µg/L	0.00092	U	0.00093	U	NC
Perfluorohexanesulfonic acid (PFHxS)	µg/L	0.00092	U	0.00093	U	NC
Perfluorohexanoic acid (PFHxA)	µg/L	0.00092	U	0.00093	U	NC
Perfluorononanoic acid (PFNA)	µg/L	0.00092	U	0.00093	U	NC
Perfluorooctanesulfonic acid (PFOS)	µg/L	0.00092	U	0.00093	U	NC
Perfluorooctanoic acid (PFOA)	µg/L	0.00092	U	0.00093	U	NC
Perfluorotetradecanoic acid (PFTA)	µg/L	0.00092	UJ		R	NC
Perfluorotridecanoic acid (PFTrDA)	µg/L	0.00092	U		R	NC
Perfluoroundecanoic acid (PFUnA)	µg/L	0.00092	U	0.00093	UJ	NC
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonicacid (11Cl-PF3OUdS)	µg/L	0.00092	U	0.00093	U	NC
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)	µg/L	0.00092	U	0.00093	U	NC
4,8-dioxa-3H-perfluorononanoic acid (DONA)	µg/L	0.00092	U	0.00093	U	NC

Notes:

µg/L = microgram(s) per liter

NC - not calculated; one or more of the sample pair results are “U” qualified.

Q = qualifier

RPD - relative percent difference

Data Qualifiers:

J = The reported result is an estimated value.

R = The result is rejected.

U = The analyte is not detected; the associated numerical value is the limit of detection or as qualifie

UJ = The analyte is not detected; the associated numerical value is approximate.

Table B-2. Relative Percent Differences between Results Above the Limit of Quantitation for the Primary Samples and Field Duplicate Pairs

Location		P1-3		P1-3		RPD
Field Sample ID		GM-21-063		GM-21-064		
Analyte	Units	Result	Q	Result	Q	
Hexafluoropropylene oxide dimer acid (HFPO-DA)	µg/L	0.00091	UJ	0.0017	J	NC
N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA)	µg/L	0.00091	UJ	0.00053	J	NC
N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA)	µg/L	0.0011	UJ	0.0011	U	NC
Perfluorobutanesulfonic acid (PFBS)	µg/L	0.0014	J	0.0012	J	NC
Perfluorodecanoic acid (PFDA)	µg/L	0.00091	UJ	0.00089	U	NC
Perfluorododecanoic acid (PFDoA)	µg/L	0.00091	UJ		R	NC
Perfluoroheptanoic acid (PFHpA)	µg/L	0.0031	J	0.0028	J	10%
Perfluorohexanesulfonic acid (PFHxS)	µg/L	0.0038	J	0.0041	J	8%
Perfluorohexanoic acid (PFHxA)	µg/L	0.0053	J	0.0054	J	2%
Perfluorononanoic acid (PFNA)	µg/L	0.00095	J	0.00085	J	NC
Perfluorooctanesulfonic acid (PFOS)	µg/L	0.0058	J	0.0062	J	7%
Perfluorooctanoic acid (PFOA)	µg/L	0.017	J	0.017	J	0%
Perfluorotetradecanoic acid (PFTA)	µg/L		R		R	NC
Perfluorotridecanoic acid (PFTrDA)	µg/L	0.00091	UJ		R	NC
Perfluoroundecanoic acid (PFUnA)	µg/L	0.00091	UJ	0.00089	UJ	NC
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonicacid (11Cl-PF3OUdS)	µg/L	0.00091	UJ	0.00089	U	NC
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)	µg/L	0.00091	UJ	0.00089	U	NC
4,8-dioxa-3H-perfluorononanoic acid (DONA)	µg/L	0.00091	UJ	0.00089	U	NC

Notes:

µg/L = microgram(s) per liter

NC - not calculated; one or more of the sample pair results are “U” qualified.

Q = qualifier

RPD - relative percent difference

Data Qualifiers:

J = The reported result is an estimated value.

R = The result is rejected.

U = The analyte is not detected; the associated numerical value is the limit of detection or as qualifie

UJ = The analyte is not detected; the associated numerical value is approximate.

Table B-3. Summary of Field Blank Results

				Field Sample ID		FB-120721		FB-120821	
				Sample Collection Date		7-Dec-2021		8-Dec-2021	
Analyte	Analytical Method	CASRN	Units	Result	Q	Result	Q	Result	Q
Hexafluoropropylene oxide dimer acid (HFPO-DA)	QSM B15	13252-13-6	µg/L	0.00088	U	0.00091	U	0.00088	U
N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA)	QSM B15	2991-50-6	µg/L	0.00088	U	0.00091	U	0.00088	U
N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA)	QSM B15	2355-31-9	µg/L	0.0011	U	0.0011	U	0.0011	U
Perfluorobutanesulfonic acid (PFBS)	QSM B15	375-73-5	µg/L	0.00088	U	0.00091	U	0.00088	U
Perfluorodecanoic acid (PFDA)	QSM B15	335-76-2	µg/L	0.00088	UJ	0.00091	U	0.00088	U
Perfluorododecanoic acid (PFDoA)	QSM B15	307-55-1	µg/L	0.00088	U	0.00091	U	0.00088	U
Perfluoroheptanoic acid (PFHpA)	QSM B15	375-85-9	µg/L	0.00088	U	0.00091	U	0.00088	U
Perfluorohexanesulfonic acid (PFHxS)	QSM B15	355-46-4	µg/L	0.00088	U	0.00091	U	0.00088	U
Perfluorohexanoic acid (PFHxA)	QSM B15	307-24-4	µg/L	0.00088	U	0.00091	U	0.00088	U
Perfluorononanoic acid (PFNA)	QSM B15	375-95-1	µg/L	0.00088	U	0.00091	U	0.00088	U
Perfluorooctanesulfonic acid (PFOS)	QSM B15	1763-23-1	µg/L	0.00088	U	0.00091	U	0.00088	U
Perfluorooctanoic acid (PFOA)	QSM B15	335-67-1	µg/L	0.00088	U	0.00091	U	0.00088	U
Perfluorotetradecanoic acid (PFTA)	QSM B15	376-06-7	µg/L	0.00088	U	0.00091	U	0.00088	U
Perfluorotridecanoic acid (PFTrDA)	QSM B15	72629-94-8	µg/L	0.00088	U	0.00091	U	0.00088	U
Perfluoroundecanoic acid (PFUnA)	QSM B15	2058-94-8	µg/L	0.00088	U	0.00091	U	0.00088	U
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonicacid (11Cl-PF3OUdS)	QSM B15	763051-92-9	µg/L	0.00088	UJ	0.00091	U	0.00088	U
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)	QSM B15	756426-58-1	µg/L	0.00088	U	0.00091	U	0.00088	U
4,8-dioxa-3H-perfluorononanoic acid (DONA)	QSM B15	919005-14-4	µg/L	0.00088	U	0.00091	U	0.00088	U

Notes:

µg/L = microgram(s) per liter

CASRN = Chemical Abstracts Service Registry No.

Q = qualifier

Data Qualifiers:

U = The analyte is not detected; the associated numerical value is the limit of detection or as qualified during data validation.

UJ = The analyte is not detected; the associated numerical value is approximate.

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Attachment B-1

Data Validation Reports

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LABORATORY DATA CONSULTANTS, INC.
2701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Bus: 760-827-1100 Fax: 760-827-1099

EA Engineering, Science, & Technology, Inc.
2200 Sixth Ave., Suite 707
Seattle, WA 98121
ATTN: Ms. Sherri Wunderlich
swunderlich@eaest.com

March 14, 2022

SUBJECT: Keyport LTM - Data Validation

Dear Ms. Wunderlich,

Enclosed is the final validation report for the fraction listed below. This SDG was received on January 11, 2022. Attachment 1 is a summary of the samples that were reviewed for the analysis.

LDC Project #53144_RV2:

SDG #	Fraction
410-66173-1 410-66189-1 410-66194-1 410-66202-1	Perfluoroalkyl & Polyfluoroalkyl Substances

The data validation was performed under Stage 2B & 4 validation guidelines. The analysis was validated using the following documents and variances, as applicable to the method:

- Final Tier I Sampling and Analysis Plan, Groundwater Sampling at Operable Unit 1, Area 1 Former Landfill and Long-Term Monitoring at Operable Unit 2, Area 2 Van Meter Road Spill/Drum Storage Site, Naval Base Kitsap Keyport, Keyport, Washington (October 2021)
- NAVFAC Northwest Standard Operating Procedure: Field Procedures Manual (Naval Facilities Engineering Command Northwest, 2015)
- U.S. Department of Defense (DoD) General Validation Guidelines (November 2019)
- DoD Data Validation Guidelines Module 3: Data Validation Procedure for Per- and Polyfluoroalkyl Substances Analysis by Quality Systems Manual for Environmental Laboratories (QSM) Table B-15 (2020)

Please feel free to contact us if you have any questions.

Sincerely,

Pei Geng
Project Manager/Senior Chemist
pgeng@lab-data.com

90/10 2B/4 EDD	LDC# 53144 (EA Engineering - Seattle, WA / Keyport LTM)																																				
																																					PO# 23092	
LDC	SDG#	DATE REC'D	(2) DATE DUE	PFAs (537M/ QSM5.3)																																	
Matrix: Water/Soil				W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S
A	410-66173-1	01/11/22	01/25/22	19	0																																
B	410-66189-1	01/11/22	01/25/22	22	0																																
C	410-66194-1	01/11/22	01/25/22	26	0																																
D	410-66202-1	01/11/22	01/25/22	20	0																																
D	410-66202-1	01/11/22	01/25/22	14	0																																
Total	T/PG			101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	101

Shaded cells indicate Stage 4 validation (all other cells are Stage 2B validation). Sample counts do not include MS, MSD, and DUP's.

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Keyport LTM

LDC Report Date: March 11, 2022

Parameters: Perfluoroalkyl & Polyfluoroalkyl Substances

Validation Level: Stage 2B

Laboratory: Eurofins, Lancaster, PA

Sample Delivery Group (SDG): 410-66173-1

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
GM-21-059	410-66173-1	Water	12/08/21
GM-21-059RE	410-66173-1RE	Water	12/08/21
FB-120821	410-66173-2	Water	12/08/21
GM-21-004	410-66173-3	Water	12/08/21
GM-21-004RE	410-66173-3RE	Water	12/08/21
GM-21-028	410-66173-4	Water	12/08/21
GM-21-019	410-66173-5	Water	12/08/21
GM-21-019RE	410-66173-5RE	Water	12/08/21
GM-21-013	410-66173-6	Water	12/08/21
GM-21-013RE	410-66173-6RE	Water	12/08/21
GM-21-029	410-66173-7	Water	12/08/21
GM-21-029RE	410-66173-7RE	Water	12/08/21
GM-21-027	410-66173-8	Water	12/08/21
GM-21-057	410-66173-9	Water	12/08/21
GM-21-057RE	410-66173-9RE	Water	12/08/21
GM-21-061	410-66173-10	Water	12/08/21
GM-21-061RE	410-66173-10RE	Water	12/08/21
GM-21-058	410-66173-11	Water	12/08/21
GM-21-058RE	410-66173-11RE	Water	12/08/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Tier I Sampling and Analysis Plan, Groundwater Sampling at Operable Unit 1, Area 1 Former Landfill and Long-Term Monitoring at Operable Unit 2, Area 2 Van Meter Road Spill/Drum Storage Site, Naval Base Kitsap Keyport, Keyport, Washington (October 2021), the NAVFAC Northwest Standard Operating Procedure: Field Procedures Manual (Naval Facilities Engineering Command Northwest, 2015), the U.S. Department of Defense (DoD) General Validation Guidelines (November 2019), and the DoD Data Validation Guidelines Module 3: Data Validation Procedure for Per- and Polyfluoroalkyl Substances Analysis by Quality Systems Manual for Environmental Laboratories (QSM) Table B-15 (2020). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) by Environmental Protection Agency (EPA) Method 537 Modified and LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DoD QSM 5.3

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

X (Exclusion of data recommended): The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Exclusion of the data is recommended.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Codes

H	Holding times were exceeded.
S	Surrogate recovery was outside QC limits.
C	Calibration %RSD or %D were noncompliant.
R	Calibration RRF was <0.05.
B	Presumed contamination from preparation (method) blank.
L	Laboratory Blank Spike/Blank Spike Duplicate %R was not within control limits.
Q	MS/MSD recovery was poor or RPD high.
I	Internal standard performance was unsatisfactory.
M	Tuning (BFB or DFTPP) was noncompliant.
T	Presumed contamination from trip blank.
+	False positive – reported compound was not present. Not applicable.
-	False negative – compound was present but not reported.
F	Presumed contamination from FB, or ER.
$	Reported result or other information was incorrect.
?	TIC identity or reported retention time has been changed.
D	The analysis with this flag should not be used because another more technically sound analysis is available.
P	Instrument performance for pesticides was poor.
*#	Unusual problems found with the data that have been described in Section 2.2.3.3, "Data Validation Findings." The number following the asterisk (*) will indicate the subsection where a description of the problem can be found.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. LC/MS Instrument Performance Check

Instrument performance was checked and the requirements were met.

III. Initial Calibration and Initial Calibration Verification

Initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all analytes.

For each calibration standard, all analytes were within 70-130% of their true value.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all analytes.

IV. Continuing Calibration and Instrument Sensitivity Check

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 30.0% for all analytes.

The percent differences (%D) of the instrument sensitivity check (ISC) were less than or equal to 30.0% for all analytes.

All analyte concentrations were at the limit of quantitation (LOQ) for the ISC standard.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Analyte	Concentration	Associated Samples
MB 410-205983/1-A	12/20/21	Perfluorooctanesulfonic acid	0.586 ng/L	GM-21-059 GM-21-004 GM-21-028 GM-21-019 GM-21-013 GM-21-029 GM-21-027 GM-21-057 GM-21-061 GM-21-058

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater (>5X) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration	Modified Final Concentration
GM-21-004	Perfluorooctanesulfonic acid	2.2 ng/L	2.2J ng/L
GM-21-057	Perfluorooctanesulfonic acid	2.5 ng/L	2.5J ng/L
GM-21-061	Perfluorooctanesulfonic acid	2.8 ng/L	2.8J ng/L
GM-21-058	Perfluorooctanesulfonic acid	1.9 ng/L	1.9J ng/L

VI. Field Blanks

Sample FB-120821 was identified as a field blank. No contaminants were found.

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target analytes were within QC limits with the following exceptions:

Sample	Labeled Compound	%R (Limits)	Affected Analyte	Flag	A or P
GM-21-059	13C2-PFDoDA d5-NEtFOSAA d3-NMeFOSAA 13C7 PFUnA 13C6 PFDA 13C8 PFOS 13C2 PFTeDA 13C8 PFOS	0.4 (50-150) 3 (50-150) 4 (50-150) 2 (50-150) 10 (50-150) 17 (50-150) 0.3 (50-150) 17 (50-150)	Perfluorododecanoic acid Perfluorotridecanoic acid NEtFOSAA NMeFOSAA Perfluoroundecanoic acid Perfluorodecanoic acid 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid Perfluorotetradecanoic acid Perfluorooctanesulfonic acid	X	P
GM-21-059	13C9 PFNA	41 (50-150)	Perfluorononanoic acid	UJ (all non-detects)	P
GM-21-059RE	13C2 PFTeDA	30 (50-150)	Perfluorotetradecanoic acid	UJ (all non-detects)	P
GM-21-004	13C2 PFTeDA	14 (50-150)	Perfluorotetradecanoic acid	X	P
GM-21-004	13C2-PFDoDA	37 (50-150)	Perfluorododecanoic acid Perfluorotridecanoic acid	UJ (all non-detects) UJ (all non-detects)	P
GM-21-004RE	13C2 PFTeDA	27 (50-150)	Perfluorotetradecanoic acid	UJ (all non-detects)	P
GM-21-019	13C2 PFTeDA	17 (50-150)	Perfluorotetradecanoic acid	X	P
GM-21-013	13C2-PFDoDA d3-NMeFOSAA 13C7 PFUnA	27 (50-150) 48 (50-150) 42 (50-150)	Perfluorododecanoic acid Perfluorotridecanoic acid NMeFOSAA Perfluoroundecanoic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P
GM-21-013	13C2 PFTeDA	7 (50-150)	Perfluorotetradecanoic acid	X	P
GM-21-013RE	13C2 PFTeDA	8 (50-150)	Perfluorotetradecanoic acid	X	P
GM-21-029	13C2 PFTeDA	12 (50-150)	Perfluorotetradecanoic acid	X	P
GM-21-029	13C2-PFDoDA	37 (50-150)	Perfluorododecanoic acid Perfluorotridecanoic acid	UJ (all non-detects) UJ (all non-detects)	P
GM-21-029RE	13C2 PFTeDA	7 (50-150)	Perfluorotetradecanoic acid	X	P
GM-21-029RE	13C2-PFDoDA	34 (50-150)	Perfluorododecanoic acid Perfluorotridecanoic acid	UJ (all non-detects) UJ (all non-detects)	P
GM-21-057	13C2 PFTeDA	13 (50-150)	Perfluorotetradecanoic acid	X	P

Sample	Labeled Compound	%R (Limits)	Affected Analyte	Flag	A or P
GM-21-057	13C2-PFDoDA 13C7 PFUnA	25 (50-150) 37 (50-150)	Perfluorododecanoic acid Perfluorotridecanoic acid Perfluoroundecanoic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P
GM-21-057RE	13C2 PFTeDA	13 (50-150)	Perfluorotetradecanoic acid	X	P
GM-21-057RE	13C2-PFDoDA 13C7 PFUnA	27 (50-150) 35 (50-150)	Perfluorododecanoic acid Perfluorotridecanoic acid Perfluoroundecanoic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P
GM-21-061	13C2 PFTeDA 13C2-PFDoDA	0.4 (50-150) 11 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid	X	P
GM-21-061	d5-NEtFOSAA d3-NMeFOSAA 13C7 PFUnA	36 (50-150) 38 (50-150) 30 (50-150)	NEtFOSAA NMeFOSAA Perfluoroundecanoic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P
GM-21-061RE	13C2 PFTeDA	10 (50-150)	Perfluorotetradecanoic acid	X	P
GM-21-061RE	13C2-PFDoDA	38 (50-150)	Perfluorododecanoic acid Perfluorotridecanoic acid	UJ (all non-detects) UJ (all non-detects)	P
GM-21-058	13C2 PFTeDA 13C2-PFDoDA	7 (50-150) 15 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid	X	P
GM-21-058	d5-NEtFOSAA d3-NMeFOSAA 13C7 PFUnA 13C6 PFDA	39 (50-150) 39 (50-150) 25 (50-150) 40 (50-150)	NEtFOSAA NMeFOSAA Perfluoroundecanoic acid Perfluorodecanoic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P
GM-21-058RE	13C2 PFTeDA 13C2-PFDoDA	22 (50-150) 48 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P

XI. Target Analyte Quantitation

The laboratory indicated that PFAs are currently being reported as the sum of the branched and linear isomers so both peaks were integrated.

Raw data were not reviewed for Stage 2B validation.

XII. Target Analyte Identification

All target analyte identifications were within validation criteria with the following exceptions:

Sample	Analyte	Flag	A or P
GM-21-058 GM-21-058RE	Results flagged "I" by the laboratory due to ion ratio outside QC limits.	J (all detects)	P

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

In the case where more than one result was reported for an individual sample, the least technically acceptable results were deemed not reportable as follows:

Sample	Analyte	Reason	Flag	A or P
GM-21-059 GM-21-004 GM-21-013 GM-21-029 GM-21-057 GM-21-061	All analytes	Results from re-analyses were more usable.	Not reportable	-
GM-21-019	Perfluorotetradecanoic acid	Results from re-analyses were more usable.	Not reportable	-
GM-21-019RE	All analytes except Perfluorotetradecanoic acid	Results from original analyses were more usable.	Not reportable	-
GM-21-058	All analytes except Perfluorohexanoic acid Perfluoroheptanoic acid Perfluorooctanoic acid Perfluorobutanesulfonic acid Perfluorohexanesulfonic acid Perfluorooctanesulfonic acid	Results from re-analyses were more usable.	Not reportable	-
GM-21-058RE	Perfluorohexanoic acid Perfluoroheptanoic acid Perfluorooctanoic acid Perfluorobutanesulfonic acid Perfluorohexanesulfonic acid Perfluorooctanesulfonic acid	Results from original analyses were more usable.	Not reportable	-

Due to labeled compound %R and ion ratio, data were qualified as estimated in thirteen samples.

Due to labeled compound %R, data were recommended for exclusion in four samples.

Due to laboratory blank contamination, data were qualified as estimated in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Keyport LTM
Perfluoroalkyl & Polyfluoroalkyl Substances - Data Qualification Summary - SDG 410-66173-1

Sample	Analyte	Flag	A or P	Reason (Code)
GM-21-059RE	Perfluorotetradecanoic acid	UJ (all non-detects)	P	Labeled compounds (%R) (I)
GM-21-004RE	Perfluorotetradecanoic acid	UJ (all non-detects)	P	Labeled compounds (%R) (I)
GM-21-013RE	Perfluorotetradecanoic acid	X	P	Labeled compounds (%R) (I)
GM-21-029RE	Perfluorotetradecanoic acid	X	P	Labeled compounds (%R) (I)
GM-21-029RE	Perfluorododecanoic acid Perfluorotridecanoic acid	UJ (all non-detects) UJ (all non-detects)	P	Labeled compounds (%R) (I)
GM-21-057RE	Perfluorotetradecanoic acid	X	P	Labeled compounds (%R) (I)
GM-21-057RE	Perfluorododecanoic acid Perfluorotridecanoic acid Perfluoroundecanoic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P	Labeled compounds (%R) (I)
GM-21-061RE	Perfluorotetradecanoic acid	X	P	Labeled compounds (%R) (I)
GM-21-061RE	Perfluorododecanoic acid Perfluorotridecanoic acid	UJ (all non-detects) UJ (all non-detects)	P	Labeled compounds (%R) (I)
GM-21-058RE	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P	Labeled compounds (%R) (I)
GM-21-058	Results flagged "I" by the laboratory due to ion ratio outside QC limits.	J (all detects)	P	Target analyte identification (ion ratio) (*XII)
GM-21-059 GM-21-004 GM-21-013 GM-21-029 GM-21-057 GM-21-061	All analytes	Not reportable	-	Overall assessment of data (*XIV)
GM-21-019	Perfluorotetradecanoic acid	Not reportable	-	Overall assessment of data (*XIV)
GM-21-019RE	All analytes except Perfluorotetradecanoic acid	Not reportable	-	Overall assessment of data (*XIV)

Sample	Analyte	Flag	A or P	Reason (Code)
GM-21-058	All analytes except Perfluorohexanoic acid Perfluoroheptanoic acid Perfluorooctanoic acid Perfluorobutanesulfonic acid Perfluorohexanesulfonic acid Perfluorooctanesulfonic acid	Not reportable	-	Overall assessment of data (*XIV)
GM-21-058RE	Perfluorohexanoic acid Perfluoroheptanoic acid Perfluorooctanoic acid Perfluorobutanesulfonic acid Perfluorohexanesulfonic acid Perfluorooctanesulfonic acid	Not reportable	-	Overall assessment of data (*XIV)

Keyport LTM
Perfluoroalkyl & Polyfluoroalkyl Substances - Laboratory Blank Data Qualification Summary - SDG 410-66173-1

Sample	Analyte	Modified Final Concentration	A or P	Code
GM-21-058	Perfluorooctanesulfonic acid	1.9J ng/L	A	B

Keyport LTM
Perfluoroalkyl & Polyfluoroalkyl Substances - Field Blank Data Qualification Summary - SDG 410-66173-1

No Sample Data Qualified in this SDG

LDC #: 53144A96 **VALIDATION COMPLETENESS WORKSHEET** Date: 1/31/22
SDG #: 410-66173-1 Stage 2B Page: 1 of 2
Laboratory: Eurofins, Lancaster, PA Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: GC Perfluoroalkyl & Polyfluoroalkyl Substances (EPA Method 537M/QSM 5.3 B-15)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II.	LC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	RSD ≤ 20 TV/IC ≤ 30
IV.	Continuing calibration/ISC	A/A	D ≤ 30
V.	Laboratory Blanks	SW	
V.I	Field blanks	ND	FB=>
VII.	Matrix spike/Matrix spike duplicates	N	
VIII.	Laboratory control samples	A	LCS/D
IX.	Field duplicates	N	
X.	Labeled Compounds	SW	
XI.	Target analyte quantitation	N	
XII.	Target analyte identification	SW	
XIII.	System performance	N	
XIV.	Overall assessment of data	SW	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1 1	GM-21-059	410-66173-1	Water	12/08/21
2 3	GM-21-059RE	410-66173-1RE	Water	12/08/21
3 3	FB-120821	410-66173-2	Water	12/08/21
4 1	GM-21-004	410-66173-3	Water	12/08/21
5 2	GM-21-004RE	410-66173-3RE	Water	12/08/21
6 1	GM-21-028	410-66173-4	Water	12/08/21
7 1	GM-21-019	410-66173-5	Water	12/08/21
8 2	GM-21-019RE	410-66173-5RE	Water	12/08/21
9 1	GM-21-013	410-66173-6	Water	12/08/21
10 2	GM-21-013RE	410-66173-6RE	Water	12/08/21
11 1	GM-21-029	410-66173-7	Water	12/08/21
12 2	GM-21-029RE	410-66173-7RE	Water	12/08/21
13 1	GM-21-027	410-66173-8	Water	12/08/21
14 1	GM-21-057	410-66173-9	Water	12/08/21
15 2	GM-21-057RE	410-66173-9RE	Water	12/08/21

LDC #: 53144A96 **VALIDATION COMPLETENESS WORKSHEET** Date: 1/31/22
SDG #: 410-66173-1 Stage 2B Page: 2 of 2
Laboratory: Eurofins, Lancaster, PA Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: GC Perfluoroalkyl & Polyfluoroalkyl Substances (EPA Method 537M/QSM 5.3 B-15)

	Client ID	Lab ID	Matrix	Date
16 [1]	GM-21-061	410-66173-10	Water	12/08/21
17 [2]	GM-21-061RE	410-66173-10RE	Water	12/08/21
18 [1]	GM-21-058	410-66173-11	Water	12/08/21
19 [2]	GM-21-058RE	410-66173-11RE	Water	12/08/21
20				
21				
22				

Notes:

1	205983						
2	207809						
3	208162						

TARGET COMPOUND WORKSHEET

METHOD: PFAS

A. Perfluorobutanoic acid	W. 6:2 Fluorotelomer sulfonate	
B. Perfluoropentanoic acid	X. 8:2 Fluorotelomer sulfonate	
C. Perfluorohexanoic acid	Y. 4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	
D. Perfluoroheptanoic acid	Z. HFPO-DA (GenX)	
E. Perfluorooctanoic acid	AA. 9Cl-PF3ONS (F-53B Major)	
F. Perfluorononanoic acid	BB. 11Cl-PF3OUdS (F-53B Minor)	
G. Perfluorodecanoic acid	CC. Hexafluoropropylene oxide dimer acid (HFPO-DA)	
H. Perfluoroundecanoic acid	DD. 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	
I. Perfluorododecanoic acid	EE. 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	
J. Perfluorotridecanoic acid	FF. 4:2 Fluorotelomersulfonic acid	
K. Perfluorotetradecanoic acid	GG. 6:2 Fluorotelomersulfonic acid	
L. Perfluorobutanesulfonic acid	HH. 8:2 Fluorotelomersulfonic acid	
M. Perfluoropentanesulfonic acid	II. 1H,1H,2H,2H-perfluorohexane sulfonic acid	
N. Perfluorohexanesulfonic acid	JJ. 1H,1H,2H,2H- Perfluorooctanesulfonic acid	
O. Perfluoroheptanesulfonic acid	KK. 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid	
P. Perfluorooctanesulfonic acid	LL. NMeFOSA	
Q. Perfluorononanesulfonic acid	MM. 3:3 Fluorotelomer carboxylate	
R. Perfluorodecanesulfonic acid	NN. 5:3 Fluorotelomer carboxylate	
S. Perfluorooctanesulfonamide	OO. 7:3 Fluorotelomer carboxylate	
T. NMeFOSAA	PP. Perfluorooctadecanoic acid	
U. NEtFOSAA		
V. 4:2 Fluorotelomer sulfonate		

LDC #: 53144A96

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: [illegible]

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DoD QSM 5.3

Blank extraction date: 12/30/21
Conc. units: ng/L **Associated Samples:** 1, 4, 6, 7, 9, 11, 13, 14, 16, 18 (B)

Analyte	Blank ID	Sample Identification								
MB 410-205983/1-A 5x		4	14	16	18					
P	0.586	2.93	2.2/J* n	2.5/J	2.8/J	1.9/J				

Blank extraction date:
Conc. units: **Associated Samples:**

Analyte	Blank ID	Sample Identification								

LDC #: 53144A6

VALIDATION FINDINGS WORKSHEET
Labeled Compounds

Reviewer: SC

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DOD QSM 5.3

Percent recoveries (%R) were within QC limits with the exceptions identified below.

#	Sample ID	Labeled Compound	%R (50-150)	Qualifications
	GM-21-059 (ND)	13C2-PFDoDA	0.4	X/P (I,J)
		13C9 PFNA	41	J/UJ/P (F)
		d5-NEtFOSAA	3	X/P (U)
		d3-NMeFOSAA	4	X/P (T)
		13C7 PFUnA	2	X/P (H)
		13C6 PFDA	10	X/P (G)
	(P-det)	13C8 PFOS	17	X/P (P,DD,EE)
	(ND)	13C2 PFTeDA	0.3	X/P (K)
	GM-21-059RE (ND)	13C2 PFTeDA	30	J/UJ/P (K)
	GM-21-004	13C2 PFTeDA	14	X/P (K)
		13C2-PFDoDA	37	J/UJ/P (I,J)
	GM-21-004RE	13C2 PFTeDA	27	J/UJ/P (K)
	GM-21-019	13C2 PFTeDA	17	X/P (K)
	GM-21-013	13C2-PFDoDA	27	J/UJ/P (I,J)
		d3-NMeFOSAA	48	J/UJ/P (T)
		13C7 PFUnA	42	J/UJ/P (H)
		13C2 PFTeDA	7	X/P (K)
	GM-21-013RE	13C2 PFTeDA	8	X/P (K)
	GM-21-029	13C2 PFTeDA	12	X/P (K)
		13C2-PFDoDA	37	J/UJ/P (I,J)
	GM-21-029RE	13C2 PFTeDA	7	X/P (K)
		13C2-PFDoDA	34	J/UJ/P (I,J)
	GM-21-057	13C2 PFTeDA	13	X/P (K)
		13C2-PFDoDA	25	J/UJ/P (I,J)
		13C7 PFUnA	37	J/UJ/P (H)

LDC #: 53144A96

VALIDATION FINDINGS WORKSHEET
Labeled Compounds

Reviewer: SC

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DOD QSM 5.3

Percent recoveries (%R) were within QC limits with the exceptions identified below.

#	Sample ID	Labeled Compound	%R (50-150)	Qualifications
	GM-21-057RE (ND)	13C2 PFTeDA	13	X/P (K)
		13C2-PFDoDA	27	J/UJ/P (I,J)
		13C7 PFUnA	35	J/UJ/P (H)
	GM-21-061	13C2 PFTeDA	0.4	X/P (K)
		13C2-PFDoDA	11	X/P (I,J)
		d5-NEtFOSAA	36	J/UJ/P (U)
		d3-NMeFOSAA	38	J/UJ/P (T)
		13C7 PFUnA	30	J/UJ/P (H)
	GM-21-061RE	13C2 PFTeDA	10	X/P (K)
		13C2-PFDoDA	38	J/UJ/P (I), J
	GM-21-058	13C2 PFTeDA	7	X/P (K)
		13C2-PFDoDA	15	X/P (I,J)
		d5-NEtFOSAA	39	J/UJ/P (U)
		d3-NMeFOSAA	39	J/UJ/P (T)
		13C7 PFUnA	25	J/UJ/P (H)
		13C6 PFDA	40	J/UJ/P (G)
	GM-21-058RE	13C2 PFTeDA	22	J/UJ/P (K)
	↓	13C2-PFDoDA	48	J/UJ/P (I,J)

LDC #: 53144A96

VALIDATION FINDINGS WORKSHEET
Target Analyte Identification

Reviewer: 9

METHOD: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DoD QSM 5.3

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Was the signal to noise (S/N) ratio for all analytes within the validation criteria?
Y (N) N/A Were two transitions and the ion transition ratio per analyte monitored and documented with the exception of PFBA and PFPeA?
Y (N) N/A Were ion ratios within QC limits?

#	Date	Sample ID	Analyte	Ion ratio (Limits)	Qualifications
		18, 19		Results flagged "I" by the laboratory due to	Jdets/P (* XII)
				ion ratio outside QC limits.	

LDC #: 914496

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

Reviewer: R

METHOD: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DoD QSM 5.3

#	Date	Sample ID	Analyte	Finding	Qualifications
		1, 4, 9, 11, 14, 16	All	Reextraction more usable (higher results)	NR
		7	K	~~RE more usable~~ Labeled %R < 20	
		8	All except K	Original more usable	
		18	All except C, D, E, L, N, P	~~Original~~ RE more usable (~~higher~~ several labeled %Rs out)	
		19	C, D, E, L, N, P	Orig more usable (higher results)	

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Keyport LTM

LDC Report Date: March 4, 2022

Parameters: Perfluoroalkyl & Polyfluoroalkyl Substances

Validation Level: Stage 2B

Laboratory: Eurofins, Lancaster, PA

Sample Delivery Group (SDG): 410-66189-1

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
GM-21-050	410-66189-1	Water	12/07/21
GM-21-050RE	410-66189-1RE	Water	12/07/21
GM-21-018	410-66189-2	Water	12/07/21
GM-21-046	410-66189-3	Water	12/07/21
GM-21-046RE	410-66189-3RE	Water	12/07/21
GM-21-011	410-66189-4	Water	12/07/21
GM-21-011RE	410-66189-4RE	Water	12/07/21
GM-21-012	410-66189-5	Water	12/07/21
GM-21-012RE	410-66189-5RE	Water	12/07/21
GM-21-051	410-66189-6	Water	12/07/21
GM-21-051RE	410-66189-6RE	Water	12/07/21
GM-21-048	410-66189-7	Water	12/07/21
GM-21-048RE	410-66189-7RE	Water	12/07/21
GM-21-045	410-66189-8	Water	12/07/21
GM-21-045RE	410-66189-8RE	Water	12/07/21
GM-21-005	410-66189-9	Water	12/07/21
FB-120721	410-66189-10	Water	12/07/21
GM-21-023	410-66189-11	Water	12/07/21
GM-21-062	410-66189-12	Water	12/07/21
GM-21-062RE	410-66189-12RE	Water	12/07/21
GM-21-049	410-66189-13	Water	12/07/21
GM-21-049RE	410-66189-13RE	Water	12/07/21
GM-21-023MS	410-66189-11MS	Water	12/07/21
GM-21-023MSD	410-66189-11MSD	Water	12/07/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Tier I Sampling and Analysis Plan, Groundwater Sampling at Operable Unit 1, Area 1 Former Landfill and Long-Term Monitoring at Operable Unit 2, Area 2 Van Meter Road Spill/Drum Storage Site, Naval Base Kitsap Keyport, Keyport, Washington (October 2021), the NAVFAC Northwest Standard Operating Procedure: Field Procedures Manual (Naval Facilities Engineering Command Northwest, 2015), the U.S. Department of Defense (DoD) General Validation Guidelines (November 2019), and the DoD Data Validation Guidelines Module 3: Data Validation Procedure for Per- and Polyfluoroalkyl Substances Analysis by Quality Systems Manual for Environmental Laboratories (QSM) Table B-15 (2020). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) by Environmental Protection Agency (EPA) Method 537 Modified and LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DoD QSM 5.3

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

X (Exclusion of data recommended): The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Exclusion of the data is recommended.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Codes

H	Holding times were exceeded.
S	Surrogate recovery was outside QC limits.
C	Calibration %RSD or %D were noncompliant.
R	Calibration RRF was <0.05.
B	Presumed contamination from preparation (method) blank.
L	Laboratory Blank Spike/Blank Spike Duplicate %R was not within control limits.
Q	MS/MSD recovery was poor or RPD high.
I	Internal standard performance was unsatisfactory.
M	Tuning (BFB or DFTPP) was noncompliant.
T	Presumed contamination from trip blank.
+	False positive – reported compound was not present. Not applicable.
-	False negative – compound was present but not reported.
F	Presumed contamination from FB, or ER.
$	Reported result or other information was incorrect.
?	TIC identity or reported retention time has been changed.
D	The analysis with this flag should not be used because another more technically sound analysis is available.
P	Instrument performance for pesticides was poor.
*#	Unusual problems found with the data that have been described in Section 2.2.3.3, "Data Validation Findings." The number following the asterisk (*) will indicate the subsection where a description of the problem can be found.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. LC/MS Instrument Performance Check

Instrument performance was checked and the requirements were met.

III. Initial Calibration and Initial Calibration Verification

Initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all analytes.

For each calibration standard, all analytes were within 70-130% of their true value.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all analytes.

IV. Continuing Calibration and Instrument Sensitivity Check

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 30.0% for all analytes.

The percent differences (%D) of the instrument sensitivity check (ISC) were less than or equal to 30.0% for all analytes.

All analyte concentrations were at the limit of quantitation (LOQ) for the ISC standard.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

Sample FB-120721 was identified as a field blank. No contaminants were found.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
GM-21-023MS/MSD (GM-21-023)	Perfluorotridecanoic acid 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	16 (65-144) 19 (70-130)	5 (65-144) 3 (70-130)	X (all non-detects) X (all non-detects)	A

Relative percent differences (RPD) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	RPD (Limits)	Flag	A or P
GM-21-023MS/MSD (GM-21-023)	Perfluorotridecanoic acid 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	109 (≤30) 149 (≤30)	NA	-

VIII. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Field Duplicates

Samples GM-21-011 and GM-21-012 and samples GM-21-011RE and GM-21-012RE were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (ng/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	GM-21-011-12072021	GM-21-012-12072021				
Perfluorooctanesulfonic acid	1.0	0.95	-	0.046 (≤1.8)	-	-

Analyte	Concentration (ng/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	GM-21-011-12072021RE	GM-21-012-12072021RE				
Perfluorooctanesulfonic acid	0.88	0.96	-	0.08 (≤1.9)	-	-
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	0.91U	0.54	-	0.37 (≤2.8)	-	-

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target analytes were within QC limits with the following exceptions:

Sample	Labeled Compound	%R (Limits)	Affected Analyte	Flag	A or P
GM-21-050	13C2 PFTeDA 13C2-PFDoDA 13C7 PFUnA	1 (50-150) 6 (50-150) 18 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid Perfluoroundecanoic acid	X	P
GM-21-050	d5-NEtFOSAA d3-NMeFOSAA 13C6 PFDA	33 (50-150) 39 (50-150) 48 (50-150)	NEtFOSAA NMeFOSAA Perfluorodecanoic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P
GM-21-050RE	13C2 PFTeDA 13C2-PFDoDA	1 (50-150) 14 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid	X	P
GM-21-050RE	d5-NEtFOSAA d3-NMeFOSAA 13C7 PFUnA	42 (50-150) 49 (50-150) 37 (50-150)	NEtFOSAA NMeFOSAA Perfluoroundecanoic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P
GM-21-046	13C2 PFTeDA 13C2-PFDoDA 13C9 PFNA d5-NEtFOSAA d3-NMeFOSAA 13C7 PFUnA 13C6 PFDA 13C8 PFOS	0.04 (50-150) 0.1 (50-150) 15 (50-150) 2 (50-150) 3 (50-150) 0.4 (50-150) 2 (50-150) 11 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid Perfluorononanoic acid NEtFOSAA NMeFOSAA Perfluoroundecanoic acid Perfluorodecanoic acid Perfluorooctanesulfonic acid 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	X	P
GM-21-046	13C8 PFOA	40 (50-150)	Perfluorooctanoic acid	UJ (all non-detects)	P
GM-21-046RE	13C2 PFTeDA 13C2-PFDoDA 13C7 PFUnA	0.1 (50-150) 2 (50-150) 11 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid Perfluoroundecanoic acid	X	P
GM-21-046RE	d5-NEtFOSAA d3-NMeFOSAA 13C6 PFDA	46 (50-150) 47 (50-150) 40 (50-150)	NEtFOSAA NMeFOSAA Perfluorodecanoic acid	J (all detects) UJ (all non-detects)	P
GM-21-011	13C2 PFTeDA 13C2-PFDoDA 13C7 PFUnA	0.04 (50-150) 2 (50-150) 9 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid Perfluoroundecanoic acid	X	P
GM-21-011	d5-NEtFOSAA d3-NMeFOSAA 13C6 PFDA	28 (50-150) 31 (50-150) 31 (50-150)	NEtFOSAA NMeFOSAA Perfluorodecanoic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P
GM-21-011RE	13C2 PFTeDA	26 (50-150)	Perfluorotetradecanoic acid	UJ (all non-detects)	P
GM-21-012	13C2 PFTeDA 13C2-PFDoDA	0.6 (50-150) 10 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid	X	P

Sample	Labeled Compound	%R (Limits)	Affected Analyte	Flag	A or P
GM-21-012	d5-NEtFOSAA d3-NMeFOSAA 13C7 PFUnA	47 (50-150) 48 (50-150) 27 (50-150)	NEtFOSAA NMeFOSAA Perfluoroundecanoic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P
GM-21-012RE	13C2 PFTeDA	7 (50-150)	Perfluorotetradecanoic acid	X	P
GM-21-012RE	13C2-PFDoDA	35 (50-150)	Perfluorododecanoic acid Perfluorotridecanoic acid	UJ (all non-detects) UJ (all non-detects)	P
GM-21-051	13C2 PFTeDA	2 (50-150)	Perfluorotetradecanoic acid	X	P
GM-21-051	13C2-PFDoDA 13C7 PFUnA	23 (50-150) 44 (50-150)	Perfluorododecanoic acid Perfluorotridecanoic acid Perfluoroundecanoic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P
GM-21-051RE	13C2 PFTeDA	6 (50-150)	Perfluorotetradecanoic acid	X	P
GM-21-051RE	13C2-PFDoDA d5-NEtFOSAA	35 (50-150) 47 (50-150)	Perfluorododecanoic acid Perfluorotridecanoic acid NEtFOSAA	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P
GM-21-048	13C2 PFTeDA 13C2-PFDoDA 13C7 PFUnA	0.1 (50-150) 2 (50-150) 8 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid Perfluoroundecanoic acid	X	P
GM-21-048	d5-NEtFOSAA d3-NMeFOSAA 13C6 PFDA	33 (50-150) 34 (50-150) 34 (50-150)	NEtFOSAA NMeFOSAA Perfluorodecanoic acid	J (all detects) UJ (all non-detects)	P
GM-21-048RE	13C2 PFTeDA	6 (50-150)	Perfluorotetradecanoic acid	X	P
GM-21-045	13C2 PFTeDA	10 (50-150)	Perfluorotetradecanoic acid	X	P
GM-21-045	13C2-PFDoDA	47 (50-150)	Perfluorododecanoic acid Perfluorotridecanoic acid	UJ (all non-detects) UJ (all non-detects)	P
GM-21-045RE	13C2 PFTeDA	28 (50-150)	Perfluorotetradecanoic acid	UJ (all non-detects)	P
GM-21-023	13C2 PFTeDA	6 (50-150)	Perfluorotetradecanoic acid	X	P
GM-21-023	13C2-PFDoDA 13C7 PFUnA	26 (50-150) 44 (50-150)	Perfluorododecanoic acid Perfluorotridecanoic acid Perfluoroundecanoic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P
GM-21-062	13C3 PFHxS 13C5 PFHxA 13C4 PFHpA 13C3 HFPO-DA	38 (50-150) 40 (50-150) 35 (50-150) 34 (50-150)	Perfluorohexanesulfonic acid Perfluorohexanoic acid Perfluoroheptanoic acid 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) Hexafluoropropylene oxide dimer acid (HFPO-DA)	J (all detects) J (all detects) J (all detects) J (all detects) J (all detects)	P

Sample	Labeled Compound	%R (Limits)	Affected Analyte	Flag	A or P
GM-21-062	13C2 PFTeDA 13C2-PFDoDA 13C9 PFNA d5-NEtFOSAA d3-NMeFOSAA 13C7 PFUnA 13C6 PFDA 13C8 PFOS 13C8 PFOA	0.008 (50-150) 0.002 (50-150) 2 (50-150) 0.2 (50-150) 0.2 (50-150) 0.01 (50-150) 0.1 (50-150) 2 (50-150) 11 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid Perfluorononanoic acid NEtFOSAA NMeFOSAA Perfluoroundecanoic acid Perfluorodecanoic acid Perfluorooctanesulfonic acid 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid Perfluorooctanoic acid	X	P
GM-21-062RE	13C5 PFHxA 13C2 PFTeDA 13C3 HFPO-DA	44 (50-150) 30 (50-150) 38 (50-150)	Perfluorohexanoic acid Perfluorotetradecanoic acid Hexafluoropropylene oxide dimer acid (HFPO-DA)	J (all detects) UJ (all non-detects)	P
GM-21-049	13C2 PFTeDA	10 (50-150)	Perfluorotetradecanoic acid	X	P
GM-21-049	13C2-PFDoDA d5-NEtFOSAA d3-NMeFOSAA 13C7 PFUnA	36 (50-150) 45 (50-150) 45 (50-150) 39 (50-150)	Perfluorododecanoic acid Perfluorotridecanoic acid NEtFOSAA NMeFOSAA Perfluoroundecanoic acid	J (all detects) J (all detects) J (all detects) J (all detects) J (all detects)	P
GM-21-049RE	13C2 PFTeDA 13C3 HFPO-DA	46 (50-150) 42 (50-150)	Perfluorotetradecanoic acid Hexafluoropropylene oxide dimer acid (HFPO-DA)	J (all detects) UJ (all non-detects)	P

XI. Target Analyte Quantitation

The laboratory indicated that PFAs are currently being reported as the sum of the branched and linear isomers so both peaks were integrated.

Raw data were not reviewed for Stage 2B validation.

XII. Target Analyte Identification

All target analyte identifications were within validation criteria with the following exceptions:

Sample	Analyte	Flag	A or P
GM-21-046RE GM-21-045 GM-21-005 GM-21-062RE GM-21-049RE	Results flagged "I" by the laboratory due to ion ratio outside QC limits.	J (all detects)	P

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

In the case where more than one result was reported for an individual sample, the least technically acceptable results were deemed not reportable as follows:

Sample	Analyte	Reason	Flag	A or P
GM-21-050 GM-21-011 GM-21-012 GM-21-051	All analytes	Results from re-analyses were more usable.	Not reportable	-
GM-21-046 GM-21-045 GM-21-049	All analytes	Results from re-analyses were more usable.	Not reportable	-
GM-21-048	All analytes except Perfluorooctanoic acid Perfluorodecanoic acid Perfluorohexanesulfonic acid Perfluorooctanesulfonic acid	Results from re-analyses were more usable.	Not reportable	-
GM-21-048RE	Perfluorooctanoic acid Perfluorodecanoic acid Perfluorohexanesulfonic acid Perfluorooctanesulfonic acid	Results from original analyses were more usable.	Not reportable	-
GM-21-062	All analytes except Hexafluoropropylene oxide dimer acid (HFPO-DA)	Results from re-analyses were more usable.	Not reportable	-
GM-21-062RE	Hexafluoropropylene oxide dimer acid (HFPO-DA)	Results from original analyses were more usable.	Not reportable	-

Due to MS/MSD %R and labeled compound %R and ion ratio, data were qualified as estimated in eighteen samples.

Due to labeled compound %R, data were recommended for exclusion in six samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Sample	Analyte	Flag	A or P	Reason (Code)
GM-21-062	Hexafluoropropylene oxide dimer acid (HFPO-DA)	J (all detects)	P	Labeled compounds (%R) (I)
GM-21-062RE	Perfluorohexanoic acid	J (all detects)	P	Labeled compounds (%R) (I)
GM-21-062RE	Perfluorotetradecanoic acid	UJ (all non-detects)	P	Labeled compounds (%R) (I)
GM-21-049RE	Perfluorotetradecanoic acid	UJ (all non-detects)	P	Labeled compounds (%R) (I)
GM-21-049RE	Hexafluoropropylene oxide dimer acid (HFPO-DA)	J (all detects)	P	Labeled compounds (%R) (I)
GM-21-046RE GM-21-045 GM-21-005 GM-21-062RE GM-21-049RE	Results flagged "I" by the laboratory due to ion ratio outside QC limits.	J (all detects)	P	Target analyte identification (ion ratio) (*XII)
GM-21-050 GM-21-011 GM-21-012 GM-21-051 GM-21-046 GM-21-045 GM-21-049	All analytes	Not reportable	-	Overall assessment of data (*XIV)
GM-21-048	All analytes except Perfluorooctanoic acid Perfluorodecanoic acid Perfluorohexanesulfonic acid Perfluorooctanesulfonic acid	Not reportable	-	Overall assessment of data (*XIV)
GM-21-048RE	Perfluorooctanoic acid Perfluorodecanoic acid Perfluorohexanesulfonic acid Perfluorooctanesulfonic acid	Not reportable	-	Overall assessment of data (*XIV)
GM-21-062	All analytes except Hexafluoropropylene oxide dimer acid (HFPO-DA)	Not reportable	-	Overall assessment of data (*XIV)
GM-21-062RE	Hexafluoropropylene oxide dimer acid (HFPO-DA)	Not reportable	-	Overall assessment of data (*XIV)

Keyport LTM
Perfluoroalkyl & Polyfluoroalkyl Substances - Laboratory Blank Data Qualification Summary - SDG 410-66189-1

No Sample Data Qualified in this SDG

Keyport LTM
Perfluoroalkyl & Polyfluoroalkyl Substances - Field Blank Data Qualification Summary - SDG 410-66189-1

No Sample Data Qualified in this SDG

LDC #: 53144B96
SDG #: 410-66189-1
Laboratory: Eurofins, Lancaster, PA

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 3/2/22
Page: 1 of 2
Reviewer: JL
2nd Reviewer: CL

METHOD: GC Perfluoroalkyl & Polyfluoroalkyl Substances (EPA Method 537M/QSM 5.3 B-15)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	LC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	RSD ≤ 20 TV/Q ≤ 30
IV.	Continuing calibration/ISC	A/A	D ≤ 30
V.	Laboratory Blanks	A	
V.I	Field blanks	ND	FB = 17
VII.	Matrix spike/Matrix spike duplicates	SW	
VIII.	Laboratory control samples	A	LCS/D
IX.	Field duplicates	SW	D = 6+8, 7+9
X.	Labeled Compounds	SW	
XI.	Target analyte quantitation	N	
XII.	Target analyte identification	SN	
XIII.	System performance	N	
XIV.	Overall assessment of data	SW	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	GM-21-050	410-66189-1	Water	12/07/21
2	GM-21-050RE	410-66189-1RE	Water	12/07/21
3	GM-21-018	410-66189-2	Water	12/07/21
4	GM-21-046	410-66189-3	Water	12/07/21
5	GM-21-046RE	410-66189-3RE	Water	12/07/21
6	GM-21-011	410-66189-4	Water	12/07/21
7	GM-21-011RE	410-66189-4RE	Water	12/07/21
8	GM-21-012	410-66189-5	Water	12/07/21
9	GM-21-012RE	410-66189-5RE	Water	12/07/21
10	GM-21-051	410-66189-6	Water	12/07/21
11	GM-21-051RE	410-66189-6RE	Water	12/07/21
12	GM-21-048	410-66189-7	Water	12/07/21
13	GM-21-048RE	410-66189-7RE	Water	12/07/21
14	GM-21-045	410-66189-8	Water	12/07/21
15	GM-21-045RE	410-66189-8RE	Water	12/07/21

LDC #: 53144B96 **VALIDATION COMPLETENESS WORKSHEET** Date: 2/3/22
SDG #: 410-66189-1 Stage 2B Page: 2 of 2
Laboratory: Eurofins, Lancaster, PA Reviewer: TO
2nd Reviewer:

METHOD: GC Perfluoroalkyl & Polyfluoroalkyl Substances (EPA Method 537M/QSM 5.3 B-15)

	Client ID	Lab ID	Matrix	Date
16 [1]	GM-21-005	410-66189-9	Water	12/07/21
17 [1]	FB-120721	410-66189-10	Water	12/07/21
18 [1]	GM-21-023	410-66189-11	Water	12/07/21
19 [1]	GM-21-062	410-66189-12	Water	12/07/21
20	GM-21-062RE	410-66189-12RE	Water	12/07/21
21 [1]	GM-21-049	410-66189-13	Water	12/07/21
22	GM-21-049RE	410-66189-13RE	Water	12/07/21
23	GM-21-023MS	410-66189-11MS	Water	12/07/21
24	GM-21-023MSD	410-66189-11MSD	Water	12/07/21
25				
26				
27				

Notes:

1	207022						
2	208135						
3	208162						

TARGET COMPOUND WORKSHEET

METHOD: PFAS

A. Perfluorobutanoic acid	W. 6:2 Fluorotelomer sulfonate	
B. Perfluoropentanoic acid	X. 8:2 Fluorotelomer sulfonate	
C. Perfluorohexanoic acid	Y. 4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	
D. Perfluoroheptanoic acid	Z. HFPO-DA (GenX)	
E. Perfluorooctanoic acid	AA. 9Cl-PF3ONS (F-53B Major)	
F. Perfluorononanoic acid	BB. 11Cl-PF3OUdS (F-53B Minor)	
G. Perfluorodecanoic acid	CC. Hexafluoropropylene oxide dimer acid (HFPO-DA)	
H. Perfluoroundecanoic acid	DD. 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	
I. Perfluorododecanoic acid	EE. 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	
J. Perfluorotridecanoic acid	FF. 4:2 Fluorotelomersulfonic acid	
K. Perfluorotetradecanoic acid	GG. 6:2 Fluorotelomersulfonic acid	
L. Perfluorobutanesulfonic acid	HH. 8:2 Fluorotelomersulfonic acid	
M. Perfluoropentanesulfonic acid	II. 1H,1H,2H,2H-perfluorohexane sulfonic acid	
N. Perfluorohexanesulfonic acid	JJ. 1H,1H,2H,2H- Perfluorooctanesulfonic acid	
O. Perfluoroheptanesulfonic acid	KK. 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid	
P. Perfluorooctanesulfonic acid	LL. NMeFOSA	
Q. Perfluorononanesulfonic acid	MM. 3:3 Fluorotelomer carboxylate	
R. Perfluorodecanesulfonic acid	NN. 5:3 Fluorotelomer carboxylate	
S. Perfluorooctanesulfonamide	OO. 7:3 Fluorotelomer carboxylate	
T. NMeFOSAA	PP. Perfluorooctadecanoic acid	
U. NEtFOSAA		
V. 4:2 Fluorotelomer sulfonate		

LDC #: 53144B96

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Reviewer: SC

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DoD QSM 5.3

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample.
Percent recoveries (%R) and %RPD were within QC limits with the exceptions identified below.

(Q)

#	MS/MSD ID	Analyte	MS %R (Limits)	MSD %R (Limits)	RPD (≤30)	Associated Samples	Qualifications
	23/24	J	16 (65-144)	5 (65-144)		18 (ND)	J/X/A
		EE	19 (70-130)	3 (70-130)			↓
		J			109		Jdets/A
		EE			149		↓

LDC #: 53144B96

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: SC

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DOD QSM 5.3

Analyte	Concentration (ng/L)		RPD≤30	Difference <5XLOQ	Difference Limit:<LOQ	Qualification
	GM-21-011-12072021	GM-21-012-12072021				
Perfluorooctanesulfonic acid	1.0	0.95		0.046	1.8	

Analyte	Concentration (ng/L)		RPD≤30	Difference <5XLOQ	Difference Limit:<LOQ	Qualification
	GM-21-011-12072021RE	GM-21-012-12072021RE				
Perfluorooctanesulfonic acid	0.88	0.96		0.08	1.9	
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	0.91U	0.54		0.37	2.8	

LDC #: 53144B9c

VALIDATION FINDINGS WORKSHEET
Labeled Compounds

Reviewer: SC

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DOD QSM 5.3

Percent recoveries (%R) were within QC limits with the exceptions identified below.

#	Sample ID	Labeled Compound	%R (50-150)	Qualifications
	GM-21-050 (ND)	13C2 PFTeDA	1	X/P (K)
		13C2-PFDoDA	6	X/P (I,J)
		d5-NEtFOSAA	33	J/UJ/P (U)
		d3-NMeFOSAA	39	J/UJ/P (T)
		13C7 PFUnA	18	X/P (H)
		13C6 PFDA	48	J/UJ/P (G)
	GM-21-050RE (ND)	13C2 PFTeDA	1	X/P (K)
		13C2-PFDoDA	14	X/P (I,J)
		d5-NEtFOSAA	42	J/UJ/P (U)
		d3-NMeFOSAA	49	J/UJ/P (T)
		13C7 PFUnA	37	J/UJ/P (H)
	GM-21-046 (ND)	13C2 PFTeDA	0.04	X/P (K)
		13C2-PFDoDA	0.1	X/P (I,J)
		13C9 PFNA	15	X/P (F)
		d5-NEtFOSAA	2	X/P (U)
		d3-NMeFOSAA	3	X/P (T)
		13C7 PFUnA	0.4	X/P (H)
		13C6 PFDA	2	X/P (G)
	(P-det)	13C8 PFOS	11	X/P (P,DD,EE)
	(ND)	13C8 PFOA	40	~~X/P (E)~~ J/UJ/P (E)
	GM-21-046RE (ND)	13C2 PFTeDA	0.1	X/P (K)
		13C2-PFDoDA	2	X/P (I,J)
		d5-NEtFOSAA	46	J/UJ/P (U)
		d3-NMeFOSAA	47	J/UJ/P (T)
		13C7 PFUnA	11	X/P (H)
	(det)	13C6 PFDA	40	J/UJ/P (G)
	GM-21-011 (ND)	13C2 PFTeDA	0.04	X/P (K)
		13C2-PFDoDA	2	X/P (I,J)
		d5-NEtFOSAA	28	J/UJ/P (U)
		d3-NMeFOSAA	31	J/UJ/P (T)

VALIDATION FINDINGS WORKSHEET
Labeled Compounds

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DOD QSM 5.3

Percent recoveries (%R) were within QC limits with the exceptions identified below.

#	Sample ID	Labeled Compound	%R (50-150)	Qualifications
	GM-21-011 (cont'd) (ND)	13C7 PFUnA	9	X/P (H)
		13C6 PFDA	31	J/UJ/P (G)
	GM-21-011RE	13C2 PFTeDA	26	J/UJ/P (K)
	GM-21-012	13C2 PFTeDA	0.6	X/P (K)
		13C2-PFDoDA	10	X/P (I,J)
		d5-NEtFOSAA	47	J/UJ/P (U)
		d3-NMeFOSAA	48	J/UJ/P (T)
		13C7 PFUnA	27	J/UJ/P (H)
	GM-21-012RE	13C2 PFTeDA	7	X/P (K)
		13C2-PFDoDA	35	J/UJ/P (I,J)
	GM-21-051	13C2 PFTeDA	2	X/P (K)
		13C2-PFDoDA	23	J/UJ/P (I,J)
		13C7 PFUnA	44	J/UJ/P (H)
	GM-21-051RE	13C2 PFTeDA	6	X/P (K)
		13C2-PFDoDA	35	J/UJ/P (I,J)
		d5-NEtFOSAA	47	J/UJ/P (U)
	GM-21-048	13C2 PFTeDA	0.1	X/P (K)
		13C2-PFDoDA	2	X/P (I,J)
		d5-NEtFOSAA	33	J/UJ/P (U)
		d3-NMeFOSAA	34	J/UJ/P (T)
		13C7 PFUnA	8	X/P (H)
	(det)	13C6 PFDA	34	J/UJ/P (G)
	GM-21-048RE (ND)	13C2 PFTeDA	6	X/P (K)
	GM-21-045	13C2 PFTeDA	10	X/P (K)
		13C2-PFDoDA	47	J/UJ/P (I,J)

VALIDATION FINDINGS WORKSHEET
Labeled Compounds

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DOD QSM 5.3

Percent recoveries (%R) were within QC limits with the exceptions identified below.

#	Sample ID	Labeled Compound	%R (50-150)	Qualifications
	GM-21-045RE (ND)	13C2 PFTeDA	28	J/UJ/P (K)
	GM-21-023	13C2 PFTeDA	6	X/P (K)
		13C2-PFDoDA	26	J/UJ/P (I,J)
		13C7 PFUnA	44	J/UJ/P (H)
	GM-21-062 (all)	13C3 PFHxS	38	J/UJ/P (N)
		13C5 PFHxA	40	J/UJ/P (C)
		13C4 PFHpA	35	J/UJ/P (D, DONA)
	(ND)	13C2 PFTeDA	0.008	X/P (K)
	(all)	13C3 HFPO-DA	34	J/UJ/P (HFPO-DA)
	(ND)	13C2-PFDoDA	0.002	X/P (I,J)
		13C9 PFNA	2	X/P (F)
		d5-NEtFOSAA	0.2	X/P (U)
		d3-NMeFOSAA	0.2	X/P (T)
		13C7 PFUnA	0.01	X/P (H)
		13C6 PFDA	0.1	X/P (G)
		13C8 PFOS	2	X/P (P,DD,EE)
	(all)	13C8 PFOA	11	X.P (E)
	GM-21-062RE	13C5 PFHxA	44	J/UJ/P (C)
	(ND)	13C2 PFTeDA	30	J/UJ/P (K)
		13C3 HFPO-DA	38	J/UJ/P (HFPO-DA)
	GM-21-049	13C2 PFTeDA	10	X/P (K)
		13C2-PFDoDA	36	J/UJ/P (I,J)
		d5-NEtFOSAA	45	J/UJ/P (U)
		d3-NMeFOSAA	45	J/UJ/P (T)
		13C7 PFUnA	39	J/UJ/P (H)
	GM-21-049RE	13C2 PFTeDA	46	J/UJ/P (K)
	(all)	13C3 HFPO-DA	42	J/UJ/P (HFPO-DA)

LDC #: 53144B96

VALIDATION FINDINGS WORKSHEET
Target Analyte Identification

Reviewer: AT

METHOD: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DoD QSM 5.1

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was the signal to noise (S/N) ratio for all analytes within the validation criteria?

Y N N/A Were two transitions and the ion transition ratio per analyte monitored and documented with the exception of PFBA and PFPeA?

Y N N/A Were ion ratios within QC limits?

#	Date	Sample ID	Analyte	Ion ratio (Limits)	Qualifications
		5, 14, 16, 20, 22		Results flagged "I" by the laboratory due to ion ratio outside QC limits.	Jdets/P (*X1)

LDC #: 53144B96

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

Reviewer: AC

METHOD: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DoD QSM 5.3

#	Date	Sample ID	Analyte	Finding	Qualifications
		1, 6, 8, 10, ~~11~~ 11	All	~~Reextraction~~ more usable (several labeled %Rs out in orig)	UB
		4, 14, 21	All	RE more usable (higher results)	
		12	All except E, G, N, P	RE more usable (several labeled %Rs out in orig)	
		13	E, G, N, P	~~RE~~ Orig more usable (higher results)	
		19	~~All~~ All except CC	RE more usable ~~(higher results)~~ (several labeled %Rs out in orig)	
		20	~~All except~~ CC	Orig more usable (higher results)	

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Keyport LTM

LDC Report Date: March 11, 2022

Parameters: Perfluoroalkyl & Polyfluoroalkyl Substances

Validation Level: Stage 2B

Laboratory: Eurofins, Lancaster, PA

Sample Delivery Group (SDG): 410-66194-1

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
GM-21-055	410-66194-1	Water	12/07/21
GM-21-055RE	410-66194-1RE	Water	12/07/21
GM-21-036	410-66194-2	Water	12/07/21
GM-21-036RE	410-66194-2RE	Water	12/07/21
GM-21-035	410-66194-3	Water	12/07/21
GM-21-056	410-66194-4	Water	12/07/21
GM-21-030	410-66194-5	Water	12/07/21
GM-21-030RE	410-66194-5RE	Water	12/07/21
GM-21-001	410-66194-6	Water	12/07/21
GM-21-064	410-66194-7	Water	12/07/21
GM-21-064RE	410-66194-7RE	Water	12/07/21
GM-21-034	410-66194-8	Water	12/07/21
GM-21-034RE	410-66194-8RE	Water	12/07/21
GM-21-063	410-66194-9	Water	12/07/21
GM-21-063RE	410-66194-9RE	Water	12/07/21
GM-21-026	410-66194-10	Water	12/07/21
GM-21-026RE	410-66194-10RE	Water	12/07/21
GM-21-039	410-66194-11	Water	12/07/21
GM-21-039RE	410-66194-11RE	Water	12/07/21
GM-21-065	410-66194-12	Water	12/07/21
GM-21-065RE	410-66194-12RE	Water	12/07/21
GM-21-033	410-66194-13	Water	12/07/21
GM-21-033RE	410-66194-13RE	Water	12/07/21
GM-21-014	410-66194-14	Water	12/07/21
GM-21-014RE	410-66194-14RE	Water	12/07/21
GM-21-056REMS	410-66194-4REMS	Water	12/07/21

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
GM-21-056REMSD	410-66194-4REMSD	Water	12/07/21
GM-21-001REMS	410-66194-6REMS	Water	12/07/21
GM-21-001REMSD	410-66194-6REMSD	Water	12/07/21
GM-21-056RE	410-66194-4RE	Water	12/07/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Tier I Sampling and Analysis Plan, Groundwater Sampling at Operable Unit 1, Area 1 Former Landfill and Long-Term Monitoring at Operable Unit 2, Area 2 Van Meter Road Spill/Drum Storage Site, Naval Base Kitsap Keyport, Keyport, Washington (October 2021), the NAVFAC Northwest Standard Operating Procedure: Field Procedures Manual (Naval Facilities Engineering Command Northwest, 2015), the U.S. Department of Defense (DoD) General Validation Guidelines (November 2019), and the DoD Data Validation Guidelines Module 3: Data Validation Procedure for Per- and Polyfluoroalkyl Substances Analysis by Quality Systems Manual for Environmental Laboratories (QSM) Table B-15 (2020). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) by Environmental Protection Agency (EPA) Method 537 Modified and LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DoD QSM 5.3

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

X (Exclusion of data recommended): The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Exclusion of the data is recommended.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Codes

H	Holding times were exceeded.
S	Surrogate recovery was outside QC limits.
C	Calibration %RSD or %D were noncompliant.
R	Calibration RRF was <0.05.
B	Presumed contamination from preparation (method) blank.
L	Laboratory Blank Spike/Blank Spike Duplicate %R was not within control limits.
Q	MS/MSD recovery was poor or RPD high.
I	Internal standard performance was unsatisfactory.
M	Tuning (BFB or DFTPP) was noncompliant.
T	Presumed contamination from trip blank.
+	False positive – reported compound was not present. Not applicable.
-	False negative – compound was present but not reported.
F	Presumed contamination from FB, or ER.
$	Reported result or other information was incorrect.
?	TIC identity or reported retention time has been changed.
D	The analysis with this flag should not be used because another more technically sound analysis is available.
P	Instrument performance for pesticides was poor.
*#	Unusual problems found with the data that have been described in Section 2.2.3.3, "Data Validation Findings." The number following the asterisk (*) will indicate the subsection where a description of the problem can be found.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met with the following exceptions:

Sample	Analyte	Total Days From Sample Collection Until Extraction	Required Holding Time (in Days) From Sample Collection Until Extraction	Flag	A or P
GM-21-030RE GM-21-064RE GM-21-034RE GM-21-063RE GM-21-026RE GM-21-039RE GM-21-065RE GM-21-033RE GM-21-014RE	All analytes	16	14	J (all detects) UJ (all non-detects)	A

II. LC/MS Instrument Performance Check

Instrument performance was checked and the requirements were met.

III. Initial Calibration and Initial Calibration Verification

Initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all analytes.

For each calibration standard, all analytes were within 70-130% of their true value.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all analytes.

IV. Continuing Calibration and Instrument Sensitivity Check

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 30.0% for all analytes.

The percent differences (%D) of the instrument sensitivity check (ISC) were less than or equal to 30.0% for all analytes.

All analyte concentrations were at the limit of quantitation (LOQ) for the ISC standard.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Analyte	Concentration	Associated Samples
MB 410-207510/1-A	12/20/21	Perfluorooctanesulfonic acid	0.657 ng/L	GM-21-001
MB 410-208962/1-A	12/23/21	Perfluorooctanesulfonic acid	0.555 ng/L	GM-21-030RE GM-21-064RE GM-21-034RE GM-21-063RE GM-21-026RE GM-21-039RE GM-21-065RE GM-21-033RE GM-21-014RE

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater (>5X) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration	Modified Final Concentration
GM-21-034RE	Perfluorooctanesulfonic acid	2.6 ng/L	2.6J ng/L
GM-21-026RE	Perfluorooctanesulfonic acid	2.2 ng/L	2.2J ng/L
GM-21-065RE	Perfluorooctanesulfonic acid	2.5 ng/L	2.5J ng/L

VI. Field Blanks

Sample FB-120721 (from SDG 410-66189-1) was identified as a field blank. No contaminants were found.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
GM-21-056REMS/MSD (GM-21-056 GM-21-056RE)	Perfluorotridecanoic acid 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	30 (65-144) 50 (70-130)	- -	UJ (all non-detects) UJ (all non-detects)	A
GM-21-056REMS/MSD (GM-21-056 GM-21-056RE)	Hexafluoropropylene oxide dimer acid (HFPO-DA)	151 (70-130)	152 (70-130)	NA	-

Relative percent differences (RPD) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	RPD (Limits)	Flag	A or P
GM-21-056REMS/MSD (GM-21-056 GM-21-056RE)	Perfluorotridecanoic acid	106 (≤30)	NA	-

VIII. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Field Duplicates

Samples GM-21-034 and GM-21-033, GM-21-034RE and GM-21-033RE, GM-21-064 and GM-21-063, and GM-21-064RE and GM-21-063RE were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (ng/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	GM-21-033-12072021	GM-21-034-12072021				
Perfluorobutanesulfonic acid	1.1	1.2	-	0.1 (≤1.9)	-	-
Perfluoroheptanoic acid	0.68	0.60	-	0.08 (≤1.9)	-	-
Perfluorooctanoic acid	1.9	1.8	-	0.1 (≤1.9)	-	-
Perfluorohexanoic acid	1.1	1.1	-	0.0 (≤1.9)	-	-
Perfluorohexanesulfonic acid	2.6	3.0	14 (≤30)	-	-	-
Perfluorooctanesulfonic acid	0.65	1.3	-	0.65 (≤1.9)	-	-

Analyte	Concentration (ng/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	GM-21-033-12072021RE	GM-21-034-12072021RE				
Perfluorobutanesulfonic acid	1.5	1.5	-	0 (≤2.0)	-	-
Perfluoroheptanoic acid	0.78	0.70	-	0.08 (≤2.0)	-	-
Perfluorooctanoic acid	2.6	2.7	4 (≤30)	-	-	-
Perfluorohexanoic acid	1.5	1.5	-	0 (≤2.0)	-	-
Perfluorohexanesulfonic acid	4.1	5.5	-	1.4 (≤2.0)	-	-
Perfluorooctanesulfonic acid	0.98U	2.6	-	1.62 (≤2.0)	-	-

Analyte	Concentration (ng/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	GM-21-063-12072021	GM-21-064-12072021				
Perfluorobutanesulfonic acid	0.77	0.71	-	0.1 (≤1.8)	-	-
Perfluoroheptanoic acid	2.1	2.4	13 (≤30)	-	-	-
NEtFOSAA	0.45	0.53	-	0.1 (≤2.7)	-	-
Perfluorooctanoic acid	13	12	8 (≤30)	-	-	-
Perfluorohexanoic acid	3.8	3.4	11 (≤30)	-	-	-
Perfluorohexanesulfonic acid	2.7	2.8	4 (≤30)	-	-	-
Perfluorooctanesulfonic acid	4.5	4.0	12 (≤30)	-	-	-
Perfluorononanoic acid	0.59	0.53	-	0.1 (≤1.8)	-	-

Analyte	Concentration (ng/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	GM-21-063-12072021RE	GM-21-064-12072021RE				
Perfluorobutanesulfonic acid	1.4	1.2	-	0.2 (≤1.8)	-	-
Perfluoroheptanoic acid	3.1	2.8	10 (≤30)	0.3 (≤1.8)	-	-
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	0.91U	1.7	-	0.79 (≤1.8)	-	-
Perfluorooctanoic acid	17	17	0 (≤30)	-	-	-

Analyte	Concentration (ng/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	GM-21-063-12072021RE	GM-21-064-12072021RE				
Perfluorohexanoic acid	5.3	5.4	2 (≤30)	-	-	-
Perfluorohexanesulfonic acid	3.8	4.1	8 (≤30)	-	-	-
Perfluorooctanesulfonic acid	5.8	6.2	7 (≤30)	-	-	-
Perfluorononanoic acid	0.95	0.85	-	0.1 (≤1.8)	-	-

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target analytes were within QC limits with the following exceptions:

Sample	Labeled Compound	%R (Limits)	Affected Analyte	Flag	A or P
GM-21-055	13C2 PFTeDA 13C2-PFDoDA d3-NMeFOSAA	4 (50-150) 16 (50-150) 18 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid NMeFOSAA	X	P
GM-21-055	13C9 PFNA d5-NEtFOSAA 13C7 PFUnA 13C6 PFDA	33 (50-150) 21 (50-150) 21 (50-150) 24 (50-150)	Perfluorononanoic acid NEtFOSAA Perfluoroundecanoic acid Perfluorodecanoic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P
GM-21-055	13C8 PFOS	30 (50-150)	Perfluorooctanesulfonic acid 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	J (all detects) UJ (all non-detects)	P
GM-21-055RE	13C2 PFTeDA 13C2-PFDoDA	0.9 (50-150) 14 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid	X	P
GM-21-055RE	d5-NEtFOSAA d3-NMeFOSAA 13C7 PFUnA	43 (50-150) 49 (50-150) 39 (50-150)	NEtFOSAA NMeFOSAA Perfluoroundecanoic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P
GM-21-036	13C2 PFTeDA 13C2-PFDoDA d5-NEtFOSAA d3-NMeFOSAA 13C7 PFUnA 13C6 PFDA 13C8 PFOS	0.05 (50-150) 2 (50-150) 7 (50-150) 8 (50-150) 5 (50-150) 10 (50-150) 18 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid NEtFOSAA NMeFOSAA Perfluoroundecanoic acid Perfluorodecanoic acid 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid Perfluorooctanesulfonic acid	X	P
GM-21-036	13C9 PFNA 13C8 PFOA	21 (50-150) 38 (50-150)	Perfluorononanoic acid Perfluorooctanoic acid	J (all detects) J (all detects)	P

Sample	Labeled Compound	%R (Limits)	Affected Analyte	Flag	A or P
GM-21-056	13C2 PFTeDA	49 (50-150)	Perfluorotetradecanoic acid	UJ (all non-detects)	P
GM-21-030	13C2 PFTeDA 13C2-PFDoDA d5-NEtFOSAA d3-NMeFOSAA 13C7 PFUnA 13C6 PFDA	0.03 (50-150) 0.06 (50-150) 10 (50-150) 14 (50-150) 0.9 (50-150) 8 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid NEtFOSAA NMeFOSAA Perfluoroundecanoic acid Perfluorodecanoic acid	X	P
GM-21-030	13C8 PFOS	43 (50-150)	Perfluorooctanesulfonic acid 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	J (all detects) UJ (all non-detects)	P
GM-21-030RE	13C2 PFTeDA	6 (50-150)	Perfluorotetradecanoic acid	X	P
GM-21-030RE	13C2-PFDoDA	44 (50-150)	Perfluorododecanoic acid Perfluorotridecanoic acid	UJ (all non-detects) UJ (all non-detects)	P
GM-21-064	13C2 PFTeDA 13C2-PFDoDA	2 (50-150) 18 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid	X	P
GM-21-064	13C7 PFUnA	35 (50-150)	Perfluoroundecanoic acid	UJ (all non-detects)	P
GM-21-064RE	13C2 PFTeDA 13C2-PFDoDA 13C7 PFUnA	0.5 (50-150) 5 (50-150) 11 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid Perfluoroundecanoic acid	X	P
GM-21-064RE	d5-NEtFOSAA d3-NMeFOSAA 13C6 PFDA	24 (50-150) 28 (50-150) 28 (50-150)	NEtFOSAA NMeFOSAA Perfluorodecanoic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P
GM-21-034	13C2 PFTeDA 13C2-PFDoDA d5-NEtFOSAA d3-NMeFOSAA 13C7 PFUnA 13C6 PFDA	0.01 (50-150) 0.3 (50-150) 7 (50-150) 9 (50-150) 1 (50-150) 6 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid NEtFOSAA NMeFOSAA Perfluorodecanoic acid Perfluorodecanoic acid	X	P
GM-21-034	13C9 PFNA	25 (50-150)	Perfluorononanoic acid	UJ (all non-detects)	P
GM-21-034	13C8 PFOS	21 (50-150)	Perfluorooctanesulfonic acid 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	J (all detects) UJ (all non-detects)	P
GM-21-034RE	13C2 PFTeDA	34 (50-150)	Perfluorotetradecanoic acid	UJ (all non-detects)	P
GM-21-063	13C2 PFTeDA 13C2-PFDoDA 13C7 PFUnA	0.07 (50-150) 3 (50-150) 12 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid Perfluoroundecanoic acid	X	P

Sample	Labeled Compound	%R (Limits)	Affected Analyte	Flag	A or P
GM-21-063	d5-NEtFOSAA d3-NMeFOSAA 13C6 PFDA	28 (50-150) 29 (50-150) 34 (50-150)	NEtFOSAA NMeFOSAA Perfluorodecanoic acid	J (all detects) UJ (all non-detects)	P
GM-21-063RE	13C2 PFTeDA	9 (50-150)	Perfluorotetradecanoic acid	X	P
GM-21-063RE	13C2-PFDoDA	43 (50-150)	Perfluorododecanoic acid Perfluorotridecanoic acid	UJ (all non-detects) UJ (all non-detects)	P
GM-21-026	13C2 PFTeDA	32 (50-150)	Perfluorotetradecanoic acid	UJ (all non-detects)	P
GM-21-026RE	13C2 PFTeDA	8 (50-150)	Perfluorotetradecanoic acid	X	P
GM-21-026RE	13C2-PFDoDA	40 (50-150)	Perfluorododecanoic acid Perfluorotridecanoic acid	UJ (all non-detects) UJ (all non-detects)	P
GM-21-039	13C3 PFHxS 13C5 PFHxA 13C9 PFNA d5-NEtFOSAA 13C8 PFOA	157 (50-150) 158 (50-150) 151 (50-150) 155 (50-150) 158 (50-150)	Perfluorohexanesulfonic acid Perfluorohexanoic acid Perfluorononanoic acid NEtFOSAA Perfluorooctanoic acid	NA	-
GM-21-039	13C3 PFBS	151 (50-150)	Perfluorobutanesulfonic acid	J (all detects)	A
GM-21-065	13C2 PFTeDA 13C2-PFDoDA d5-NEtFOSAA d3-NMeFOSAA 13C7 PFUnA 13C6 PFDA	0.02 (50-150) 0.03 (50-150) 6 (50-150) 9 (50-150) 0.5 (50-150) 6 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid NMeFOSAA NEtFOSAA Perfluoroundecanoic acid Perfluorodecanoic acid	X	P
GM-21-065	13C9 PFNA	33 (50-150)	Perfluorononanoic acid	UJ (all non-detects)	P
GM-21-065	13C8 PFOS	27 (50-150)	Perfluorooctanesulfonic acid 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	J (all detects) UJ (all non-detects)	P
GM-21-065RE	13C2 PFTeDA 13C2-PFDoDA 13C7 PFUnA	0.1 (50-150) 3 (50-150) 12 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid Perfluoroundecanoic acid	X	P
GM-21-065RE	d5-NEtFOSAA d3-NMeFOSAA 13C6 PFDA	36 (50-150) 37 (50-150) 36 (50-150)	NMeFOSAA NEtFOSAA Perfluorodecanoic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P

Sample	Labeled Compound	%R (Limits)	Affected Analyte	Flag	A or P
GM-21-033RE	13C2 PFTeDA 13C2-PFDoDA 13C9 PFNA d5-NEtFOSAA d3-NMeFOSAA 13C7 PFUnA 13C6 PFDA 13C8 PFOS	0.004 (50-150) 0.02 (50-150) 4 (50-150) 0.6 (50-150) 0.8 (50-150) 0.07 (50-150) 0.5 (50-150) 3 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid Perfluorononanoic acid NMeFOSAA NEtFOSAA Perfluoroundecanoic acid Perfluorodecanoic acid Perfluorooctanesulfonic acid 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	X	P
GM-21-033RE	13C8 PFOA	25 (50-150)	Perfluorooctanoic acid	J (all detects)	P
GM-21-014	13C2 PFTeDA 13C2-PFDoDA 13C7 PFUnA	0.4 (50-150) 7 (50-150) 19 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid Perfluoroundecanoic acid	X	P
GM-21-014	d5-NEtFOSAA d3-NMeFOSAA 13C6 PFDA	35 (50-150) 36 (50-150) 49 (50-150)	NMeFOSAA NEtFOSAA Perfluorodecanoic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P
GM-21-014RE	13C2 PFTeDA 13C2-PFDoDA 13C7 PFUnA	0.05 (50-150) 3 (50-150) 16 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid Perfluoroundecanoic acid	X	P
GM-21-014RE	13C3 HFPO-DA d5-NEtFOSAA d3-NMeFOSAA 13C6 PFDA	47 (50-150) 30 (50-150) 30 (50-150) 37 (50-150)	Hexafluoropropylene oxide dimer acid (HFPO-DA) NMeFOSAA NEtFOSAA Perfluorodecanoic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P
GM-21-014RE	13C8 PFOS	39 (50-150)	Perfluorooctanesulfonic acid 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	J (all detects) J (all detects) J (all detects)	P

XI. Target Analyte Quantitation

The laboratory indicated that PFAs are currently being reported as the sum of the branched and linear isomers so both peaks were integrated.

Raw data were not reviewed for Stage 2B validation.

XII. Target Analyte Identification

All target analyte identifications were within validation criteria with the following exceptions:

Sample	Analyte	Flag	A or P
GM-21-036 GM-21-036RE GM-21-034 GM-21-033 GM-21-014RE	Results flagged "I" by the laboratory due to ion ratio outside QC limits.	J (all detects)	P

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

In the case where more than one result was reported for an individual sample, the least technically acceptable results were deemed not reportable as follows:

Sample	Analyte	Reason	Flag	A or P
GM-21-055 GM-21-036 GM-21-030 GM-21-063 GM-21-039 GM-21-065	All analytes	Results from re-analyses were more usable.	Not reportable	-
GM-21-056	All analytes except Perfluorooctanoic acid Perfluorooctanesulfonic acid	Results from re-analyses were more usable.	Not reportable	-
GM-21-056RE	Perfluorooctanoic acid Perfluorooctanesulfonic acid	Results from original analyses were more usable.	Not reportable	-
GM-21-064	Perfluorohexanoic acid Perfluoroheptanoic acid Perfluorooctanoic acid Perfluorononanoic acid Perfluorobutanesulfonic acid Perfluorohexanesulfonic acid Perfluorooctanesulfonic acid Hexafluoropropylene oxide dimer acid (HFPO-DA)	Results from re-analyses were more usable.	Not reportable	-

Sample	Analyte	Reason	Flag	A or P
GM-21-064RE	All analytes except Perfluorohexanoic acid Perfluoroheptanoic acid Perfluorooctanoic acid Perfluorononanoic acid Perfluorobutanesulfonic acid Perfluorohexanesulfonic acid Perfluorooctanesulfonic acid Hexafluoropropylene oxide dimer acid (HFPO-DA)	Results from original analyses were more usable.	Not reportable	-
GM-21-026	All analytes except Perfluorotetradecanoic acid	Results from re-analyses were more usable.	Not reportable	-
GM-21-026RE	Perfluorotetradecanoic acid	Results from original analyses were more usable.	Not reportable	-
GM-21-033RE	All analytes	Results from original analyses were more usable.	Not reportable	-
GM-21-014	Perfluorohexanoic acid Perfluoroheptanoic acid Perfluorooctanoic acid Perfluorononanoic acid Perfluorobutanesulfonic acid Perfluorooctanesulfonic acid	Results from re-analyses were more usable.	Not reportable	-
GM-21-014RE	All analytes except Perfluorohexanoic acid Perfluoroheptanoic acid Perfluorooctanoic acid Perfluorononanoic acid Perfluorobutanesulfonic acid Perfluorooctanesulfonic acid	Results from original analyses were more usable.	Not reportable	-
GM-21-034	All analytes except 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	Results from re-analyses were more usable.	Not reportable	-
GM-21-034RE	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	Results from original analyses were more usable.	Not reportable	-

Due to technical holding time, MS/MSD %R, labeled compound %R, and ion ratio, data were qualified as estimated in twenty-four samples.

Due to labeled compound %R, data were recommended for exclusion in six samples.

Due to laboratory blank contamination, data were qualified as estimated in three samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Keyport LTM
Perfluoroalkyl & Polyfluoroalkyl Substances - Data Qualification Summary - SDG 410-66194-1

Sample	Analyte	Flag	A or P	Reason (Code)
GM-21-030RE GM-21-064RE GM-21-034RE GM-21-063RE GM-21-026RE GM-21-039RE GM-21-065RE GM-21-014RE	All analytes	J (all detects) UJ (all non-detects)	A	Technical holding times (H)
GM-21-055RE	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid	X	P	Labeled compounds (%R) (I)
GM-21-055RE	NEtFOSAA NMeFOSAA Perfluoroundecanoic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P	Labeled compounds (%R) (I)
GM-21-030RE	Perfluorotetradecanoic acid	X	P	Labeled compounds (%R) (I)
GM-21-030RE	Perfluorododecanoic acid Perfluorotridecanoic acid	UJ (all non-detects) UJ (all non-detects)	P	Labeled compounds (%R) (I)
GM-21-064	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid	X	P	Labeled compounds (%R) (I)
GM-21-064	Perfluoroundecanoic acid	UJ (all non-detects)	P	Labeled compounds (%R) (I)
GM-21-034	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	UJ (all non-detects)	P	Labeled compounds (%R) (I)
GM-21-063RE	Perfluorotetradecanoic acid	X	P	Labeled compounds (%R) (I)
GM-21-063RE	Perfluorododecanoic acid Perfluorotridecanoic acid	UJ (all non-detects) UJ (all non-detects)	P	Labeled compounds (%R) (I)
GM-21-026	Perfluorotetradecanoic acid	UJ (all non-detects)	P	Labeled compounds (%R) (I)
GM-21-026RE	Perfluorododecanoic acid Perfluorotridecanoic acid	UJ (all non-detects) UJ (all non-detects)	P	Labeled compounds (%R) (I)
GM-21-065RE	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid Perfluoroundecanoic acid	X	P	Labeled compounds (%R) (I)

Sample	Analyte	Flag	A or P	Reason (Code)
GM-21-065RE	NMeFOSAA NEtFOSAA Perfluorodecanoic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P	Labeled compounds (%R) (I)
GM-21-014	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid Perfluoroundecanoic acid	X	P	Labeled compounds (%R) (I)
GM-21-014	NMeFOSAA NEtFOSAA Perfluorodecanoic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P	Labeled compounds (%R) (I)
GM-21-036RE GM-21-034 GM-21-033 GM-21-014RE	Results flagged "I" by the laboratory due to ion ratio outside QC limits.	J (all detects)	P	Target analyte identification (ion ratio) (*XII)
GM-21-055 GM-21-036 GM-21-030 GM-21-063 GM-21-039 GM-21-065	All analytes	Not reportable	-	Overall assessment of data (*XIV)
GM-21-056	All analytes except Perfluorooctanoic acid Perfluorooctanesulfonic acid	Not reportable	-	Overall assessment of data (*XIV)
GM-21-056RE	Perfluorooctanoic acid Perfluorooctanesulfonic acid	Not reportable	-	Overall assessment of data (*XIV)
GM-21-064	Perfluorohexanoic acid Perfluoroheptanoic acid Perfluorooctanoic acid Perfluorononanoic acid Perfluorobutanesulfonic acid Perfluorohexanesulfonic acid Perfluorooctanesulfonic acid Hexafluoropropylene oxide dimer acid (HFPO-DA)	Not reportable	-	Overall assessment of data (*XIV)
GM-21-064RE	All analytes except Perfluorohexanoic acid Perfluoroheptanoic acid Perfluorooctanoic acid Perfluorononanoic acid Perfluorobutanesulfonic acid Perfluorohexanesulfonic acid Perfluorooctanesulfonic acid Hexafluoropropylene oxide dimer acid (HFPO-DA)	Not reportable	-	Overall assessment of data (*XIV)
GM-21-026	All analytes except Perfluorotetradecanoic acid	Not reportable	-	Overall assessment of data (*XIV)
GM-21-026RE	Perfluorotetradecanoic acid	Not reportable	-	Overall assessment of data (*XIV)

Sample	Analyte	Flag	A or P	Reason (Code)
GM-21-033RE	All analytes	Not reportable	-	Overall assessment of data (*XIV)
GM-21-014	Perfluorohexanoic acid Perfluoroheptanoic acid Perfluorooctanoic acid Perfluorononanoic acid Perfluorobutanesulfonic acid Perfluorooctanesulfonic acid	Not reportable	-	Overall assessment of data (*XIV)
GM-21-014RE	All analytes except Perfluorohexanoic acid Perfluoroheptanoic acid Perfluorooctanoic acid Perfluorononanoic acid Perfluorobutanesulfonic acid Perfluorooctanesulfonic acid	Not reportable	-	Overall assessment of data (*XIV)
GM-21-034	All analytes except 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	Not reportable	-	Overall assessment of data (*XIV)
GM-21-034RE	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	Not reportable	-	Overall assessment of data (*XIV)

Keyport LTM
Perfluoroalkyl & Polyfluoroalkyl Substances - Laboratory Blank Data Qualification Summary - SDG 410-66194-1

Sample	Analyte	Modified Final Concentration	A or P	Code
GM-21-034RE	Perfluorooctanesulfonic acid	2.6J ng/L	A	B
GM-21-026RE	Perfluorooctanesulfonic acid	2.2J ng/L	A	B
GM-21-065RE	Perfluorooctanesulfonic acid	2.5J ng/L	A	B

Keyport LTM
Perfluoroalkyl & Polyfluoroalkyl Substances - Field Blank Data Qualification Summary - SDG 410-66194-1

No Sample Data Qualified in this SDG

LDC #: 53144C96 **VALIDATION COMPLETENESS WORKSHEET** Date: 2/2/22
SDG #: 410-66194-1 Stage 2B Page: 1 of 2
Laboratory: Eurofins, Lancaster, PA Reviewer: A
2nd Reviewer: CF

METHOD: GC Perfluoroalkyl & Polyfluoroalkyl Substances (EPA Method 537M/QSM 5.3 B-15)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / SW	
II.	LC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	RSD≤20 TV/IV≤30
IV.	Continuing calibration/ISC	A/A	D≤30
V.	Laboratory Blanks	SW	
V.I	Field blanks	ND	FB-120721 (410-66189-1)
VII.	Matrix spike/Matrix spike duplicates	SW	
VIII.	Laboratory control samples	A	LCSD
IX.	Field duplicates	SW	D = 13+23, 14+24, 11+15, 12+16
X.	Labeled Compounds	SW	
XI.	Target analyte quantitation	N	
XII.	Target analyte identification	SN	
XIII.	System performance	N	
XIV.	Overall assessment of data	SW	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1 2	GM-21-055	410-66194-1	Water	12/07/21
2 6	GM-21-055RE	410-66194-1RE	Water	12/07/21
3 2	GM-21-036	410-66194-2	Water	12/07/21
4 6	GM-21-036RE	410-66194-2RE	Water	12/07/21
5 1	GM-21-035	410-66194-3	Water	12/07/21
6 ~~1~~	~~GM-21-035RE~~	~~410-66194-3RE~~	~~Water~~	~~12/07/21~~
7 4	GM-21-056	410-66194-4	Water	12/07/21
8 3	GM-21-030	410-66194-5	Water	12/07/21
9 7	GM-21-030RE	410-66194-5RE	Water	12/07/21
10 4	GM-21-001	410-66194-6	Water	12/07/21
11 3	GM-21-064	410-66194-7	Water	12/07/21
12 7	GM-21-064RE	410-66194-7RE	Water	12/07/21
13 3	GM-21-034	410-66194-8	Water	12/07/21
14 7	GM-21-034RE	410-66194-8RE	Water	12/07/21
15 3	GM-21-063	410-66194-9	Water	12/07/21

LDC #: 53144C96 **VALIDATION COMPLETENESS WORKSHEET** Date: 2/3/22
SDG #: 410-66194-1 Stage 2B Page: 2 of 2
Laboratory: Eurofins, Lancaster, PA Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: GC Perfluoroalkyl & Polyfluoroalkyl Substances (EPA Method 537M/QSM 5.3 B-15)

	Client ID	Lab ID	Matrix	Date
16 1	GM-21-063RE	410-66194-9RE	Water	12/07/21
17 3	GM-21-026	410-66194-10	Water	12/07/21
18 1	GM-21-026RE	410-66194-10RE	Water	12/07/21
19 3	GM-21-039	410-66194-11	Water	12/07/21
20 1	GM-21-039RE	410-66194-11RE	Water	12/07/21
21 3	GM-21-065	410-66194-12	Water	12/07/21
22 1	GM-21-065RE	410-66194-12RE	Water	12/07/21
23 3	GM-21-033	410-66194-13	Water	12/07/21
24 1	GM-21-033RE	410-66194-13RE	Water	12/07/21
25 3	GM-21-014	410-66194-14	Water	12/07/21
26 1	GM-21-014RE	410-66194-14RE	Water	12/07/21
5 27 4	GM-21-056MS RE	410-66194-4MS RE	Water	12/07/21
5 28 4	GM-21-056MSD RE	410-66194-4MSD RE	Water	12/07/21
8 29 4	GM-21-001MS RE	410-66194-6MS	Water	12/07/21
8 30 4	GM-21-001MSD RE	410-66194-6MSD	Water	12/07/21
31 4	~~GM-21-001RE~~	↓		
5 32 *	GM-21-056RE	↓ 4RE		
33				

Notes:

1	206955	5	208135				
2	207022	6	208162				
3	207407	7	208962				
4	207510						

TARGET COMPOUND WORKSHEET

METHOD: PFAS

A. Perfluorobutanoic acid	W. 6:2 Fluorotelomer sulfonate	
B. Perfluoropentanoic acid	X. 8:2 Fluorotelomer sulfonate	
C. Perfluorohexanoic acid	Y. 4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	
D. Perfluoroheptanoic acid	Z. HFPO-DA (GenX)	
E. Perfluorooctanoic acid	AA. 9Cl-PF3ONS (F-53B Major)	
F. Perfluorononanoic acid	BB. 11Cl-PF3OUdS (F-53B Minor)	
G. Perfluorodecanoic acid	CC. Hexafluoropropylene oxide dimer acid (HFPO-DA)	
H. Perfluoroundecanoic acid	DD. 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	
I. Perfluorododecanoic acid	EE. 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	
J. Perfluorotridecanoic acid	FF. 4:2 Fluorotelomersulfonic acid	
K. Perfluorotetradecanoic acid	GG. 6:2 Fluorotelomersulfonic acid	
L. Perfluorobutanesulfonic acid	HH. 8:2 Fluorotelomersulfonic acid	
M. Perfluoropentanesulfonic acid	II. 1H,1H,2H,2H-perfluorohexane sulfonic acid	
N. Perfluorohexanesulfonic acid	JJ. 1H,1H,2H,2H- Perfluorooctanesulfonic acid	
O. Perfluoroheptanesulfonic acid	KK. 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid	
P. Perfluorooctanesulfonic acid	LL. NMeFOSA	
Q. Perfluorononanesulfonic acid	MM. 3:3 Fluorotelomer carboxylate	
R. Perfluorodecanesulfonic acid	NN. 5:3 Fluorotelomer carboxylate	
S. Perfluorooctanesulfonamide	OO. 7:3 Fluorotelomer carboxylate	
T. NMeFOSAA	PP. Perfluorooctadecanoic acid	
U. NEtFOSAA		
V. 4:2 Fluorotelomer sulfonate		

LDC #: 53144C96

VALIDATION FINDINGS WORKSHEET
Technical Holding Times

Reviewer: JC

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DoD QSM 5.3

All circled dates have exceeded the technical holding times.
(Y) N N/A Were all cooler temperatures within validation criteria?

HT: 14

Sample ID	Matrix	Preserved	Sampling Date	Extraction date	Analysis date	Total # of Days	(H) Qualifier
9, 12, 14, 16, 18, 20, 22, 24, 26 (dup/MD)	W		12/7/21	12/23/21	12/28/21	16	J/UJ A

TECHNICAL HOLDING TIME CRITERIA

Water: Extracted within 14 days, analyzed within 28 days.
Soil: Extracted within 28 days, analyzed within 28 days.

LDC #: 53144C96

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: [illegible]

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DoD QSM 5.3

Blank extraction date: 12/20/21
Conc. units: ng/L **Associated Samples:** 10, 32R

Analyte	Blank ID	Sample Identification								
MB 410-207510/1-A		5X								
P	0.657	3.285								

Blank extraction date: 12/23/21
Conc. units: ng/L **Associated Samples:** 9, 12, 14, 16, 18, 20, 22, 24, 26 (B)

Analyte	Blank ID	Sample Identification								
MB 410-208962/1-A		5X	14	18	22					
P	0.555	2.775	2.6/J	2.2/J	2.5/J					

LDC #: 53144C96

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Reviewer: SC

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DoD QSM 5.3

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample.
Percent recoveries (%R) and %RPD were within QC limits with the exceptions identified below. (Q)

#	MS/MSD ID	Analyte	MS %R (Limits)	MSD %R (Limits)	RPD (≤30)	Associated Samples	Qualifications
	27/28	J	30 (65-144)			7,32 (ND)	J/UJ/A
		EE	50 (70-130)				↓
		dc	151 ↓	152 (70-130)			J/UJ/A
		J			106		↓

LDC #: 53144C96

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: SC

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DOD QSM 5.3

Analyte	Concentration (ng/L)		RPD≤30	Difference <5XLOQ	Difference Limit:<LOQ	Qualification
	GM-21-033-12072021	GM-21-034-12072021				
Perfluorobutanesulfonic acid	1.1	1.2		0.1	1.9	
Perfluoroheptanoic acid	0.68	0.60		0.08	1.9	
Perfluorooctanoic acid	1.9	1.8		0.1	1.9	
Perfluorohexanoic acid	1.1	1.1		0.0	1.9	
Perfluorohexanesulfonic acid	2.6	3.0	14			
Perfluorooctanesulfonic acid	0.65	1.3		0.65	1.9	

Analyte	Concentration (ng/L)		RPD≤30	Difference <5XLOQ	Difference Limit:<LOQ	Qualification
	GM-21-033-12072021RE	GM-21-034-12072021RE				
Perfluorobutanesulfonic acid	1.5	1.5		0	2.0	
Perfluoroheptanoic acid	0.78	0.70		0.08	2.0	
Perfluorooctanoic acid	2.6	2.7	4			
Perfluorohexanoic acid	1.5	1.5		0	2.0	
Perfluorohexanesulfonic acid	4.1	5.5		1.4	2.0	
Perfluorooctanesulfonic acid	0.98U	2.6		1.62	2.0	

LDC #: 53144C96

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: SC

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DOD QSM 5.3

Analyte	Concentration (ng/L)		RPD≤30	Difference <5XLOQ	Difference Limit:<LOQ	Qualification
	GM-21-063-12072021	GM-21-064-12072021				
Perfluorobutanesulfonic acid	0.77	0.71		0.1	1.8	
Perfluoroheptanoic acid	2.1	2.4	13			
NEtFOSAA	0.45	0.53		0.1	2.7	
Perfluorooctanoic acid	13	12	8			
Perfluorohexanoic acid	3.8	3.4	11			
Perfluorohexanesulfonic acid	2.7	2.8	4			
Perfluorooctanesulfonic acid	4.5	4.0	12			
Perfluorononanoic acid	0.59	0.53		0.1	1.8	

Analyte	Concentration (ng/L)		RPD≤30	Difference <5XLOQ	Difference Limit:<LOQ	Qualification
	GM-21-063-12072021RE	GM-21-064-12072021RE				
Perfluorobutanesulfonic acid	1.4	1.2		0.2	1.8	
Perfluoroheptanoic acid	3.1	2.8	10			
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	0.91U	1.7		0.79	1.8	
Perfluorooctanoic acid	17	17	0			
Perfluorohexanoic acid	5.3	5.4	2			
Perfluorohexanesulfonic acid	3.8	4.1	8			
Perfluorooctanesulfonic acid	5.8	6.2	7			
Perfluorononanoic acid	0.95	0.85		0.1	1.8	

LDC #: 53144C96

VALIDATION FINDINGS WORKSHEET
Labeled Compounds

Reviewer: SC

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DOD QSM 5.3

Percent recoveries (%R) were within QC limits with the exceptions identified below.

#	Sample ID	Labeled Compound	%R (50-150)	Qualifications
	GM-21-055 (ND)	13C2 PFTeDA	4	X/P (K)
		13C2-PFDoDA	16	X/P (I,J)
		13C9 PFNA	33	J/UJ/P (F)
		d5-NEtFOSAA	21	J/UJ/P (U)
		d3-NMeFOSAA	18	X/P (T)
		13C7 PFUnA	21	J/UJ/P (H)
		13C6 PFDA	24	J/UJ/P (G)
	(P- det)	13C8 PFOS	30	J/UJ/P (P,DD,EE)
	GM-21-055RE (ND)	13C2 PFTeDA	0.9	X/P (K)
		13C2-PFDoDA	14	X/P (I,J)
		d5-NEtFOSAA	43	J/UJ/P (U)
		d3-NMeFOSAA	49	J/UJ/P (T)
		13C7 PFUnA	39	J/UJ/P (H)
	GM-21-036	13C2 PFTeDA	0.05	X/P (K)
		13C2-PFDoDA	2	X/P (I,J)
	(det)	13C9 PFNA	21	J/UJ/P (F)
	(ND)	d5-NEtFOSAA	7	X/P (U)
		d3-NMeFOSAA	8	X/P (T)
		13C7 PFUnA	5	X/P (H)
	(det)	13C6 PFDA	10	X/P (G)
	(P-det)	13C8 PFOS	18	X/P (P,DD,EE)
	(det)	13C8 PFOA	38	J/UJ/P (E)
	GM-21-056 (ND)	13C2 PFTeDA	49	J/UJ/P (K)
	GM-21-030	13C2 PFTeDA	0.03	X/P (K)
		13C2-PFDoDA	0.06	X/P (I,J)
		d5-NEtFOSAA	10	X/P (U)
		d3-NMeFOSAA	14	X/P (T)
		13C7 PFUnA	0.9	X/P (H)
		13C6 PFDA	8	X/P (G)
	(P-det)	13C8 PFOS	43	J/UJ/P (P,DD,EE)

LDC #: 53144C9L

VALIDATION FINDINGS WORKSHEET
Labeled Compounds

Reviewer: SC

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DOD QSM 5.3

Percent recoveries (%R) were within QC limits with the exceptions identified below.

#	Sample ID	Labeled Compound	%R (50-150)	Qualifications
	GM-21-030RE (ND)	13C2 PFTeDA	6	X/P (K)
		13C2-PFDoDA	44	J/UJ/P (I,J)
	GM-21-064	13C2 PFTeDA	2	X/P (K)
		13C2-PFDoDA	18	X/P (I,J)
		13C7 PFUnA	35	J/UJ/P (H)
	GM-21-064RE	13C2 PFTeDA	0.5	X/P (K)
		13C2-PFDoDA	5	X/P (I,J)
		d5-NEtFOSAA	24	J/UJ/P (U)
		d3-NMeFOSAA	28	J/UJ/P (T)
		13C7 PFUnA	11	X/P (H)
		13C6 PFDA	28	J/UJ/P (G)
	GM-21-034	13C2 PFTeDA	0.01	X/P (K)
		13C2-PFDoDA	0.3	X/P (I,J)
		13C9 PFNA	25	J/UJ/P (F)
		d5-NEtFOSAA	7	X/P (U)
		d3-NMeFOSAA	9	X/P (T)
		13C7 PFUnA	1	X/P (H)
		13C6 PFDA	6	X/P (G)
	(P-det)	13C8 PFOS	21	J/UJ/P (P,DD,EE)
	GM-21-034RE (ND)	13C2 PFTeDA	34	J/UJ/ P (K)
	GM-21-063	13C2 PFTeDA	0.07	X/P (K)
		13C2-PFDoDA	3	X/P (I,J)
	(det)	d5-NEtFOSAA	28	J/UJ/P (U)
	(ND)	d3-NMeFOSAA	29	J/UJ/P (T)
		13C7 PFUnA	12	X/P (H)
		13C6 PFDA	34	J/UJ/P (G)
	GM-21-063RE	13C2 PFTeDA	9	X/P (K)
		13C2-PFDoDA	43	J/UJ/P (H)

VALIDATION FINDINGS WORKSHEET
Labeled Compounds

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DOD QSM 5.3

Percent recoveries (%R) were within QC limits with the exceptions identified below.

#	Sample ID	Labeled Compound	%R (50-150)	Qualifications
	GM-21-026 (ND)	13C2 PFTeDA	32	J/UJ/P (K)
	GM-21-026RE	13C2 PFTeDA	8	X/P (K)
		13C2-PFDoDA	40	J/UJ/P (I,J)
	GM-21-039 (ND)	13C3 PFHxS	157	Jdets/P (N)
	(det)	13C3 PFBS	151	Jdets/P (L)
	(ND)	13C5 PFHxA	158	Jdets/P (C)
		13C9 PFNA	151	Jdets/P (F)
		d5-NEtFOSAA	155	Jdets/P (U)
		13C8 PFOA	158	Jdets/P (E)
	GM-21-065	13C2 PFTeDA	0.02	X/P (K)
		13C2-PFDoDA	0.03	X/P (I,J)
		13C9 PFNA	33	J/UJ/P (F)
		d5-NEtFOSAA	6	X/P (T)
		d3-NMeFOSAA	9	X/P (U)
		13C7 PFUnA	0.5	X/P (H)
		13C6 PFDA	6	X/P (G)
	(P-det)	13C8 PFOS	27	J/UJ/P (P,DD,EE)
	GM-21-065RE (ND)	13C2 PFTeDA	0.1	X/P (K)
		13C2-PFDoDA	3	X/P (I,J)
		d5-NEtFOSAA	36	J/UJ/P (T)
		d3-NMeFOSAA	37	J/UJ/P (U)
		13C7 PFUnA	12	X/P (H)
		13C6 PFDA	36	J/UJ/P (G)
	GM-21-033RE (ND)	13C2 PFTeDA	0.004	X/P (K)
		13C2-PFDoDA	0.02	X/P (I,J)
		13C9 PFNA	4	X/P (F)
		d5-NEtFOSAA	0.6	X/P (T)
		d3-NMeFOSAA	0.8	X/P (U)
		13C7 PFUnA	0.07	X/P (H)

VALIDATION FINDINGS WORKSHEET
Labeled Compounds

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DOD QSM 5.3

Percent recoveries (%R) were within QC limits with the exceptions identified below.

#	Sample ID	Labeled Compound	%R (50-150)	Qualifications
	GM-21-033RE (ND)	13C6 PFDA	0.5	X/P (G)
		13C8 PFOS	3	X/P (P,DD,EE)
	(det)	13C8 PFOA	25	J/UJ/P (E)
	GM-21-014 (ND)	13C2 PFTeDA	0.4	X/P (K)
		13C2-PFDoDA	7	X/P (I,J)
		d5-NEtFOSAA	35	J/UJ/P (T)
		d3-NMeFOSAA	36	J/UJ/P (U)
		13C7 PFUnA	19	X/P (H)
		13C6 PFDA	49	J/UJ/P (G)
	GM-21-014RE	13C2 PFTeDA	0.05	X/P (K)
		13C3 HFPO-DA	47	J/UJ/P (CC)
		13C2-PFDoDA	3	X/P (I,J)
		d5-NEtFOSAA	30	J/UJ/P (T)
		d3-NMeFOSAA	30	J/UJ/P (U)
		13C7 PFUnA	16	~~J/UJ/P (H)~~ √/X/P (H)
		13C6 PFDA	37	J/UJ/P (G)
	(P-det)	13C8 PFOS	39	J/UJ/P (P,DD,EE)

LDC #: 53144C96

VALIDATION FINDINGS WORKSHEET
Target Analyte Identification

Page: 1 of 1
Reviewer: A

METHOD: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DoD QSM 5.1

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was the signal to noise (S/N) ratio for all analytes within the validation criteria?
Y N N/A Were two transitions and the ion transition ratio per analyte monitored and documented with the exception of PFBA and PFPeA?
Y N N/A Were ion ratios within QC limits?

#	Date	Sample ID	Analyte	Ion ratio (Limits)	Qualifications
		3,4,13,23,26		Results flagged "I" by the laboratory due to ion ratio outside QC limits.	Jdets/P (XI)

LDC #: 53144C96

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

Reviewer: M

METHOD: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DoD QSM 5.3

#	Date	Sample ID	Analyte	Finding	Qualifications
		~~23~~	~~C, D, E, L, N~~	~~RE more usable (higher results)~~	NR
		~~24~~	~~All except above~~	~~Orig more usable (several labeled %RS out in RE)~~	
		25	C, D, E, F, L, P	RE more usable (higher results)	
		26	All except above	Orig more usable (several labeled %RS out in RE)	
		24	~~All (X)~~	~~RE more usable~~	NR
		13	All except EE	RE more usable	
		14	EE		

LDC #: 53144C96

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

Reviewer: JC

METHOD: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DoD QSM 5.3

#	Date	Sample ID	Analyte	Finding	Qualifications
		1, 3, 8, ~~13~~, 15, 19, 21, ~~23~~	All	Reextraction more usable (higher results + several labeled %Rs out in orig)	NR
		7	All except E, P	RE more usable (higher results)	
		32	E, P	Orig more usable (higher results)	
		~~8~~	~~All~~	~~RE more usable (higher result)~~	
		11	~~All except~~ C, D, E, F, L, N, P, CC	RE more usable (higher results)	
		12	All except above	Orig more usable (several labeled %Rs out in RE)	
		17	All except K	RE more usable (higher)	
		18	K	Labeled %R <20	

LDC Report# 53144D96

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Keyport LTM

LDC Report Date: February 10, 2022

Parameters: Perfluoroalkyl & Polyfluoroalkyl Substances

Validation Level: Stage 2B & 4

Laboratory: Eurofins, Lancaster, PA

Sample Delivery Group (SDG): 410-66202-1

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
GM-21-042**	410-66202-1**	Water	12/06/21
GM-21-042RE**	410-66202-1RE**	Water	12/06/21
GM-21-037	410-66202-2	Water	12/06/21
GM-21-037RE	410-66202-2RE	Water	12/06/21
GM-21-007**	410-66202-3**	Water	12/06/21
GM-21-007RE**	410-66202-3RE**	Water	12/06/21
GM-21-041	410-66202-4	Water	12/06/21
GM-21-041RE	410-66202-4RE	Water	12/06/21
GM-21-060**	410-66202-5**	Water	12/06/21
GM-21-060RE**	410-66202-5RE**	Water	12/06/21
GM-21-038	410-66202-6	Water	12/06/21
GM-21-038RE	410-66202-6RE	Water	12/06/21
GM-21-008**	410-66202-7**	Water	12/06/21
GM-21-008RE**	410-66202-7RE**	Water	12/06/21
GM-21-043	410-66202-8	Water	12/06/21
GM-21-043RE	410-66202-8RE	Water	12/06/21
GM-21-044**	410-66202-9**	Water	12/06/21
GM-21-044RE**	410-66202-9RE**	Water	12/06/21
FB-120621	410-66202-10	Water	12/06/21
FB-120621RE	410-66202-10RE	Water	12/06/21
GM-21-006	410-66202-11	Water	12/06/21
GM-21-006RE	410-66202-11RE	Water	12/06/21
GM-21-066	410-66202-12	Water	12/06/21
GM-21-066RE	410-66202-12RE	Water	12/06/21
GM-21-015**	410-66202-13**	Water	12/06/21
GM-21-015RE**	410-66202-13RE**	Water	12/06/21

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
GM-21-054	410-66202-14	Water	12/06/21
GM-21-054RE	410-66202-14RE	Water	12/06/21
GM-21-031**	410-66202-15**	Water	12/06/21
GM-21-031RE**	410-66202-15RE**	Water	12/06/21
GM-21-032	410-66202-16	Water	12/06/21
GM-21-032RE	410-66202-16RE	Water	12/06/21
GM-21-040	410-66202-17	Water	12/06/21
GM-21-040RE	410-66202-17RE	Water	12/06/21
GM-21-044MS	410-66202-9MS	Water	12/06/21
GM-21-044MSD	410-66202-9MSD	Water	12/06/21
GM-21-044REMS	410-66202-9REMS	Water	12/06/21
GM-21-044REMSD	410-66202-9REMSD	Water	12/06/21

**Indicates sample underwent Stage 4 validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Tier I Sampling and Analysis Plan, Groundwater Sampling at Operable Unit 1, Area 1 Former Landfill and Long-Term Monitoring at Operable Unit 2, Area 2 Van Meter Road Spill/Drum Storage Site, Naval Base Kitsap Keyport, Keyport, Washington (October 2021), the NAVFAC Northwest Standard Operating Procedure: Field Procedures Manual (Naval Facilities Engineering Command Northwest, 2015), the U.S. Department of Defense (DoD) General Validation Guidelines (November 2019), and the DoD Data Validation Guidelines Module 3: Data Validation Procedure for Per- and Polyfluoroalkyl Substances Analysis by Quality Systems Manual for Environmental Laboratories (QSM) Table B-15 (2020). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) by Environmental Protection Agency (EPA) Method 537 Modified and LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DoD QSM 5.3

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Stage 4 data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

X (Exclusion of data recommended): The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Exclusion of the data is recommended.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Codes

H	Holding times were exceeded.
S	Surrogate recovery was outside QC limits.
C	Calibration %RSD or %D were noncompliant.
R	Calibration RRF was <0.05.
B	Presumed contamination from preparation (method) blank.
L	Laboratory Blank Spike/Blank Spike Duplicate %R was not within control limits.
Q	MS/MSD recovery was poor or RPD high.
I	Internal standard performance was unsatisfactory.
M	Tuning (BFB or DFTPP) was noncompliant.
T	Presumed contamination from trip blank.
+	False positive – reported compound was not present. Not applicable.
-	False negative – compound was present but not reported.
F	Presumed contamination from FB, or ER.
$	Reported result or other information was incorrect.
?	TIC identity or reported retention time has been changed.
D	The analysis with this flag should not be used because another more technically sound analysis is available.
P	Instrument performance for pesticides was poor.
*#	Unusual problems found with the data that have been described in Section 2.2.3.3, "Data Validation Findings." The number following the asterisk (*) will indicate the subsection where a description of the problem can be found.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met with the following exceptions:

Sample	Analyte	Total Days From Sample Collection Until Extraction	Required Holding Time (in Days) From Sample Collection Until Extraction	Flag	A or P
GM-21-042RE** GM-21-037RE GM-21-007RE** GM-21-041RE GM-21-060RE** GM-21-038RE GM-21-008RE** GM-21-043RE GM-21-044RE** FB-120621RE GM-21-006RE GM-21-066RE GM-21-015RE** GM-21-054RE GM-21-031RE** GM-21-032RE GM-21-040RE	All analytes	15	14	J (all detects) UJ (all non-detects)	A

II. LC/MS Instrument Performance Check

Instrument performance was checked and the requirements were met.

III. Initial Calibration and Initial Calibration Verification

Initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all analytes.

For each calibration standard, all analytes were within 70-130% of their true value.

The signal to noise (S/N) ratio was within validation criteria for all analytes associated to samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

Retention time windows were established as required by the method for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all analytes.

IV. Continuing Calibration and Instrument Sensitivity Check

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 30.0% for all analytes.

The signal to noise (S/N) ratio was within validation criteria for all analytes associated to samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

The percent differences (%D) of the instrument sensitivity check (ISC) were less than or equal to 30.0% for all analytes.

Raw data were not reviewed for Stage 2B validation.

All analyte concentrations were at the limit of quantitation (LOQ) for the ISC standard.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

Samples FB-120621 and FB-120621RE were identified as field blanks. No contaminants were found.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
GM-21-044MS/MSD (GM-21-044**)	Perfluorodecanoic acid	68 (71-129)	67 (71-129)	UJ (all non-detects)	A
	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	65 (70-130)	69 (70-130)	UJ (all non-detects)	
	Perfluorododecanoic acid	71 (72-134)	-	UJ (all non-detects)	

Relative percent differences (RPD) were within QC limits.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits with the following exceptions:

LCS ID (Associated Samples)	Analyte	LCS %R (Limits)	LCSD %R (Limits)	Flag	A or P
LCS 410-205470 (GM-21-042** GM-21-037 GM-21-007** GM-21-041 GM-21-060** GM-21-038 GM-21-008** GM-21-043 GM-21-044** FB-120621 GM-21-006 GM-21-066 GM-21-015** GM-21-054 GM-21-031** GM-21-032 GM-21-040)	Perfluorodecanoic acid 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	69 (71-129) 69 (70-130)	- -	UJ (all non-detects) UJ (all non-detects)	P

Relative percent differences (RPD) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target analytes were within QC limits with the following exceptions:

Sample	Labeled Compound	%R (Limits)	Affected Analyte	Flag	A or P
GM-21-042	13C3 PFBS	156 (50-150)	Perfluorobutanesulfonic acid	J (all detects)	P
GM-21-042RE	13C2 PFTeDA	11 (50-150)	Perfluorotetradecanoic acid	X	P
GM-21-042RE	13C2-PFDoDA d5-NEtFOSAA	40 (50-150) 46 (50-150)	Perfluorododecanoic acid Perfluorotridecanoic acid NEtFOSAA	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P
GM-21-037	13C2 PFTeDA 13C2-PFDoDA d5-NEtFOSAA d3-NMeFOSAA 13C7 PFUnA	7 (50-150) 3 (50-150) 9 (50-150) 13 (50-150) 8 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid NEtFOSAA NMeFOSAA Perfluoroundecanoic acid	X	P
GM-21-037	13C6 PFDA	31 (50-150)	Perfluorodecanoic acid	UJ (all non-detects)	P
GM-21-037	13C8 PFOS	36 (50-150)	Perfluorooctanesulfonic acid 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	J (all detects) UJ (all non-detects)	P

Sample	Labeled Compound	%R (Limits)	Affected Analyte	Flag	A or P
GM-21-037RE	13C2 PFTeDA	27 (50-150)	Perfluorotetradecanoic acid	UJ (all non-detects)	P
GM-21-007	13C3 PFBS	164 (50-150)	Perfluorobutanesulfonic acid	J (all detects)	P
GM-21-007RE	13C2 PFTeDA	6 (50-150)	Perfluorotetradecanoic acid	X	P
GM-21-007RE	13C2-PFDoDA	44 (50-150)	Perfluorododecanoic acid Perfluorotridecanoic acid	UJ (all non-detects) UJ (all non-detects)	P
GM-21-041	13C3 PFBS	152 (50-150)	Perfluorobutanesulfonic acid	NA	-
GM-21-041RE	13C2 PFTeDA	25 (50-150)	Perfluorotetradecanoic acid	UJ (all non-detects)	P
GM-21-060	13C2 PFTeDA	47 (50-150)	Perfluorotetradecanoic acid	UJ (all non-detects)	P
GM-21-060RE	13C2 PFTeDA	22 (50-150)	Perfluorotetradecanoic acid	UJ (all non-detects)	P
GM-21-038	13C3 PFBS	152 (50-150)	Perfluorobutanesulfonic acid	NA	-
GM-21-038RE	13C2 PFTeDA	44 (50-150)	Perfluorotetradecanoic acid	UJ (all non-detects)	P
GM-21-008	13C2 PFTeDA	7 (50-150)	Perfluorotetradecanoic acid	X	P
GM-21-008RE	13C2 PFTeDA	2 (50-150)	Perfluorotetradecanoic acid	X	P
GM-21-008RE	13C2-PFDoDA	32 (50-150)	Perfluorododecanoic acid Perfluorotridecanoic acid	UJ (all non-detects) UJ (all non-detects)	P
FB-120621	13C3 PFBS	151 (50-150)	Perfluorobutanesulfonic acid	NA	-
GM-21-006	13C3 PFBS	151 (50-150)	Perfluorobutanesulfonic acid	NA	-
GM-21-066	13C3 PFBS 13C7 PFUnA 13C6 PFDA	156 (50-150) 152 (50-150) 153 (50-150)	Perfluorobutanesulfonic acid Perfluoroundecanoic acid Perfluorodecanoic acid	NA	-
GM-21-015	13C3 PFBS	161 (50-150)	Perfluorobutanesulfonic acid	NA	-
GM-21-015	13C2 PFTeDA	43 (50-150)	Perfluorotetradecanoic acid	UJ (all non-detects)	P
GM-21-015RE	13C2 PFTeDA 13C2-PFDoDA	2 (50-150) 17 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid	X	P
GM-21-015RE	13C7 PFUnA	49 (50-150)	Perfluoroundecanoic acid	UJ (all non-detects)	P

Sample	Labeled Compound	%R (Limits)	Affected Analyte	Flag	A or P
GM-21-054	13C3 PFBS	154 (50-150)	Perfluorobutanesulfonic acid	J (all detects)	P
GM-21-054RE	13C2 PFTeDA	19 (50-150)	Perfluorotetradecanoic acid	X	P
GM-21-031	13C3 PFBS	160 (50-150)	Perfluorobutanesulfonic acid	J (all detects)	P
GM-21-031RE	13C2 PFTeDA	21 (50-150)	Perfluorotetradecanoic acid	UJ (all non-detects)	P
GM-21-032	13C3 PFBS	157 (50-150)	Perfluorobutanesulfonic acid	J (all detects)	P
GM-21-032RE	13C2 PFTeDA 13C2-PFDoDA	0.6 (50-150) 18 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid	X	P
GM-21-040RE	13C2 PFTeDA 13C2-PFDoDA	0.6 (50-150) 19 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid	X	P
GM-21-040RE	d5-NEtFOSAA	47 (50-150)	NEtFOSAA	UJ (all non-detects)	P

XI. Target Analyte Quantitation

All target analyte quantitations met validation criteria for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

The laboratory indicated that PFAs are currently being reported as the sum of the branched and linear isomers so both peaks were integrated.

XII. Target Analyte Identification

All target analyte identifications were within validation criteria with the following exceptions:

Sample	Analyte	Flag	A or P
GM-21-037RE GM-21-032 GM-21-032RE	Results flagged "I" by the laboratory due to ion ratio outside QC limits.	J (all detects)	P

Sample	Analyte	Ion Ratio (Limits)	Flag	A or P
GM-21-060**	Perfluorooctanesulfonic acid	6.81 (2.23-6.68)	J (all detects)	P
GM-21-015**	NMeFOSAA	2.76 (0.86-2.57)	J (all detects)	P

Sample	Analyte	Ion Ratio (Limits)	Flag	A or P
GM-21-031**	Perfluorooctanesulfonic acid	6.96 (2.30-6.89)	J (all detects)	P

Raw data were not reviewed for Stage 2B validation.

Manual integrations were reviewed and were considered acceptable. The laboratory provided before and after integration printouts.

XIII. System Performance

The system performance was acceptable for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

In the case where more than one result was reported for an individual sample, the least technically acceptable results were deemed not reportable as follows:

Sample	Analyte	Reason	Flag	A or P
GM-21-042** GM-21-008** GM-21-031** GM-21-032	Perfluorohexanoic acid Perfluoroheptanoic acid Perfluorooctanoic acid Perfluorononanoic acid Perfluorobutanesulfonic acid Perfluorohexanesulfonic acid Perfluorooctanesulfonic acid	Results from re-analyses were more usable.	Not reportable	-
GM-21-042RE** GM-21-008RE** GM-21-031RE** GM-21-032RE	All analytes except Perfluorohexanoic acid Perfluoroheptanoic acid Perfluorooctanoic acid Perfluorononanoic acid Perfluorobutanesulfonic acid Perfluorohexanesulfonic acid Perfluorooctanesulfonic acid	Results from original analyses were more usable.	Not reportable	-
GM-21-037	All analytes	Results from re-analyses were more usable.	Not reportable	-
GM-21-041	Perfluorohexanoic acid Perfluorooctanoic acid	Results from re-analyses were more usable.	Not reportable	-
GM-21-041RE	All analytes except Perfluorohexanoic acid Perfluorooctanoic acid	Results from original analyses were more usable.	Not reportable	-

Sample	Analyte	Reason	Flag	A or P
GM-21-038	Perfluorooctanesulfonic acid	Results from re-analyses were more usable.	Not reportable	-
GM-21-038RE	All analytes except Perfluorooctanesulfonic acid	Results from original analyses were more usable.	Not reportable	-
GM-21-043	Perfluorobutanesulfonic acid	Results from re-analyses were more usable.	Not reportable	-
GM-21-043RE	All analytes except Perfluorobutanesulfonic acid	Results from original analyses were more usable.	Not reportable	-
GM-21-060RE** FB-120621RE GM-21-006RE GM-21-066RE GM-21-007RE** GM-21-044RE**	All analytes	Results from original analyses were more usable.	Not reportable	-
GM-21-015**	Perfluorohexanoic acid Perfluoroheptanoic acid Perfluorooctanoic acid Perfluorononanoic acid Perfluorobutanesulfonic acid Perfluorohexanesulfonic acid Perfluorooctanesulfonic acid NMeFOSAA NEtFOSAA	Results from re-analyses were more usable.	Not reportable	-
GM-21-015RE**	All analytes except Perfluorohexanoic acid Perfluoroheptanoic acid Perfluorooctanoic acid Perfluorononanoic acid Perfluorobutanesulfonic acid Perfluorohexanesulfonic acid Perfluorooctanesulfonic acid NMeFOSAA NEtFOSAA	Results from original analyses were more usable.	Not reportable	-
GM-21-054	Perfluorohexanoic acid Perfluoroheptanoic acid Perfluorooctanoic acid Perfluorononanoic acid Perfluorodecanoic acid Perfluorobutanesulfonic acid Perfluorohexanesulfonic acid Perfluorooctanesulfonic acid	Results from re-analyses were more usable.	Not reportable	-
GM-21-054RE	All analytes except Perfluorohexanoic acid Perfluoroheptanoic acid Perfluorooctanoic acid Perfluorononanoic acid Perfluorodecanoic acid Perfluorobutanesulfonic acid Perfluorohexanesulfonic acid Perfluorooctanesulfonic acid	Results from original analyses were more usable.	Not reportable	-

Sample	Analyte	Reason	Flag	A or P
GM-21-040	Perfluorooctanoic acid	Results from re-analyses were more usable.	Not reportable	-
GM-21-040RE	All analytes except Perfluorooctanoic acid	Results from original analyses were more usable.	Not reportable	-

Due to technical holding time, MS/MSD %R, LCS/LCSD %R, labeled compound %R, and ion ratio, data were qualified as estimated in forty-five samples.

Due to labeled compound %R, data were recommended for exclusion in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Keyport LTM
Perfluoroalkyl & Polyfluoroalkyl Substances - Data Qualification Summary - SDG 410-66202-1

Sample	Analyte	Flag	A or P	Reason (Code)
GM-21-042RE** GM-21-037RE GM-21-041RE GM-21-038RE GM-21-008RE** GM-21-043RE GM-21-015RE** GM-21-054RE GM-21-031RE** GM-21-032RE GM-21-040RE	All analytes	J (all detects) UJ (all non-detects)	A	Technical holding times (H)
GM-21-044**	Perfluorodecanoic acid 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid Perfluorododecanoic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	A	Matrix spike/Matrix spike duplicate (%R) (Q)
GM-21-042** GM-21-007** GM-21-041 GM-21-060** GM-21-038 GM-21-008** GM-21-043 GM-21-044** FB-120621 GM-21-006 GM-21-066 GM-21-015** GM-21-054 GM-21-031** GM-21-032 GM-21-040	Perfluorodecanoic acid 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	UJ (all non-detects) UJ (all non-detects)	P	Laboratory control samples (%R) (L)
GM-21-037RE	Perfluorotetradecanoic acid	UJ (all non-detects)	P	Labeled compounds (%R) (I)
GM-21-007	Perfluorobutanesulfonic acid	J (all detects)	P	Labeled compounds (%R) (I)
GM-21-060	Perfluorotetradecanoic acid	UJ (all non-detects)	P	Labeled compounds (%R) (I)
GM-21-008	Perfluorotetradecanoic acid	X	P	Labeled compounds (%R) (I)
GM-21-015	Perfluorotetradecanoic acid	UJ (all non-detects)	P	Labeled compounds (%R) (I)
GM-21-037RE GM-21-032 GM-21-032RE	Results flagged "I" by the laboratory due to ion ratio outside QC limits.	J (all detects)	P	Target analyte identification (ion ratio) (*XII)

Sample	Analyte	Flag	A or P	Reason (Code)
GM-21-042** GM-21-008** GM-21-031** GM-21-032	Perfluorohexanoic acid Perfluoroheptanoic acid Perfluorooctanoic acid Perfluorononanoic acid Perfluorobutanesulfonic acid Perfluorohexanesulfonic acid Perfluorooctanesulfonic acid	Not reportable	-	Overall assessment of data (*XIV)
GM-21-042RE** GM-21-008RE** GM-21-031RE** GM-21-032RE	All analytes except Perfluorohexanoic acid Perfluoroheptanoic acid Perfluorooctanoic acid Perfluorononanoic acid Perfluorobutanesulfonic acid Perfluorohexanesulfonic acid Perfluorooctanesulfonic acid	Not reportable	-	Overall assessment of data (*XIV)
GM-21-037	All analytes	Not reportable	-	Overall assessment of data (*XIV)
GM-21-041	Perfluorohexanoic acid Perfluorooctanoic acid	Not reportable	-	Overall assessment of data (*XIV)
GM-21-041RE	All analytes except Perfluorohexanoic acid Perfluorooctanoic acid	Not reportable	-	Overall assessment of data (*XIV)
GM-21-038	Perfluorooctanesulfonic acid	Not reportable	-	Overall assessment of data (*XIV)
GM-21-038RE	All analytes except Perfluorooctanesulfonic acid	Not reportable	-	Overall assessment of data (*XIV)
GM-21-043	Perfluorobutanesulfonic acid	Not reportable	-	Overall assessment of data (*XIV)
GM-21-043RE	All analytes except Perfluorobutanesulfonic acid	Not reportable	-	Overall assessment of data (*XIV)
GM-21-060RE** FB-120621RE GM-21-006RE GM-21-066RE GM-21-007RE** GM-21-044RE**	All analytes	Not reportable	-	Overall assessment of data (*XIV)
GM-21-015**	Perfluorohexanoic acid Perfluoroheptanoic acid Perfluorooctanoic acid Perfluorononanoic acid Perfluorobutanesulfonic acid Perfluorohexanesulfonic acid Perfluorooctanesulfonic acid NMeFOSAA NEtFOSAA	Not reportable	-	Overall assessment of data (*XIV)

Sample	Analyte	Flag	A or P	Reason (Code)
GM-21-015RE**	All analytes except Perfluorohexanoic acid Perfluoroheptanoic acid Perfluorooctanoic acid Perfluorononanoic acid Perfluorobutanesulfonic acid Perfluorohexanesulfonic acid Perfluorooctanesulfonic acid NMeFOSAA NEtFOSAA	Not reportable	-	Overall assessment of data (*XIV)
GM-21-054	Perfluorohexanoic acid Perfluoroheptanoic acid Perfluorooctanoic acid Perfluorononanoic acid Perfluorodecanoic acid Perfluorobutanesulfonic acid Perfluorohexanesulfonic acid Perfluorooctanesulfonic acid	Not reportable	-	Overall assessment of data (*XIV)
GM-21-054RE	All analytes except Perfluorohexanoic acid Perfluoroheptanoic acid Perfluorooctanoic acid Perfluorononanoic acid Perfluorodecanoic acid Perfluorobutanesulfonic acid Perfluorohexanesulfonic acid Perfluorooctanesulfonic acid	Not reportable	-	Overall assessment of data (*XIV)
GM-21-040	Perfluorooctanoic acid	Not reportable	-	Overall assessment of data (*XIV)
GM-21-040RE	All analytes except Perfluorooctanoic acid	Not reportable	-	Overall assessment of data (*XIV)

Keyport LTM
Perfluoroalkyl & Polyfluoroalkyl Substances – Laboratory Blank Data Qualification Summary – SDG 410-66202-1

No Sample Data Qualified in this SDG

Keyport LTM
Perfluoroalkyl & Polyfluoroalkyl Substances - Field Blank Data Qualification Summary - SDG 410-66202-1

No Sample Data Qualified in this SDG

LDC #: 53144D96 **VALIDATION COMPLETENESS WORKSHEET** Date: 2/3/22
SDG #: 410-66202-1 Stage 2B/4 Page: 1 of 2
Laboratory: Eurofins, Lancaster, PA Reviewer: M
2nd Reviewer:

METHOD: GC Perfluoroalkyl & Polyfluoroalkyl Substances (EPA Method 537M/QSM 5.3 B-15)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A SW	
II.	LC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	RSD ≤ 20 TV/IV ≤ 30
IV.	Continuing calibration/ISC	A/A	D ≤ 30
V.	Laboratory Blanks	A	
V.I	Field blanks	ND	FB = 19, 20
VII.	Matrix spike/Matrix spike duplicates	SW	
VIII.	Laboratory control samples	SW	LCS/D
IX.	Field duplicates	N	
X.	Labeled Compounds	SW	
XI.	Target analyte quantitation	A	Not reviewed for Stage 2B validation.
XII.	Target analyte identification	SW	Not reviewed for Stage 2B validation. MI
XIII.	System performance	A	Not reviewed for Stage 2B validation.
XIV.	Overall assessment of data	SW	

Note: A = Acceptable ND = No compounds detected D = Duplicate SB=Source blank
N = Not provided/applicable R = Rinsate TB = Trip blank OTHER:
SW = See worksheet FB = Field blank EB = Equipment blank
** Indicates sample underwent Stage 4 validation

	Client ID	Lab ID	Matrix	Date
1	GM-21-042**	410-66202-1**	Water	12/06/21
2	GM-21-042RE**	410-66202-1RE**	Water	12/06/21
3	GM-21-037	410-66202-2	Water	12/06/21
4	GM-21-037RE	410-66202-2RE	Water	12/06/21
5	GM-21-007**	410-66202-3**	Water	12/06/21
6	GM-21-007RE**	410-66202-3RE**	Water	12/06/21
7	GM-21-041	410-66202-4	Water	12/06/21
8	GM-21-041RE	410-66202-4RE	Water	12/06/21
9	GM-21-060	410-66202-5	Water	12/06/21
10	GM-21-060RE	410-66202-5RE	Water	12/06/21
11	GM-21-038	410-66202-6	Water	12/06/21
12	GM-21-038RE	410-66202-6RE	Water	12/06/21
13	GM-21-008**	410-66202-7**	Water	12/06/21
14	GM-21-008RE**	410-66202-7RE**	Water	12/06/21
15	GM-21-043	410-66202-8	Water	12/06/21

LDC #: 53144D96 **VALIDATION COMPLETENESS WORKSHEET** Date: 3/3/22
SDG #: 410-66202-1 Stage 2B/4 Page: 2 of 2
Laboratory: Eurofins, Lancaster, PA Reviewer:
2nd Reviewer:

METHOD: GC Perfluoroalkyl & Polyfluoroalkyl Substances (EPA Method 537M/QSM 5.3 B-15)

	Client ID	Lab ID	Matrix	Date
16	GM-21-043RE	410-66202-8RE	Water	12/06/21
17 1	GM-21-044 **	410-66202-9 **	Water	12/06/21
18 3	GM-21-044RE **	410-66202-9RE **	Water	12/06/21
19 1	FB-120621	410-66202-10	Water	12/06/21
20	FB-120621RE	410-66202-10RE	Water	12/06/21
21 1	GM-21-006	410-66202-11	Water	12/06/21
22	GM-21-006RE	410-66202-11RE	Water	12/06/21
23 1	GM-21-066	410-66202-12	Water	12/06/21
24	GM-21-066RE	410-66202-12RE	Water	12/06/21
25 1	GM-21-015**	410-66202-13**	Water	12/06/21
26	GM-21-015RE**	410-66202-13RE**	Water	12/06/21
27 1	GM-21-054	410-66202-14	Water	12/06/21
28	GM-21-054RE	410-66202-14RE	Water	12/06/21
29 1	GM-21-031**	410-66202-15**	Water	12/06/21
30	GM-21-031RE**	410-66202-15RE**	Water	12/06/21
31 1	GM-21-032	410-66202-16	Water	12/06/21
32	GM-21-032RE	410-66202-16RE	Water	12/06/21
33 1	GM-21-040	410-66202-17	Water	12/06/21
34	GM-21-040RE	410-66202-17RE	Water	12/06/21
35 1	GM-21-044MS	410-66202-9MS	Water	12/06/21
36 1	GM-21-044MSD	410-66202-9MSD	Water	12/06/21
37 3	GM-21-044REMS	410-66202-9REMS	Water	12/06/21
38 3	GM-21-044REMSD	410-66202-9REMSD	Water	12/06/21
39				
40				
41				

Notes:

1	205470						
2	209135						
3	208162						

LDC #: 53144D9c

VALIDATION FINDINGS CHECKLIST

Reviewer: N

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DoD QSM 5.3

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?		√		
Were cooler temperature criteria met?	√			
II. LC/MS Instrument performance check				
Were the instrument performance reviewed and found to be within the validation criteria?	√			
III. Initial calibration and Initial calibration verification				
Did the laboratory perform a 5-point calibration prior to sample analysis?	√			
Were all percent relative standard deviations (%RSD) ≤ 20%?	√			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the coefficient of determination (r^2) criteria of ≥ 0.990?			√	
Were all analytes within 70-130% or percent differences (%D) ≤30% of their true value for each calibration standard?	√			
Was the signal to noise (S/N) ratio for all analytes within the validation criteria?	√			
Were the retention time windows properly established?	√			
Was an initial calibration verification (ICV) standard analyzed after each initial calibration for each instrument?	√			
Were all ICV percent differences (%D) of the initial calibration verification ≤ 30%?	√			
IV. Continuing calibration and Instrument sensitivity check				
Was a continuing calibration analyzed prior to sample analysis, after every 10 samples and at the end of the analytical sequence?	√			
Were all percent differences (%D) of the continuing calibration ≤ 30%?	√			
Were all the retention times within the acceptance windows?	√			
Was the signal to noise (S/N) ratio for all analytes within the validation criteria?	√			
Were all percent differences (%D) of the Instrument Sensitivity Check ≤ 30%?	√			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	√			
Was there contamination in the laboratory blanks?		√		
VI. Field blanks				
Were field blanks identified in this SDG?	√			
Were target analytes detected in the field blanks?		√		
VII. Matrix spike/Matrix spike duplicates				
Were matrix spike (MS) and matrix spike duplicate (MSD) analyzed in this SDG?	√			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?		√		

Validation Area	Yes	No	NA	Findings/Comments
VIII. Laboratory control samples				
Was an LCS analyzed per extraction batch for this SDG?	√			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?		√		
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?		√		
Were target analytes detected in the field duplicates?			√	
X. Labeled compounds				
Were labeled compound percent recoveries (%R) within the QC limits?		√		
Were retention times within 0.4 minutes of the associated calibration standard?	√			
XI. Target analyte quantitation				
Did the laboratory reporting limits (i.e. DL, LOD, LOQ) meet the QAPP?	√			
Did reported results include both branched and linear isomers?	√			
Were the correct ion transition, labeled compound and relative response factor (RRF) used to quantitate the analyte?	√			
Were analyte retention times within 0.1 minutes of the associated labeled compound for analytes with a labeled analog?	√			
Were analyte quantitation and reporting limits adjusted to reflect all sample dilutions and dry weight factors applicable to Stage 4 validation?	√			
XII. Target analyte identification				
Was the signal to noise (S/N) ratio for all analytes within the validation criteria?	√			
Were two transitions and the ion transition ratio per analyte monitored and documented with the exception of PFBA and PFPeA?	√			
Were ion ratios between 50-150%?		√		
Were manual integrations performed and found acceptable?	√			
Did the laboratory provide before and after printouts?	√			
XIII. System performance				
System performance was found to be acceptable.	√			
XIV. Overall assessment of Data				
Overall assessment of data was found to be acceptable.	√			

TARGET COMPOUND WORKSHEET

METHOD: PFAS

A. Perfluorobutanoic acid	W. 6:2 Fluorotelomer sulfonate	
B. Perfluoropentanoic acid	X. 8:2 Fluorotelomer sulfonate	
C. Perfluorohexanoic acid	Y. 4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	
D. Perfluoroheptanoic acid	Z. HFPO-DA (GenX)	
E. Perfluorooctanoic acid	AA. 9Cl-PF3ONS (F-53B Major)	
F. Perfluorononanoic acid	BB. 11Cl-PF3OUdS (F-53B Minor)	
G. Perfluorodecanoic acid	CC. Hexafluoropropylene oxide dimer acid (HFPO-DA)	
H. Perfluoroundecanoic acid	DD. 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	
I. Perfluorododecanoic acid	EE. 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	
J. Perfluorotridecanoic acid	FF. 4:2 Fluorotelomersulfonic acid	
K. Perfluorotetradecanoic acid	GG. 6:2 Fluorotelomersulfonic acid	
L. Perfluorobutanesulfonic acid	HH. 8:2 Fluorotelomersulfonic acid	
M. Perfluoropentanesulfonic acid	II. 1H,1H,2H,2H-perfluorohexane sulfonic acid	
N. Perfluorohexanesulfonic acid	JJ. 1H,1H,2H,2H- Perfluorooctanesulfonic acid	
O. Perfluoroheptanesulfonic acid	KK. 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid	
P. Perfluorooctanesulfonic acid	LL. NMeFOSA	
Q. Perfluorononanesulfonic acid	MM. 3:3 Fluorotelomer carboxylate	
R. Perfluorodecanesulfonic acid	NN. 5:3 Fluorotelomer carboxylate	
S. Perfluorooctanesulfonamide	OO. 7:3 Fluorotelomer carboxylate	
T. NMeFOSAA	PP. Perfluorooctadecanoic acid	
U. NEtFOSAA		
V. 4:2 Fluorotelomer sulfonate		

LDC #: 53144D96

VALIDATION FINDINGS WORKSHEET
Technical Holding Times

Reviewer: AC

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DoD QSM 5.3

All circled dates have exceeded the technical holding times.
Y N N/A Were all cooler temperatures within validation criteria?

HT: 14

Sample ID	Matrix	Preserved	Sampling Date	Extraction date	Analysis date	Total # of Days	Qualifier (H)
All REs (all ND)			12/6/21	12/21/21	12/22 23/21	15	J NJ/A

TECHNICAL HOLDING TIME CRITERIA

Water: Extracted within 14 days, analyzed within 28 days.
Soil: Extracted within 28 days, analyzed within 28 days.

LDC #: 53144D9b

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Reviewer: SC

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DoD QSM 5.3

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample.
Percent recoveries (%R) and %RPD were within QC limits with the exceptions identified below. (Q)

#	MS/MSD ID	Analyte	MS %R (Limits)	MSD %R (Limits)	RPD (≤30)	Associated Samples	Qualifications
	35/36	G	68 (71-129)	67 (71-129)		17, 18 (ND)	J/UJ/A
		EE	65 (70-130)	69 (70-130)		C	
		I	71 (72-134)				↓
	37/38	w/in limits				18	

LDC #: 53144D96

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

Reviewer: SC

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DOD QSM 5.3

Laboratory control samples (LCS) and laboratory control sample duplicate (LCSD) were analyzed in this SDG.
Percent recoveries (%R) and %RPD were within QC limits with the exceptions identified below.

#	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (≤30)	Associated Samples	Qualifications (L)
	LCS 410-205470	G	69 (71-129)			1,3,5,7,9,11, 13,15,17,19, 21,23,25,27 29,31,33 (ND)	J/UJ/P
		EE	69 (70-130)				

LDC #: 53144D96

VALIDATION FINDINGS WORKSHEET
Labeled Compounds

Reviewer: SC

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DOD QSM 5.3

Percent recoveries (%R) were within QC limits with the exceptions identified below.

#	Sample ID	Labeled Compound	%R (50-150)	Qualifications
	GM-21-042 (det)	13C3 PFBS	156	Jdets/P (L)
	GM-21-042RE (ND)	13C2 PFTeDA	11	X/P (K)
		13C2-PFDoDA	40	J/UJ/P (I,J)
		d5-NEtFOSAA	46	J/UJ/P (U)
	GM-21-037	13C2 PFTeDA	7	X/P (K)
		13C2-PFDoDA	3	X/P (I,J)
		d5-NEtFOSAA	9	X/P (U)
		d3-NMeFOSAA	13	X/P (T)
		13C7 PFUnA	8	X/P (H)
		13C6 PFDA	31	J/UJ/P (G)
	(P-det)	13C8 PFOS	36	J/UJ/P (P,DD,EE)
	GM-21-037RE (ND)	13C2 PFTeDA	27	J/UJ/P (K)
	GM-21-007 (det)	13C3 PFBS	164	Jdets/P (L)
	GM-21-007RE (ND)	13C2 PFTeDA	6	X/P (K)
		13C2-PFDoDA	44	J/UJ/P (I,J)
	GM-21-041	13C3 PFBS	152	Jdets/P (L)
	GM-21-041RE	13C2 PFTeDA	25	J/UJ/P (K)
	GM-21-060	13C2 PFTeDA	47	J/UJ/P (K)
	GM-21-060RE	13C2 PFTeDA	22	J/UJ/P (K)
	GM-21-038	13C3 PFBS	152	Jdets/P (L)
	GM-21-038RE	13C2 PFTeDA	44	J/UJ/P (K)
	GM-21-008	13C2 PFTeDA	7	X/P (K)

LDC #: 53144B96

VALIDATION FINDINGS WORKSHEET
Labeled Compounds

Reviewer: SC

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DOD QSM 5.3

Percent recoveries (%R) were within QC limits with the exceptions identified below.

#	Sample ID	Labeled Compound	%R (50-150)	Qualifications
	GM-21-008RE (ND)	13C2 PFTeDA	2	X/P (K)
		13C2-PFDoDA	32	J/UJ/P (I,J)
	FB-120621	13C3 PFBS	151	Jdets/P (L)
	GM-21-006	13C3 PFBS	151	Jdets/P (L)
	GM-21-066	13C3 PFBS	156	Jdets/P (L)
		13C7 PFUnA	152	Jdets/P (H)
		13C6 PFDA	153	Jdets/P (G)
	GM-21-015	13C3 PFBS	161	Jdets/P (L)
		13C2 PFTeDA	43	J/UJ/P (K)
	GM-21-015RE	13C2 PFTeDA	2	X/P (K)
		13C2-PFDoDA	17	X/P (I,J)
	√	13C7 PFUnA	49	J/UJ/P (H)
	GM-21-054 (det)	13C3 PFBS	154	Jdets/P (L)
	GM-21-054RE (ND)	13C2 PFTeDA	19	X/P (K)
	GM-21-031 (det)	13C3 PFBS	160	Jdets/P (L)
	GM-21-031RE (ND)	13C2 PFTeDA	21	J/UJ/P (K)
	GM-21-032 (det)	13C3 PFBS	157	Jdets/P (L)
	GM-21-032RE (ND)	13C2 PFTeDA	0.6	X/P (K)
		13C2-PFDoDA	18	X/P (I,J)
	GM-21-040RE (ND)	13C2 PFTeDA	0.6	X/P (K)
		13C2-PFDoDA	19	X/P (I,J)
		d5-NEtFOSAA	47	J/UJ/P (U)

LDC #: 53144D96

VALIDATION FINDINGS WORKSHEET
Target Analyte Identification

Reviewer: R

METHOD: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DoD QSM 5.1

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Was the signal to noise (S/N) ratio for all analytes within the validation criteria?
(Y) N N/A Were two transitions and the ion transition ratio per analyte monitored and documented with the exception of PFBA and PFPeA?
Y (N) N/A Were ion ratios within QC limits?

#	Date	Sample ID	Analyte	Ion ratio (Limits)	Qualifications
		4,31,32	H	Results flagged "I" by the laboratory due to ion ratio outside QC limits.	Jdets/P (*XII)
		9	P	6.81 (2.23-6.68)	
		25	T	2.76 (0.86-2.57)	
		29	P	6.96 (2.30-6.89)	

LDC #: 53144D96

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

METHOD: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DoD QSM 5.3

#	Date	Sample ID	Analyte	Finding	Qualifications
		1, 13, 29, ~~31~~	C, D, E, F, L, N, P	~~Reextraction~~ more usable (higher results)	NR
		2, 14, 30, ~~32~~	All except above	Orig more usable (several labeled %Rs out in RE)	
		3	All	RE more usable (higher result & several labeled %Rs out in orig)	
		~~5~~	~~All except K, CC~~	~~RE more usable (higher results)~~	
		6	~~K, CC RE~~ All	Orig more usable (labeled %R <20 in ~~orig~~ RE for K; ~~ND in RE for CC~~ HT out)	
		~~8~~ 7	C, E	RE more usable (higher results)	
		9 8	All except C, E	Orig more usable (RE outside HT)	

LDC #: 53144D96

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

Reviewer: AC

METHOD: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DoD QSM 5.3

#	Date	Sample ID	Analyte	Finding	Qualifications
		10, 17R	All	Orig more usable (higher results)	NR
		11	P	RE more usable (higher result)	
		12	All except P	Orig more usable (RE out HT)	
		~~13~~ 15	L		
		16	All except L		
		18, 20, 22, 24, 32	All	Orig more usable (RE out HT)	
		25	C, D, E, F, L, N, P, T, U	RE more usable (higher results)	
		26	All except above	Orig more usable (several labeled %R out in RE)	
		27	C, D, E, F, G, L, N, P	RE more usable (higher result)	
		28	All except above	Orig more usable (RE out HT)	

LDC #: 53144D96

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

Reviewer: M

METHOD: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DoD QSM 5.3

#	Date	Sample ID	Analyte	Finding	Qualifications
		29 33	E	RE more usable (higher result)	NR
		34	All except E	Orig more usable (several labeled %Rs out in RE)	

LDC #: 53144D6

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DOD QSM 5.3

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

$RRF = (A_x)(C_{is})/(A_{is})(C_x)$
average RRF = sum of the RRFs/number of standards
%RSD = 100 * (S/X)

A_x = Area of Compound
C_x = Concentration of compound
S = Standard deviation of the RRFs

A_{is} = Area of associated internal standard
C_{is} = Concentration of internal standard
X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound	Reported RRF (RRF 8.0/7.4)	Recalculated RRF (RRF 8.0/7.4)	Reported Average RRF	Recalculated Average RRF	Reported %RSD	Recalculated %RSD
1	ICAL	12/10/2021	PFOA (13C8-PFOA)	0.7734	0.7734	0.8005	0.8005	4.8	4.8
	30731		PFOS (13C8-PFOS)	1.0461	1.0461	1.0637	1.0637	3.0	3.0
2			PFOA (13C8-PFOA)						
			PFOS (13C8-PFOS)						
3			PFOA (13C8-PFOA)						
			PFOS (13C8-PFOS)						

LDC #: 31446J6

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Calculation Verification

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DOD QSM 5.3

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
RRF = (Ax)(Cis)/(Ais)(Cx)

Where:
ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
Ax = Area of compound
Cx = Concentration of compound,
Ais = Area of associated internal standard
Cis = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (IS)	True Conc	Reported Conc	Recalculated Conc	Reported %D	Recalculated %D
1	21DEC16-60	12/16/2021	PFOA (13C8-PFOA)	2.000	2.100	2.102	5.1	5.1
			PFOS (13C8-PFOS)	1.850	1.790	1.791	3.3	3.2
2	21DEC22-48	12/22/2021	PFOA (13C8-PFOA)	2.000	2.090	2.094	4.7	4.7
			PFOS (13C8-PFOS)	1.850	1.780	1.778	4.0	3.9
3			PFOA (13C8-PFOA)					
			PFOS (13C8-PFOS)					
4			PFOA (13C8-PFOA)					
			PFOS (13C8-PFOS)					
5			PFOA (13C8-PFOA)					
			PFOS (13C8-PFOS)					

LDC # 53144B6

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

Reviewer: SC

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DOD QSM 5.3

The percent recoveries (%R) and relative percent differences (RPD) of the matrix spike and matrix spike duplicate were recalculated for the compounds identified below using the following calculation:

SSC = (Area spike) (Conc IS) / (Area IS) (average RRF spike)

%Recovery = 100 * (SSC - SC)/SA

Where: SSC = Spiked concentration, SA = Spike added, SC = Sample concentration

RPD = | MS - MSD | * 2/(MS + MSD)

MS = Matrix spike recovery, MSD = Matrix spike duplicate recovery

MS/MSD ID: 35/36

Compound	SA (ng/L)		SC (ng/L)	SSC (ng/L)		MS Percent Recovery		MSD Percent Recovery		MS/MSD RPD	
	MS	MSD		MS	MSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
PFOA	24.1	24.4	0.00	18.1	17.7	75	75	73	73	2	2
PFOS	22.3	22.6	0.00	15.7	16.4	71	70	73	73	4	4

LDC #: 53144B6

VALIDATION FINDINGS WORKSHEET
LCS Results Verification

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DOD QSM 5.3

The percent recoveries (%R) and relative percent differences (RPD) of the laboratory control sample and laboratory control duplicate were recalculated for the compounds identified below using the following calculation:

SSC = (Area spike) (Conc IS) / (Area IS) (average RRF spike)
%Recovery = 100 * SSC/SA

Where:
SSC = Spiked concentration
SA = Spike added
LCS = Laboratory control spike recovery
LCSD = Laboratory control spike duplicate recovery

RPD = | LCS - LCSD | * 2/(LCS + LCSD)

LCS/LCSD ID: LCS 410-208135

Compound	SA (ng/L)		SSC (ng/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
PFOA	25.6		25.3		99	99				
PFOS	23.7		22.5		95	95				

LDC #: 53144D96

VALIDATION FINDINGS WORKSHEET
Sample Results Verification

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DOD QSM 5.3

Compound results for all Level IV samples reported with a positive detect were recalculated and verified using the following equation:

$$\text{Concentration} = \frac{(Ax)\,(Vt)\,(Df)}{(Ais)\,(RRF)\,(Wt)\,(\%S)}$$

Where:

Ax = Area or height of the peak for the compound to be measured
Ais = Area or height of the peak for the internal standard
Cis = Concentration of the internal standard
DF = Dilution factor
Vt = Volume of extract in milliters (mL)
RRF = Average relative response factor
Wt = Weight of sample in grams (g)
Vo = Volume of sample in milliliters (mL)

Sample #	Compound	Ax	Ais	Cis (ng/mL)	DF	RRF	Vt (mL)	Vo (mL)	%S	Calculated Concentration (ng/L)	Reported Concentration (ng/L)	% Diff
1	PFOA	331344	4971347	10.00	1	0.8005	1	277.60		3.0	3.0	
2 (1RE)	PFOA	292096	3315544	10.00	1	0.8005	1	278.80		3.9	3.9	

LABORATORY DATA CONSULTANTS, INC.
2701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Bus: 760-827-1100 Fax: 760-827-1099

EA Engineering, Science, & Technology, Inc.
2200 Sixth Ave., Suite 707
Seattle, WA 98121
ATTN: Ms. Sherri Wunderlich
swunderlich@eaest.com

March 9, 2022

SUBJECT: Keyport LTM - Data Validation

Dear Ms. Wunderlich,

Enclosed is the final validation report for the fraction listed below. This SDG was received on January 19, 2022. Attachment 1 is a summary of the samples that were reviewed for the analysis.

LDC Project #53180_RV3:

SDG #	Fraction
410-66184-1	Perfluoroalkyl & Polyfluoroalkyl Substances

The data validation was performed under Stage 2B validation guidelines. The analysis was validated using the following documents and variances, as applicable to the method:

- Final Tier I Sampling and Analysis Plan, Groundwater Sampling at Operable Unit 1, Area 1 Former Landfill and Long-Term Monitoring at Operable Unit 2, Area 2 Van Meter Road Spill/Drum Storage Site, Naval Base Kitsap Keyport, Keyport, Washington (October 2021)
- NAVFAC Northwest Standard Operating Procedure: Field Procedures Manual (Naval Facilities Engineering Command Northwest, 2015)
- U.S. Department of Defense (DoD) General Validation Guidelines (November 2019)
- DoD Data Validation Guidelines Module 3: Data Validation Procedure for Per- and Polyfluoroalkyl Substances Analysis by Quality Systems Manual for Environmental Laboratories (QSM) Table B-15 (2020)

Please feel free to contact us if you have any questions.

Sincerely,

Pei Geng
Project Manager/Senior Chemist
pgeng@lab-data.com

90/10 2B/4 EDD

LDC# 53180 (EA Engineering - Seattle, WA / Keyport LTM)

PO# 23092

LDC	SDG#	DATE REC'D	(2) DATE DUE	PFAs (537M/ QSM5.3)																													
Matrix:	Water/Soil			W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S
A	410-66184-1	01/19/22	02/02/22	19	0																												
A	410-66184-1	01/19/22	02/02/22	3	0																												
Total	T/PG			22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22

Shaded cells indicate Stage 4 validation (all other cells are Stage 2B validation). Sample counts do not include MS, MSD, and DUP's.

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Keyport LTM

LDC Report Date: March 8, 2022

Parameters: Perfluoroalkyl & Polyfluoroalkyl Substances

Validation Level: Stage 2B

Laboratory: Eurofins, Lancaster, PA

Sample Delivery Group (SDG): 410-66184-1

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
GM-21-002	410-66184-1	Water	12/08/21
GM-21-002RE	410-66184-1RE	Water	12/08/21
GM-21-003	410-66184-2	Water	12/08/21
GM-21-003RE	410-66184-2RE	Water	12/08/21
GM-21-009	410-66184-3	Water	12/08/21
GM-21-010	410-66184-4	Water	12/08/21
GM-21-010RE	410-66184-4RE	Water	12/08/21
GM-21-016	410-66184-5	Water	12/08/21
GM-21-020	410-66184-6	Water	12/08/21
GM-21-020RE	410-66184-6RE	Water	12/08/21
GM-21-021	410-66184-7	Water	12/08/21
GM-21-021RE	410-66184-7RE	Water	12/08/21
GM-21-022	410-66184-8	Water	12/08/21
GM-21-022RE	410-66184-8RE	Water	12/08/21
GM-21-024	410-66184-9	Water	12/08/21
GM-21-024RE	410-66184-9RE	Water	12/08/21
GM-21-025	410-66184-10	Water	12/08/21
GM-21-025RE	410-66184-10RE	Water	12/08/21
GM-21-052	410-66184-11	Water	12/08/21
GM-21-052RE	410-66184-11RE	Water	12/08/21
GM-21-053	410-66184-12	Water	12/08/21
GM-21-053RE	410-66184-12RE	Water	12/08/21
GM-21-009RE	410-66184-3RE	Water	12/08/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Tier I Sampling and Analysis Plan, Groundwater Sampling at Operable Unit 1, Area 1 Former Landfill and Long-Term Monitoring at Operable Unit 2, Area 2 Van Meter Road Spill/Drum Storage Site, Naval Base Kitsap Keyport, Keyport, Washington (October 2021), the NAVFAC Northwest Standard Operating Procedure: Field Procedures Manual (Naval Facilities Engineering Command Northwest, 2015), the U.S. Department of Defense (DoD) General Validation Guidelines (November 2019), and the DoD Data Validation Guidelines Module 3: Data Validation Procedure for Per- and Polyfluoroalkyl Substances Analysis by Quality Systems Manual for Environmental Laboratories (QSM) Table B-15 (2020). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) by Environmental Protection Agency (EPA) Method 537 Modified and LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DoD QSM 5.3

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

X (Exclusion of data recommended): The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Exclusion of the data is recommended.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Codes

H	Holding times were exceeded.
S	Surrogate recovery was outside QC limits.
C	Calibration %RSD or %D were noncompliant.
R	Calibration RRF was <0.05.
B	Presumed contamination from preparation (method) blank.
L	Laboratory Blank Spike/Blank Spike Duplicate %R was not within control limits.
Q	MS/MSD recovery was poor or RPD high.
I	Internal standard performance was unsatisfactory.
M	Tuning (BFB or DFTPP) was noncompliant.
T	Presumed contamination from trip blank.
+	False positive – reported compound was not present. Not applicable.
-	False negative – compound was present but not reported.
F	Presumed contamination from FB, or ER.
$	Reported result or other information was incorrect.
?	TIC identity or reported retention time has been changed.
D	The analysis with this flag should not be used because another more technically sound analysis is available.
P	Instrument performance for pesticides was poor.
*#	Unusual problems found with the data that have been described in Section 2.2.3.3, "Data Validation Findings." The number following the asterisk (*) will indicate the subsection where a description of the problem can be found.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. LC/MS Instrument Performance Check

Instrument performance was checked and the requirements were met.

III. Initial Calibration and Initial Calibration Verification

Initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all analytes.

For each calibration standard, all analytes were within 70-130% of their true value.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all analytes.

IV. Continuing Calibration and Instrument Sensitivity Check

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 30.0% for all analytes.

The percent differences (%D) of the instrument sensitivity check (ISC) were less than or equal to 30.0% for all analytes.

All analyte concentrations were at the limit of quantitation (LOQ) for the ISC standard.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Analyte	Concentration	Associated Samples
MB 410-205983/1-A	12/16/21	Perfluorooctanesulfonic acid	0.586 ng/L	GM-21-002 GM-21-003 GM-21-009 GM-21-010 GM-21-016 GM-21-020 GM-21-021 GM-21-022 GM-21-024

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater (>5X) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration	Modified Final Concentration
GM-21-022	Perfluorooctanesulfonic acid	2.6 ng/L	2.6J ng/L

VI. Field Blanks

Sample FB-120821 (from SDG 410-66173-1) was identified as a field blank. No contaminants were found.

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Field Duplicates

Samples GM-21-002 and GM-21-003, GM-21-002RE and GM-21-003RE, GM-21-020 and GM-21-021, GM-21-020RE and GM-21-021RE, GM-21-052 and GM-21-053, and GM-21-052RE and GM-21-053RE were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (ng/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	GM-21-002-12082021	GM-21-003-12082021				
Perfluorobutanesulfonic acid	1.1	1.1	-	0 (≤1.8)	-	-
Perfluoroheptanoic acid	0.74	0.82	-	0.08 (≤1.8)	-	-
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	0.52	0.46	-	0.06 (≤1.8)	-	-
Perfluorooctanoic acid	3.4	3.7	8 (≤30)	-	-	-
Perfluorohexanoic acid	2.2	2.2	0 (≤30)	-	-	-

Analyte	Concentration (ng/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	GM-21-002-12082021	GM-21-003-12082021				
Perfluorohexanesulfonic acid	0.67	0.67	-	0 (≤1.8)	-	-

Analyte	Concentration (ng/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	GM-21-002-12082021RE	GM-21-003-12082021RE				
Perfluorobutanesulfonic acid	0.96	1.2	-	0.24 (≤1.8)	-	-
Perfluoroheptanoic acid	0.99	0.81	-	0.18 (≤1.8)	-	-
Perfluorooctanoic acid	3.5	3.7	6 (≤30)	-	-	-
Perfluorohexanoic acid	2.3	2.3	0 (≤30)	-	-	-
Perfluorohexanesulfonic acid	0.65	0.69	-	0.04 (≤1.8)	-	-

Analyte	Concentration (ng/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	GM-21-020-12082021	GM-21-021-12082021				
Perfluorobutanesulfonic acid	0.44	0.89U	-	0.45 (≤1.8)	-	-

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target analytes were within QC limits with the following exceptions:

Sample	Labeled Compound	%R (Limits)	Affected Analyte	Flag	A or P
GM-21-002	13C2 PFTeDA	15 (50-150)	Perfluorotetradecanoic acid	X	P
GM-21-002	13C2 PFTeDA	33 (50-150)	Perfluorododecanoic acid Perfluorotridecanoic acid	UJ (all non-detects) UJ (all non-detects)	P
GM-21-002RE	13C2 PFTeDA	19 (50-150)	Perfluorotetradecanoic acid	X	P
GM-21-003	13C2 PFTeDA	16 (50-150)	Perfluorotetradecanoic acid	X	P
GM-21-003	13C2 PFTeDA	40 (50-150)	Perfluorododecanoic acid Perfluorotridecanoic acid	UJ (all non-detects) UJ (all non-detects)	P
GM-21-003RE	13C2 PFTeDA	44 (50-150)	Perfluorotetradecanoic acid	UJ (all non-detects)	P

Sample	Labeled Compound	%R (Limits)	Affected Analyte	Flag	A or P
GM-21-009	13C2 PFTeDA	5 (50-150)	Perfluorotetradecanoic acid	X	P
GM-21-009	13C2-PFDoDA 13C7 PFUnA	31 (50-150) 49 (50-150)	Perfluorododecanoic acid Perfluorotridecanoic acid Perfluoroundecanoic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P
GM-21-009RE	13C2 PFTeDA	26 (50-150)	Perfluorotetradecanoic acid	UJ (all non-detects)	P
GM-21-010	13C2 PFTeDA 13C2-PFDoDA 13C9 PFNA d5-NEtFOSAA d3-NMeFOSAA 13C7 PFUnA 13C6 PFDA 13C8 PFOS	0.03 (50-150) 0.1 (50-150) 7 (50-150) 1 (50-150) 2 (50-150) 0.4 (50-150) 2 (50-150) 5 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid Perfluorononanoic acid NEtFOSAA NMeFOSAA Perfluoroundecanoic acid Perfluorodecanoic acid Perfluorooctanesulfonic acid 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	X	P
GM-21-010	13C8 PFOA	26 (50-150)	Perfluorooctanoic acid	J (all detects)	P
GM-21-010RE	13C2 PFTeDA 13C2-PFDoDA	20 (50-150) 49 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P
GM-21-016	13C2 PFTeDA 13C2-PFDoDA 13C9 PFNA d5-NEtFOSAA d3-NMeFOSAA 13C7 PFUnA 13C6 PFDA 13C8 PFOS	0.05 (50-150) 0.06 (50-150) 8 (50-150) 0.7 (50-150) 1 (50-150) 0.2 (50-150) 1 (50-150) 4 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid Perfluorononanoic acid NEtFOSAA NMeFOSAA Perfluoroundecanoic acid Perfluorodecanoic acid Perfluorooctanesulfonic acid 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	X	P
GM-21-016	13C8 PFOA	33 (50-150)	Perfluorooctanoic acid	J (all detects)	P
GM-21-020	13C2 PFTeDA 13C2-PFDoDA d5-NEtFOSAA 13C7 PFUnA	0.05 (50-150) 1 (50-150) 19 (50-150) 6 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid NEtFOSAA Perfluoroundecanoic acid	X	P
GM-21-020	13C9 PFNA d3-NMeFOSAA 13C6 PFDA 13C8 PFOS	48 (50-150) 22 (50-150) 23 (50-150) 43 (50-150)	Perfluorononanoic acid NMeFOSAA Perfluorodecanoic acid Perfluorooctanesulfonic acid 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects) UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P
GM-21-020RE	13C2 PFTeDA	16 (50-150)	Perfluorotetradecanoic acid	X	P

Sample	Labeled Compound	%R (Limits)	Affected Analyte	Flag	A or P
GM-21-021	13C2 PFTeDA 13C2-PFDoDA 13C9 PFNA d5-NEtFOSAA d3-NMeFOSAA 13C7 PFUnA 13C6 PFDA 13C8 PFOS	0.01 (50-150) 0.02 (50-150) 8 (50-150) 0.5 (50-150) 0.8 (50-150) 0.06 (50-150) 0.5 (50-150) 5 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid Perfluorononanoic acid NEtFOSAA NMeFOSAA Perfluoroundecanoic acid Perfluorodecanoic acid Perfluorooctanesulfonic acid 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	X	P
GM-21-021	13C8 PFOA	42 (50-150)	Perfluorotetradecanoic acid	UJ (all non-detects)	P
GM-21-021RE	13C2 PFTeDA	22 (50-150)	Perfluorotetradecanoic acid	UJ (all non-detects)	P
GM-21-022	13C2 PFTeDA 13C2-PFDoDA	3 (50-150) 11 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid	X	P
GM-21-022	d5-NEtFOSAA d3-NMeFOSAA 13C7 PFUnA 13C6 PFDA	41 (50-150) 41 (50-150) 21 (50-150) 41 (50-150)	NEtFOSAA NMeFOSAA Perfluoroundecanoic acid Perfluorodecanoic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P
GM-21-022RE	13C2 PFTeDA 13C2-PFDoDA d5-NEtFOSAA d3-NMeFOSAA 13C7 PFUnA 13C6 PFDA 13C8 PFOS	0.5 (50-150) 3 (50-150) 10 (50-150) 10 (50-150) 6 (50-150) 11 (50-150) 15 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid NEtFOSAA NMeFOSAA Perfluoroundecanoic acid Perfluorodecanoic acid 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	X	P
GM-21-022RE	13C8 PFOS	15 (50-150)	Perfluorooctanesulfonic acid	X	P
GM-21-022RE	13C9 PFNA	21 (50-150)	Perfluorononanoic acid	UJ (all non-detects)	P
GM-21-022RE	13C8 PFOA	43 (50-150)	Perfluorooctanoic acid	J (all detects)	P
GM-21-024	13C3 PFHxS 13C2 PFTeDA 13C2-PFDoDA 13C9 PFNA d5-NEtFOSAA d3-NMeFOSAA 13C7 PFUnA 13C6 PFDA 13C8 PFOS	14 (50-150) 0.03 (50-150) 0.02 (50-150) 1 (50-150) 0.3 (50-150) 0.2 (50-150) 0.05 (50-150) 0.2 (50-150) 0.7 (50-150)	Perfluorohexanesulfonic acid Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid Perfluorononanoic acid NEtFOSAA NMeFOSAA Perfluoroundecanoic acid Perfluorodecanoic acid Perfluorooctanesulfonic acid 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	X	P
GM-21-024	13C8 PFOA	7 (50-150)	Perfluorooctanoic acid	X	P

Sample	Labeled Compound	%R (Limits)	Affected Analyte	Flag	A or P
GM-21-024	13C4 PFHpA	32 (50-150)	Perfluoroheptanoic acid 4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	J (all detects) UJ (all non-detects)	P
GM-21-024RE	13C2 PFTeDA	12 (50-150)	Perfluorotetradecanoic acid	X	P
GM-21-024RE	13C2-PFDoDA 13C7 PFUnA	28 (50-150) 40 (50-150)	Perfluorododecanoic acid Perfluorotridecanoic acid Perfluoroundecanoic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P
GM-21-025	13C2 PFTeDA 13C2-PFDoDA 13C7 PFUnA	4 (50-150) 9 (50-150) 13 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid Perfluoroundecanoic acid	X	P
GM-21-025	d5-NEtFOSAA d3-NMeFOSAA 13C6 PFDA 13C8 PFOS	20 (50-150) 25 (50-150) 26 (50-150) 44 (50-150)	NEtFOSAA NMeFOSAA Perfluorodecanoic acid Perfluorooctanesulfonic acid 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects) UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P
GM-21-025RE	13C2 PFTeDA	24 (50-150)	Perfluorotetradecanoic acid	UJ (all non-detects)	P
GM-21-052	13C2 PFTeDA 13C2-PFDoDA 13C7 PFUnA	1 (50-150) 6 (50-150) 15 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid Perfluoroundecanoic acid	X	P
GM-21-052	d5-NEtFOSAA d3-NMeFOSAA 13C6 PFDA	38 (50-150) 39 (50-150) 38 (50-150)	NEtFOSAA NMeFOSAA Perfluorodecanoic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P
GM-21-052RE	13C2 PFTeDA	25 (50-150)	Perfluorotetradecanoic acid	UJ (all non-detects)	P
GM-21-053	13C2 PFTeDA 13C2-PFDoDA d5-NEtFOSAA d3-NMeFOSAA 13C7 PFUnA 13C6 PFDA	0.06 (50-150) 0.3 (50-150) 5 (50-150) 7 (50-150) 2 (50-150) 11 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid NEtFOSAA NMeFOSAA Perfluoroundecanoic acid Perfluorodecanoic acid	X	P
GM-21-053	13C9 PFNA 13C8 PFOS	32 (50-150) 26 (50-150)	Perfluorononanoic acid Perfluorooctanesulfonic acid 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P
GM-21-053RE	13C2 PFTeDA 13C2-PFDoDA	2 (50-150) 19 (50-150)	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid	X	P
GM-21-053RE	d5-NEtFOSAA d3-NMeFOSAA 13C7 PFUnA	34 (50-150) 40 (50-150) 38 (50-150)	NEtFOSAA NMeFOSAA Perfluoroundecanoic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P

XI. Target Analyte Quantitation

The laboratory indicated that PFAs are currently being reported as the sum of the branched and linear isomers so both peaks were integrated.

Raw data were not reviewed for Stage 2B validation.

XII. Target Analyte Identification

All target analyte identifications were within validation criteria with the following exceptions:

Sample	Finding	Flag	A or P
GM-21-009RE GM-21-010RE	Results flagged "I" by the laboratory due to ion ratio outside QC limits.	J (all detects)	P

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

In the case where more than one result was reported for an individual sample, the least technically acceptable results were deemed not reportable as follows:

Sample	Analyte	Reason	Flag	A or P
GM-21-002	Perfluorohexanoic acid Perfluoroheptanoic acid Perfluorooctanoic acid Perfluorotridecanoic acid Perfluorododecanoic acid	Results from re-analyses were more usable.	Not reportable	-
GM-21-002RE	All analytes except Perfluorohexanoic acid Perfluoroheptanoic acid Perfluorooctanoic acid Perfluorotridecanoic acid Perfluorododecanoic acid	Results from original analyses were more usable.	Not reportable	-
GM-21-003	Perfluorohexanoic acid Perfluorobutanesulfonic acid Perfluorohexanesulfonic acid Perfluorotetradecanoic acid Perfluorotridecanoic acid Perfluorododecanoic acid	Results from re-analyses were more usable.	Not reportable	-

Sample	Analyte	Reason	Flag	A or P
GM-21-003RE	All analytes except Perfluorohexanoic acid Perfluorobutanesulfonic acid Perfluorohexanesulfonic acid Perfluorotetradecanoic acid Perfluorotridecanoic acid Perfluorododecanoic acid	Results from original analyses were more usable.	Not reportable	-
GM-21-009	Perfluorooctanoic acid Perfluorooctanesulfonic acid Perfluorotetradecanoic acid Perfluorotridecanoic acid Perfluorododecanoic acid Perfluoroundecanoic acid	Results from re-analyses were more usable.	Not reportable	-
GM-21-009RE	All analytes except Perfluorooctanoic acid Perfluorooctanesulfonic acid Perfluorotetradecanoic acid Perfluorotridecanoic acid Perfluorododecanoic acid Perfluoroundecanoic acid	Results from original analyses were more usable.	Not reportable	-
GM-21-010 GM-21-020 GM-21-021 GM-21-024 GM-21-025 GM-21-052 GM-21-053	All analytes	Results from re-analyses were more usable.	Not reportable	-
GM-21-022	Perfluorohexanoic acid Perfluoroheptanoic acid Perfluorooctanoic acid	Results from re-analyses were more usable.	Not reportable	-
GM-21-022RE	All analytes except Perfluorohexanoic acid Perfluoroheptanoic acid Perfluorooctanoic acid	Results from original analyses were more usable.	Not reportable	-

Due to labeled compound %R and ion ratio data were qualified as estimated in twenty-one samples.

Due to labeled compound %R, data were recommended for exclusion in six samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Keyport LTM
Perfluoroalkyl & Polyfluoroalkyl Substances - Data Qualification Summary - SDG 410-66184-1

Sample	Analyte	Flag	A or P	Reason (Code)
GM-21-002	Perfluorotetradecanoic acid	X	P	Labeled compounds (%R) (I)
GM-21-003	Perfluorododecanoic acid Perfluorotridecanoic acid	UJ (all non-detects) UJ (all non-detects)	P	Labeled compounds (%R) (I)
GM-21-003RE	Perfluorotetradecanoic acid	UJ (all non-detects)	P	Labeled compounds (%R) (I)
GM-21-009	Perfluorododecanoic acid Perfluorotridecanoic acid Perfluoroundecanoic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P	Labeled compounds (%R) (I)
GM-21-009RE	Perfluorotetradecanoic acid	UJ (all non-detects)	P	Labeled compounds (%R) (I)
GM-21-010RE	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P	Labeled compounds (%R) (I)
GM-21-016	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid Perfluorononanoic acid NEtFOSAA NMeFOSAA Perfluoroundecanoic acid Perfluorodecanoic acid Perfluorooctanesulfonic acid 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	X	P	Labeled compounds (%R) (I)
GM-21-016	Perfluorooctanoic acid	J (all detects)	P	Labeled compounds (%R) (I)
GM-21-020RE	Perfluorotetradecanoic acid	X	P	Labeled compounds (%R) (I)
GM-21-021RE	Perfluorotetradecanoic acid	UJ (all non-detects)	P	Labeled compounds (%R) (I)
GM-21-022	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid	X	P	Labeled compounds (%R) (I)
GM-21-022	NEtFOSAA NMeFOSAA Perfluoroundecanoic acid Perfluorodecanoic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P	Labeled compounds (%R) (I)

Sample	Analyte	Flag	A or P	Reason (Code)
GM-21-022RE	Perfluorooctanesulfonic acid	X	P	Labeled compounds (%R) (I)
GM-21-024RE	Perfluorotetradecanoic acid	X	P	Labeled compounds (%R) (I)
GM-21-024RE	Perfluorododecanoic acid Perfluorotridecanoic acid Perfluoroundecanoic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P	Labeled compounds (%R) (I)
GM-21-025RE	Perfluorotetradecanoic acid	UJ (all non-detects)	P	Labeled compounds (%R) (I)
GM-21-052RE	Perfluorotetradecanoic acid	UJ (all non-detects)	P	Labeled compounds (%R) (I)
GM-21-053RE	Perfluorotetradecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid	X	P	Labeled compounds (%R) (I)
GM-21-053RE	NEtFOSAA NMeFOSAA Perfluoroundecanoic acid	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P	Labeled compounds (%R) (I)
GM-21-009RE GM-21-010RE	Results flagged "I" by the laboratory due to ion ratio outside QC limits.	J (all detects)	P	Target analyte identification (ion ratio) (*XII)
GM-21-002	Perfluorohexanoic acid Perfluoroheptanoic acid Perfluorooctanoic acid Perfluorotridecanoic acid Perfluorododecanoic acid	Not reportable	-	Overall assessment of data (*XIV)
GM-21-002RE	All analytes except Perfluorohexanoic acid Perfluoroheptanoic acid Perfluorooctanoic acid Perfluorotridecanoic acid Perfluorododecanoic acid	Not reportable	-	Overall assessment of data (*XIV)
GM-21-003	Perfluorohexanoic acid Perfluorobutanesulfonic acid Perfluorohexanesulfonic acid Perfluorotetradecanoic acid Perfluorotridecanoic acid Perfluorododecanoic acid	Not reportable	-	Overall assessment of data (*XIV)
GM-21-003RE	All analytes except Perfluorohexanoic acid Perfluorobutanesulfonic acid Perfluorohexanesulfonic acid Perfluorotetradecanoic acid Perfluorotridecanoic acid Perfluorododecanoic acid	Not reportable	-	Overall assessment of data (*XIV)

Sample	Analyte	Flag	A or P	Reason (Code)
GM-21-009	Perfluorooctanoic acid Perfluorooctanesulfonic acid Perfluorotetradecanoic acid Perfluorotridecanoic acid Perfluorododecanoic acid Perfluoroundecanoic acid	Not reportable	-	Overall assessment of data (*XIV)
GM-21-009RE	All analytes except Perfluorooctanoic acid Perfluorooctanesulfonic acid Perfluorotetradecanoic acid Perfluorotridecanoic acid Perfluorododecanoic acid Perfluoroundecanoic acid	Not reportable	-	Overall assessment of data (*XIV)
GM-21-010 GM-21-020 GM-21-021 GM-21-024 GM-21-025 GM-21-052 GM-21-053	All analytes	Not reportable	-	Overall assessment of data (*XIV)
GM-21-022	Perfluorohexanoic acid Perfluoroheptanoic acid Perfluorooctanoic acid	Not reportable	-	Overall assessment of data (*XIV)
GM-21-022RE	All analytes except Perfluorohexanoic acid Perfluoroheptanoic acid Perfluorooctanoic acid	Not reportable	-	Overall assessment of data (*XIV)

Keyport LTM
Perfluoroalkyl & Polyfluoroalkyl Substances - Laboratory Blank Data Qualification Summary - SDG 410-66184-1

No Sample Data Qualified in this SDG

Keyport LTM
Perfluoroalkyl & Polyfluoroalkyl Substances - Field Blank Data Qualification Summary - SDG 410-66184-1

No Sample Data Qualified in this SDG

LDC #: 53180A96 **VALIDATION COMPLETENESS WORKSHEET** Date: 2/3/22

SDG #: 410-66184-1 Stage 2B/4 Page: 1 of 1

Laboratory: Eurofins, Lancaster, PA Reviewer: [illegible]

2nd Reviewer: [illegible]

METHOD: GC Perfluoroalkyl & Polyfluoroalkyl Substances (EPA Method 537M/QSM 5.3 B-15)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	LC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	RSD ≤ 20 %R/CV ≤ 30
IV.	Continuing calibration/ISC	A/A	D ≤ 30
V.	Laboratory Blanks	SW	
V.I	Field blanks	ND	FB-120821 (410-66173-1)
VII.	Matrix spike/Matrix spike duplicates	N	
VIII.	Laboratory control samples	A	LCSD
IX.	Field duplicates	SW	D = 1+3, 2+4, 9+11, 10+12*, 19+21*, 20+22*
X.	Labeled Compounds	SW	
XI.	Target analyte quantitation	N	Not reviewed for Stage 2B validation.
XII.	Target analyte identification	SW	Not reviewed for Stage 2B validation.
XIII.	System performance	N	Not reviewed for Stage 2B validation.
XIV.	Overall assessment of data	SW	

Note: A = Acceptable ND = No compounds detected D = Duplicate SB=Source blank
N = Not provided/applicable R = Rinsate TB = Trip blank OTHER:
SW = See worksheet FB = Field blank EB = Equipment blank

** Indicates sample underwent Stage 4 validation

	Client ID	Lab ID	Matrix	Date
1 1	GM-21-002	410-66184-1	Water	12/08/21
2 3	GM-21-002RE	410-66184-1RE	Water	12/08/21
3 1	GM-21-003	410-66184-2	Water	12/08/21
4 3	GM-21-003RE	410-66184-2RE	Water	12/08/21
5 1	GM-21-009**	410-66184-3**	Water	12/08/21
6 1	GM-21-010	410-66184-4	Water	12/08/21
7 3	GM-21-010RE	410-66184-4RE	Water	12/08/21
8 1	GM-21-016	410-66184-5	Water	12/08/21
9 1	GM-21-020	410-66184-6	Water	12/08/21
10 3	GM-21-020RE	410-66184-6RE	Water	12/08/21
11 1	GM-21-021	410-66184-7	Water	12/08/21
12 3	GM-21-021RE	410-66184-7RE	Water	12/08/21
13 1	GM-21-022**	410-66184-8**	Water	12/08/21
14 3	GM-21-022RE**	410-66184-8RE**	Water	12/08/21
15 1	GM-21-024	410-66184-9	Water	12/08/21

LDC #: 53180A96 **VALIDATION COMPLETENESS WORKSHEET** Date: 2/3/22

SDG #: 410-66184-1 Stage 2B/4 Page: 2 of 2

Laboratory: Eurofins, Lancaster, PA Reviewer: [illegible]

2nd Reviewer: [illegible]

METHOD: GC Perfluoroalkyl & Polyfluoroalkyl Substances (EPA Method 537M/QSM 5.3 B-15)

	Client ID	Lab ID	Matrix	Date
16 3	GM-21-024RE	410-66184-9RE	Water	12/08/21
17 2	GM-21-025	410-66184-10	Water	12/08/21
18 4	GM-21-025RE	410-66184-10RE	Water	12/08/21
19 2	GM-21-052	410-66184-11	Water	12/08/21
20 4	GM-21-052RE	410-66184-11RE	Water	12/08/21
21 2	GM-21-053	410-66184-12	Water	12/08/21
22 4	GM-21-053RE	410-66184-12RE	Water	12/08/21
23 3	GM-21-009RE			
24				
25				

Notes:

1	205983						
2	207022						
3	207809						
4	208162						

TARGET COMPOUND WORKSHEET

METHOD: PFAS

A. Perfluorobutanoic acid	W. 6:2 Fluorotelomer sulfonate	
B. Perfluoropentanoic acid	X. 8:2 Fluorotelomer sulfonate	
C. Perfluorohexanoic acid	Y. 4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	
D. Perfluoroheptanoic acid	Z. HFPO-DA (GenX)	
E. Perfluorooctanoic acid	AA. 9Cl-PF3ONS (F-53B Major)	
F. Perfluorononanoic acid	BB. 11Cl-PF3OUdS (F-53B Minor)	
G. Perfluorodecanoic acid	CC. Hexafluoropropylene oxide dimer acid (HFPO-DA)	
H. Perfluoroundecanoic acid	DD. 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	
I. Perfluorododecanoic acid	EE. 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	
J. Perfluorotridecanoic acid	FF. 4:2 Fluorotelomersulfonic acid	
K. Perfluorotetradecanoic acid	GG. 6:2 Fluorotelomersulfonic acid	
L. Perfluorobutanesulfonic acid	HH. 8:2 Fluorotelomersulfonic acid	
M. Perfluoropentanesulfonic acid	II. 1H,1H,2H,2H-perfluorohexane sulfonic acid	
N. Perfluorohexanesulfonic acid	JJ. 1H,1H,2H,2H- Perfluorooctanesulfonic acid	
O. Perfluoroheptanesulfonic acid	KK. 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid	
P. Perfluorooctanesulfonic acid	LL. NMeFOSA	
Q. Perfluorononanesulfonic acid	MM. 3:3 Fluorotelomer carboxylate	
R. Perfluorodecanesulfonic acid	NN. 5:3 Fluorotelomer carboxylate	
S. Perfluorooctanesulfonamide	OO. 7:3 Fluorotelomer carboxylate	
T. NMeFOSAA	PP. Perfluorooctadecanoic acid	
U. NEtFOSAA		
V. 4:2 Fluorotelomer sulfonate		

LDC #: 53180A96

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: RC

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DoD QSM 5.3

Blank extraction date: 12/16/21
Conc. units: ng/L **Associated Samples:** 1, 3, 5, 6, 8, 9, 11, 13, 15

Analyte	Blank ID	Sample Identification								
MB 410-205983/1-A	5X	13								
P	0.586	2.93	2.6/J							

Blank extraction date:
Conc. units: **Associated Samples:**

Analyte	Blank ID	Sample Identification								

LDC #: 53180A96

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: SC

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DOD QSM 5.3

Analyte	Concentration (ng/L)		RPD≤30	Difference <5XLOQ	Difference Limit:<LOQ	Qualification
	GM-21-002-12082021	GM-21-003-12082021				
Perfluorobutanesulfonic acid	1.1	1.1		0	1.8	
Perfluoroheptanoic acid	0.74	0.82		0.08	1.8	
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	0.52	0.46		0.06	1.8	
Perfluorooctanoic acid	3.4	3.7	8			
Perfluorohexanoic acid	2.2	2.2	0			
Perfluorohexanesulfonic acid	0.67	0.67		0	1.8	

Analyte	Concentration (ng/L)		RPD≤30	Difference <5XLOQ	Difference Limit:<LOQ	Qualification
	GM-21-002-12082021RE	GM-21-003-12082021RE				
Perfluorobutanesulfonic acid	0.96	1.2		0.24	1.8	
Perfluoroheptanoic acid	0.99	0.81		0.18	1.8	
Perfluorooctanoic acid	3.5	3.7	6			
Perfluorohexanoic acid	2.3	2.3	0			
Perfluorohexanesulfonic acid	0.65	0.69		0.04	1.8	

Analyte	Concentration (ng/L)		RPD≤30	Difference <5XLOQ	Difference Limit:<LOQ	Qualification
	GM-21-020-12082021	GM-21-021-12082021				
Perfluorobutanesulfonic acid	0.44	0.89U		0.45	1.8	

LDC #: 53180X96

VALIDATION FINDINGS WORKSHEET
Labeled Compounds

Reviewer: SC

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DOD QSM 5.3

Percent recoveries (%R) were within QC limits with the exceptions identified below.

#	Sample ID	Labeled Compound	%R (50-150)	Qualifications
	GM-21-002 (ND)	13C2 PFTeDA	15	X/P (K)
		13C2-PFDoDA	33	J/UJ/P (I,J)
	GM-21-002RE	13C2 PFTeDA	19	X/P (K)
	GM-21-003	13C2 PFTeDA	16	X/P (K)
		13C2-PFDoDA	40	J/UJ/P (I,J)
	GM-21-003RE	13C2 PFTeDA	44	J/UJ/P (K)
	GM-21-009	13C2 PFTeDA	5	X/P (K)
		13C2-PFDoDA	31	J/UJ/P (I,J)
		13C7 PFUnA	49	J/UJ/P (H)
	GM-21-009RE	13C2 PFTeDA	26	J/UJ/P (K)
	GM-21-010	13C2 PFTeDA	0.03	X/P (K)
		13C2-PFDoDA	0.1	X/P (I,J)
		13C9 PFNA	7	X/P (F)
		d5-NEtFOSAA	1	X/P (U)
		d3-NMeFOSAA	2	X/P (T)
		13C7 PFUnA	0.4	X/P (H)
		13C6 PFDA	2	X/P (G)
		13C8 PFOS	5	X/P (P,DD,EE)
	(Det)	13C8 PFOA	26	J/UJ/P (E)
	GM-21-010RE (ND)	13C2 PFTeDA	20	J/UJ/P (K)
		13C2-PFDoDA	49	J/UJ/P (I,J)
	GM-21-016	13C2 PFTeDA	0.05	X/P (K)
		13C2-PFDoDA	0.06	X/P (I,J)
		13C9 PFNA	8	X/P (F)
		d5-NEtFOSAA	0.7	X/P (U)
		d3-NMeFOSAA	1	X/P (T)

LDC #: 53180A96

VALIDATION FINDINGS WORKSHEET
Labeled Compounds

Reviewer: SC

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DOD QSM 5.3

Percent recoveries (%R) were within QC limits with the exceptions identified below.

#	Sample ID	Labeled Compound	%R (50-150)	Qualifications
	GM-21-016 (cont'd) (ND)	13C7 PFUnA	0.2	X/P (H)
		13C6 PFDA	1	X/P (G)
		13C8 PFOS	4	X/P (P,DD,EE)
	(ND)	13C8 PFOA	33	J/UJ/P (E)
	GM-21-020 (ND)	13C2 PFTeDA	0.05	X/P (K)
		13C2-PFDoDA	1	X/P (I,J)
		13C9 PFNA	48	J/UJ/P (F)
		d5-NEtFOSAA	19	X/P (U)
		d3-NMeFOSAA	22	J/UJ/P (T)
		13C7 PFUnA	6	X/P (H)
		13C6 PFDA	23	J/UJ/P (G)
		13C8 PFOS	43	J/UJ/P (P,DD,EE)
	GM-21-020RE	13C2 PFTeDA	16	X/P (K)
	GM-21-021	13C2 PFTeDA	0.01	X/P (K)
		13C2-PFDoDA	0.02	X/P (I,J)
		13C9 PFNA	8	X/P (F)
		d5-NEtFOSAA	0.5	X/P (U)
		d3-NMeFOSAA	0.8	X/P (T)
		13C7 PFUnA	0.06	X/P (H)
		13C6 PFDA	0.5	X/P (G)
		13C8 PFOS	5	X/P (P,DD,EE)
		13C8 PFOA	42	J/UJ/P (E)
	GM-21-021RE	13C2 PFTeDA	22	J/UJ/P (K)
	GM-21-022	13C2 PFTeDA	3	X/P (K)
		13C2-PFDoDA	11	X/P (I,J)
		d5-NEtFOSAA	41	J/UJ/P (U)
		d3-NMeFOSAA	41	J/UJ/P (T)
		13C7 PFUnA	21	J/UJ/P (H)
		13C6 PFDA	41	J/UJ/P (G)

LDC #: 53180A96

VALIDATION FINDINGS WORKSHEET
Labeled Compounds

Reviewer: SC

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DOD QSM 5.3

Percent recoveries (%R) were within QC limits with the exceptions identified below.

#	Sample ID	Labeled Compound	%R (50-150)	Qualifications
	GM-21-022RE (ND)	13C2 PFTeDA	0.5	X/P (K)
		13C2-PFDoDA	3	X/P (I,J)
		13C9 PFNA	21	J/UJ/P (F)
		d5-NEtFOSAA	10	X/P (U)
		d3-NMeFOSAA	10	X/P (T)
		13C7 PFUnA	6	X/P (H)
		13C6 PFDA	11	X/P (G)
	(P-dup)	13C8 PFOS	15	X/P (P,DD,EE)
	(dup)	13C8 PFOA	43	J/UJ/P (E)
	GM-21-024 (dup) (ND)	13C3 PFHxS	14	X/P (N)
	(D-dup)	13C4 PFHpA	32	J/UJ/P (D, DONA)
	(ND)	13C2 PFTeDA	0.03	X/P (K)
		13C2-PFDoDA	0.02	X/P (I,J)
		13C9 PFNA	1	X/P (F)
		d5-NEtFOSAA	0.3	X/P (U)
		d3-NMeFOSAA	0.2	X/P (T)
		13C7 PFUnA	0.05	X/P (H)
		13C6 PFDA	0.2	X/P (G)
		13C8 PFOS	0.7	X/P (P,DD,EE)
	(dup)	13C8 PFOA	7	X/P (E)
	GM-21-024RE (ND)	13C2 PFTeDA	12	X/P (K)
		13C2-PFDoDA	28	J/UJ/P (I,J)
		13C7 PFUnA	40	J/UJ/P (H)
	GM-21-025	13C2 PFTeDA	4	X/P (K)
		13C2-PFDoDA	9	X/P (I,J)
		d5-NEtFOSAA	20	J/UJ/P (U)
		d3-NMeFOSAA	25	J/UJ/P (T)
		13C7 PFUnA	13	X/P (H)
		13C6 PFDA	26	J/UJ/P (G)
		13C8 PFOS	44	J/UJ/P (P,DD,EE)

LDC #: 53144B96

VALIDATION FINDINGS WORKSHEET
Labeled Compounds

Reviewer: SC

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DOD QSM 5.3

Percent recoveries (%R) were within QC limits with the exceptions identified below.

#	Sample ID	Labeled Compound	%R (50-150)	Qualifications
	GM-21-025RE (ND)	13C2 PFTeDA	24	J/UJ/P (K)
	GM-21-052	13C2 PFTeDA	1	X/P (K)
		13C2-PFDoDA	6	X/P (I,J)
		d5-NEtFOSAA	38	J/UJ/P (U)
		d3-NMeFOSAA	39	J/UJ/P (T)
		13C7 PFUnA	15	X/P (H)
		13C6 PFDA	38	J/UJ/P (G)
	GM-21-052RE	13C2 PFTeDA	25	J/UJ/P (K)
	GM-21-053	13C2 PFTeDA	0.06	X/P (K)
		13C2-PFDoDA	0.3	X/P (I,J)
		13C9 PFNA	32	J/UJ/P (F)
		d5-NEtFOSAA	5	X/P (U)
		d3-NMeFOSAA	7	X/P (T)
		13C7 PFUnA	2	X/P (H)
		13C6 PFDA	11	X/P (G)
		13C8 PFOS	26	J/UJ/P (P,DD,EE)
	GM-21-053RE	13C2 PFTeDA	2	X/P (K)
		13C2-PFDoDA	19	X/P (I,J)
		d5-NEtFOSAA	34	J/UJ/P (U)
		d3-NMeFOSAA	40	J/UJ/P (T)
	↓	13C7 PFUnA	38	J/UJ/P (H)

LDC #: 53180A96

VALIDATION FINDINGS WORKSHEET
Target Analyte Identification

Reviewer: [illegible]

METHOD: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DoD QSM 5.1

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was the signal to noise (S/N) ratio for all analytes within the validation criteria?
Y N N/A Were two transitions and the ion transition ratio per analyte monitored and documented with the exception of PFBA and PFPeA?
Y N N/A Were ion ratios within QC limits?

#	Date	Sample ID	Analyte	Ion ratio (Limits)	Qualifications
		23, 7		Results flagged "I" by the laboratory due to	Jdets/P
				ion ratio outside QC limits.	

LDC #: 53180A96

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

Reviewer: RE

METHOD: LC/MS/MS and Isotope Dilution Compliant with Table B-15 of DoD QSM 5.3

#	Date	Sample ID	Analyte	Finding	Qualifications
		1	C, D, E, I, J	Reextraction more usable (higher results)	HR
		2	All except C, D, E, I, J	Orig more usable (higher)	
		3	C, L, N, K, I, J	RE more usable (higher) (K: labeled %R <20, in orig)	
		4	All except C, L, N, K, I, J	Orig more usable (higher)	
		5	E, P, ~~K~~ K, H, I, J	RE more usable (higher) (K: labeled %R <20 in orig)	
		23	All except E, P, ~~K~~ K, H, I, J	Orig more usable (higher) ~~(several labeled labeled %Rs out %R <20 for K)~~	
		6, ~~8~~, 9, 11, 15, 17, 19, 21	All	RE more usable (several labeled %Rs out in orig)	
		13	C, D, E, ~~R~~	RE more usable (higher results)	
		14	All except above	Orig more usable (several labeled %Rs out in RE)	