Final

November 2020

Fifth Five-Year Review

Naval Base Kitsap

Keyport, Washington

Department of the Navy
Naval Facilities Engineering Command Systems Northwest
1101 Tautog Circle
Silverdale, WA 98315

EXECUTIVE SUMMARY

The fifth five-year review (FYR) of remedial actions at Operable Units (OUs) 1 and 2 of Naval Base Kitsap (NBK) Keyport has been completed pursuant to Section 121(c) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. § 9621(c), and Section 300.430(f)(4)(ii) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 C.F.R. § 300.430(f)(4)(ii).

Because hazardous substances, pollutants, or contaminants remain in place at the OUs above levels that allow for unlimited use and unrestricted exposure, a statutory review (i.e., FYR) is required under CERCLA and the NCP. The purpose of a FYR is to determine whether the remedies selected for implementation in the decision document for a site remain protective of human health and the environment. The data review and technical assessment performed and resulting protectiveness determinations are documented in this FYR report, which also identifies issues that affect current and/or future protectiveness of the remedies and provides recommendations to address these issues.

This FYR was initiated in June 2019 and is based on analytical data generated between July 2014 and June 2019. This FYR report was prepared as part of the CERCLA FYR process using U.S. Navy and United States Environmental Protection Agency (EPA) guidance (U.S. Navy, 2004, 2011b, 2013c, 2014a; EPA, 2001, 2012, and 2016) and organized in accordance with EPA's 2016 recommended template – streamlined to minimize information that has been presented in the previous FYRs.

In accordance with U.S. Navy and EPA guidance, a technical assessment was conducted to determine if: a) the remedies are functioning as intended by the decision documents; b) exposure assumptions, toxicity data, cleanup levels and remedial action objectives identified in the decision documents and used during remedy implementation are still valid and protective; and c) other information has come to light that compromises the protectiveness of the remedies. As a result of the technical assessment, issues or findings (and subsequent recommendations) have been identified for OU 1, OU 2 Area 2, and OU 2 Area 8.

The remedy at OU 1 is short-term protective, as exposure pathways that could result in unacceptable risk are being controlled and monitored via LUCs while additional data are obtained and the conceptual site model is updated. Ecology, EPA, and the Suquamish Tribe do not concur with the Navy's protectiveness determination for OU 1 and feel that a determination of 'protectiveness deferred' would be more appropriate.

The remedy at OU 2 Area 2 is short-term protective. The remedy at OU 2 Area 8 is protective of human health and not protective of ecological receptors based on a finding of unacceptable risk, and contingency actions (i.e., including a supplemental remedial investigation, focused feasibility study, record of decision amendment, remedial design/remedial action, and shoreline repair, as needed) are not complete. As identified in the ecological risk assessments, acute and chronic exposure to accumulated site contaminants of concern in intertidal zone sediment on the beach adjacent to OU 2 Area 8 (referred to as the "Area 8 beach" from here forward) pose a current hazard to benthic organisms based on the bioassay results/endpoints.

FIVE-YEAR REVIEW SUMMARY FORM

<table>
<tr><th colspan="5">SITE IDENTIFICATION</th></tr>
<tr><td colspan="5">Site Name (from WasteLAN): Naval Undersea Warfare Engineering Station (4 Waste Areas)</td></tr>
<tr><td colspan="5">EPA ID (from WasteLAN): WA1170023419</td></tr>
<tr><td colspan="2">Region: 10</td><td colspan="2">State: WA</td><td>City/County: Kitsap</td></tr>
<tr><th colspan="5">SITE STATUS</th></tr>
<tr><td colspan="5">NPL Status: Final</td></tr>
<tr><td colspan="2">Multiple OUs? Yes</td><td colspan="3">Has the site achieved construction completion? Yes, remedy construction is complete for all OUs at NBK Keyport.</td></tr>
<tr><th colspan="5">REVIEW STATUS</th></tr>
<tr><td colspan="5">Lead agency: U.S. Navy</td></tr>
<tr><td colspan="5">Author name (Federal or State Project Manager): Carlotta Cellucci</td></tr>
<tr><td colspan="5">Author affiliation: Naval Facilities Engineering Command Northwest</td></tr>
<tr><td colspan="5">Review period: July 2014 – June 2019</td></tr>
<tr><td colspan="5">Date of site inspection: September 19, 2019</td></tr>
<tr><td colspan="5">Type of review: Statutory</td></tr>
<tr><td colspan="5">Review number: 5 (Fifth)</td></tr>
<tr><td colspan="5">Triggering action date: December 2015</td></tr>
<tr><td colspan="5">Due date: December 2020</td></tr>
<tr><th colspan="5">Issues/Recommendations</th></tr>
<tr><td colspan="5">OU(s) without Issues/Recommendations Identified in the Five-Year Review:</td></tr>
<tr><td colspan="5">None</td></tr>
<tr><td colspan="5">Issues and Recommendations Identified in the Five-Year Review:</td></tr>
<tr><td rowspan="3">OU(s): 1</td><td colspan="4">Issue Category: Remedy Performance</td></tr>
<tr><td colspan="4">Issue: Investigations pursuant to recommendations from the fourth FYR (U.S. Navy, 2015b) have documented subsurface geology and contaminant distribution that differs significantly from the CSM understanding at the time of the ROD (U.S. Navy, EPA, and Ecology, 1998).</td></tr>
<tr><td colspan="4">Recommendation:
1. Complete the on-going investigations to update the CSM.
2. Complete the planned updates to the human health and ecological risk assessments using the updated CSM and incorporating the latest guidance and ARARs.
3. In collaboration with the project team, review and revise (as appropriate) the points of compliance and RAOs.
4. Based on the results of items 1 through 3, evaluate the need for any early remedial actions and/or a focused FS leading to an optimized remedy.</td></tr>
<tr><th>Affect Current Protectiveness</th><th>Affect Future Protectiveness</th><th>Implementing Party</th><th>Oversight Party</th><th>Milestone Date</th></tr>
<tr><td>No</td><td>Yes</td><td>U.S. Navy</td><td>Ecology</td><td>December 2023</td></tr>
</table>

<table>
<tr><td rowspan="3">OU(s): 1</td><td colspan="4">Issue Category: Remedy Performance</td></tr>
<tr><td colspan="4">Issue: Investigations pursuant to recommendations from the fourth FYR (U.S. Navy, 2015b) have documented an area of the landfill north of the north phytoremediation plantation with elevated PCB concentrations in soil that may represent a discrete source of the PCBs consistently detected in water from seep SP1-1, and a potential source of recontamination to an area of the wetland previously remediated.</td></tr>
<tr><td colspan="4">Recommendation:
1. Conduct an investigation to delineate and characterize the potential PCB source in soil.
2. In collaboration with the project team, evaluate the need for a removal action to address the PCB source.</td></tr>
<tr><td>Affect Current Protectiveness</td><td>Affect Future Protectiveness</td><td>Implementing Party</td><td>Oversight Party</td><td>Milestone Date</td></tr>
<tr><td>No</td><td>Yes</td><td>U.S. Navy</td><td>Ecology</td><td>December 2022</td></tr>
<tr><td rowspan="3">OU(s): 2, Area 2</td><td colspan="4">Issue Category: Remedy Performance</td></tr>
<tr><td colspan="4">Issue: The consistent vinyl chloride detections above the RG and recent increased concentration in well 2MW-6 may be an indication that cVOC mass detected in shallow groundwater (i.e., wells 2MW-1, 2MW-3, and MW2-10) during the RI may have since migrated deeper and further downgradient than revealed by the monitoring network.</td></tr>
<tr><td colspan="4">Recommendation: Conduct a limited data gap investigation to refine the CSM and verify the leading edge of the cVOC plume, both laterally and vertically, at OU 2 Area 2.</td></tr>
<tr><td>Affect Current Protectiveness</td><td>Affect Future Protectiveness</td><td>Party Responsible</td><td>Oversight Party</td><td>Milestone Date</td></tr>
<tr><td>No</td><td>Yes</td><td>U.S. Navy</td><td>Ecology</td><td>December 2022</td></tr>
<tr><td rowspan="3">OU(s): 2, Area 8</td><td colspan="4">Issue Category: Remedy Performance</td></tr>
<tr><td colspan="4">Issue: During this FYR period, the HHRA concluded that no contingency/additional actions are necessary to protect human health. However, the ERA concluded that acute and chronic exposure to accumulated contaminants in sediment poses a current potential hazard to benthic organisms at the adjacent beach based on the bioassay results/endpoints. This area of exposure with unacceptable risk is well delineated and of limited extent within the intertidal zone.</td></tr>
<tr><td colspan="4">Recommendation: Implement a contingent groundwater control action as required by the selected remedy (U.S. Navy, EPA, and Ecology, 1994). To identify a feasible contingent action, perform a supplemental RI and focused FS. Once identified and agreed upon by regulators and stakeholders, perform remedial design, implement the remedial action, and potentially conduct a shoreline repair to address elevated COC concentrations in intertidal sediment and on-going discharge of these COCs in seep water. Prepare a ROD amendment or Explanation of Significant Differences (ESD) to document the contingent action taken. Prepare a ROD amendment or Explanation of Significant Differences (ESD) to document the contingent action taken.</td></tr>
<tr><td>Affect Current Protectiveness</td><td>Affect Future Protectiveness</td><td>Party Responsible</td><td>Oversight Party</td><td>Milestone Date</td></tr>
<tr><td>Yes</td><td>Yes</td><td>U.S. Navy</td><td>Ecology</td><td>December 2024</td></tr>
</table>

Protectiveness Statement(s)		
Operable Unit: 1	**Protectiveness Determination:** Short-Term Protective	**Addendum Due Date:** Not applicable
Protectiveness Statement: The remedy at OU 1 is short-term protective. Exposure pathways that could result in unacceptable risks are being controlled and monitored via LUCs while further information is being obtained. Investigation work is on-going to verify the risk conclusions in the OU 1 ROD, to allow evaluation of potential additional removal or remedial action(s) that could be taken to shorten the overall restoration timeframe, and to ensure the remedy is protective in the long term.		
Operable Unit: 2 (Area 2 and Area 8)	**Protectiveness Determination:** Not Protective	**Addendum Due Date:** Not applicable
Protectiveness Statement: The remedy at OU 2 Area 2 is short-term protective. Exposure pathways that could result in unacceptable risks are being controlled and monitored via LUCs; however, the consistent vinyl chloride detections above the RG and recent increased concentration in well 2MW-6 may be an indication that cVOC mass detected in shallow groundwater (i.e., wells 2MW-1, 2MW-3, and MW2-10) during the RI may have since migrated deeper and further downgradient than revealed by the monitoring network. The remedy at OU 2 Area 8 is protective of human health; however, it is not protective of ecological receptors based on a finding of unacceptable risk, for which a contingent remedial action has not yet been implemented, as required by the ROD. To identify a feasible contingent groundwater control action, the Navy will perform a supplemental RI and focused FS. Once identified, and agreed upon by regulators and stakeholders, the Navy will perform remedial design, implement remedial action, and potentially conduct a shoreline repair to address elevated COC concentrations in intertidal sediment and on-going discharge of these COCs in seep water. A ROD amendment or Explanation of Significant Differences (ESD) will be prepared to document the contingent groundwater control action taken. The human health risk assessment at the Area 8 beach intertidal zone concluded that, despite the presence of several COCs in the beach sediment and clam tissue at concentrations exceeding background and reference area concentrations, the incremental site risk over reference area risk for Suquamish subsistence and recreational receptors meets target health goals. The ecological risk assessment concluded that there was no risk to higher trophic level species, but acute and chronic exposure to accumulated contaminants in sediment pose a current potential hazard to benthic organisms based on the bioassay results/endpoints.		
Operable Unit: Sitewide	**Protectiveness Determination:** Not Protective	**Addendum Due Date:** Not applicable
Protectiveness Statement: The remedies at NBK Keyport are not protective based on a finding of unacceptable ecological risk at OU 2 Area 8.		

SIGNATURE PAGE

Signature sheet for the Naval Base Kitsap Keyport fifth FYR report.

23 Nov 20

R.G. Rhinehart
Captain, U.S. Navy
Commanding Officer, Naval Base Kitsap

Date

CONTENTS

FIGURES

TABLES

APPENDICES

ABBREVIATIONS AND ACRONYMS

AFFF	aqueous film forming foam
ARAR	applicable or relevant and appropriate requirement
ATSDR	Agency for Toxic Substances and Disease Registry
AWQC	ambient water quality criteria
bgs	below ground surface
BTV	background threshold value
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLARC	cleanup levels and risk calculation
cm	centimeter
CO	contracting officer
COC	chemical of concern
COI	chemical of interest
CRA	contingent remedial action
CSM	conceptual site model
CTL	critical tissue level
cVOC	chlorinated volatile organic compound
DCA	dichloroethane
DCE	dichloroethene
EC	engineering control
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ESS	environmental sequence stratigraphy
FFA	Federal Facilities Agreement
FS	feasibility study
g/day	gram per day
GC/MS	gas chromatograph/mass spectrometer
GRO	gasoline range organic
HCID	hydrocarbon identification
Health District	Kitsap County Health District
HHRA	human health risk assessment
HI	hazard index
HPT	hydraulic profiling tool
HQ	hazard quotient
IC	institutional control
kg	kilogram
KIC	Keyport Improvement Club

LEL	lower explosive limit
LHA	Lifetime Health Advisory
LOD	limit of detection
LTM	long-term monitoring
LUC	land use control
MCL	maximum contaminant level
µg/kg	microgram per kilogram
µg/L	microgram per liter
µg/m^3	microgram per cubic meter
mg/kg	milligram per kilogram
mg/L	milligram per liter
MIP	membrane interface probe
MLLW	mean lower low water
MNA	monitored natural attenuation
MS&T	Missouri University of Science and Technology
MTCA	Model Toxics Control Act
MW	monitoring well
NAPL	non-aqueous phase liquid
Navy	U.S. Navy
NAVFAC NW	Naval Facilities Engineering Command Northwest
NBK	Naval Base Kitsap
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFA	no further action
NOAA	National Oceanic and Atmospheric Administration
NUWC	Naval Undersea Warfare Center
O&M	operation and maintenance
OM&M	operation, maintenance, and monitoring
ORO	oil range organics
OU	operable unit
PA	preliminary assessment
PAL	project action limit
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PED	polyethylene diffusion passive sampler
PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutanesulfonic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PHA	public health assessment
ppm	parts per million
PQL	practical quantitation limit
PUD	Public District Utility (Kitsap County)
RAB	Restoration Advisory Board

RAO	remedial action objective
redox	oxidation reduction
RG	remedial goal
RI	remedial investigation
ROD	Record of Decision
RPM	remedial project manager
RSL	regional screening level
SAP	sampling and analysis plan
SCO	sediment cleanup objective
SI	site investigation
SIM	selected ion monitoring
SMS	sediment management standards
SQS	sediment quality standard
SVOC	semi-volatile organic compound
TCA	trichloroethane
TCE	trichloroethene
TEQ	toxicity equivalent
TLV	threshold limit value
TOC	total organic carbon
TPH	total petroleum hydrocarbons
TRV	toxicity reference value
USGS	U.S. Geological Survey
UST	underground storage tank
UE	unrestricted exposure
UU	unlimited use
VI	vapor intrusion
VOC	volatile organic compound
XSD	halogen specific detector
WAC	Washington Administrative Code
WDOH	Washington Department of Health
WQC	water quality criteria

1.0 INTRODUCTION

This report presents the results of the fifth five-year review (FYR) performed for Naval Base Kitsap (NBK) Keyport National Priorities List (NPL) site, including Operable Units (OUs) 1 and 2. The purpose of a FYR is to determine whether the remedies selected for implementation at sites in the associated Record of Decision (ROD) remain protective of human health and the environment. The data review and technical assessment performed, and protectiveness determinations developed during the FYR process are documented in this FYR report, which also identifies issues, if any, found during the FYR process, and provides recommendations to address these issues.

This FYR was prepared pursuant to Section 121(c) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. § 9621(c), and Section 300.430(f)(4)(ii) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 C.F.R. § 300.430(f)(4)(ii). Because hazardous substances, pollutants, or contaminants remain at the OUs and sites above levels that allow for unlimited use and unrestricted exposure (UU/UE) following implementation of the remedial action, a statutory review (i.e., FYR) is required under CERCLA and the NCP. This FYR was initiated in June 2019 and is based on data reports generated between July 2014 and June 2019. In addition, analytical data from ongoing studies have been summarized. The triggering action for this review is the execution of the fourth FYR (U.S. Navy, 2015b), which was signed on December 11, 2015. The previous FYRs for NBK Keyport were completed in 2000, 2005, 2010, and 2015 (U.S. Navy, 2000b, 2005a, 2010a, and 2015e).

This FYR report was prepared as part of the CERCLA FYR process using U.S. Navy and U.S Environmental Protection Agency (EPA) guidance (U.S. Navy, 2004, 2011b, 2013c, 2014a; U.S. EPA, 2001, 2012, and 2016), documenting the results of the review, identified issues, and recommended actions. This FYR report is organized in accordance with U.S. EPA's 2016 recommended template and has been streamlined to minimize information that has been presented in the previous four FYRs. The intent is to focus on activities and issues over the last five years, current protectiveness and recommendations for the next five years.

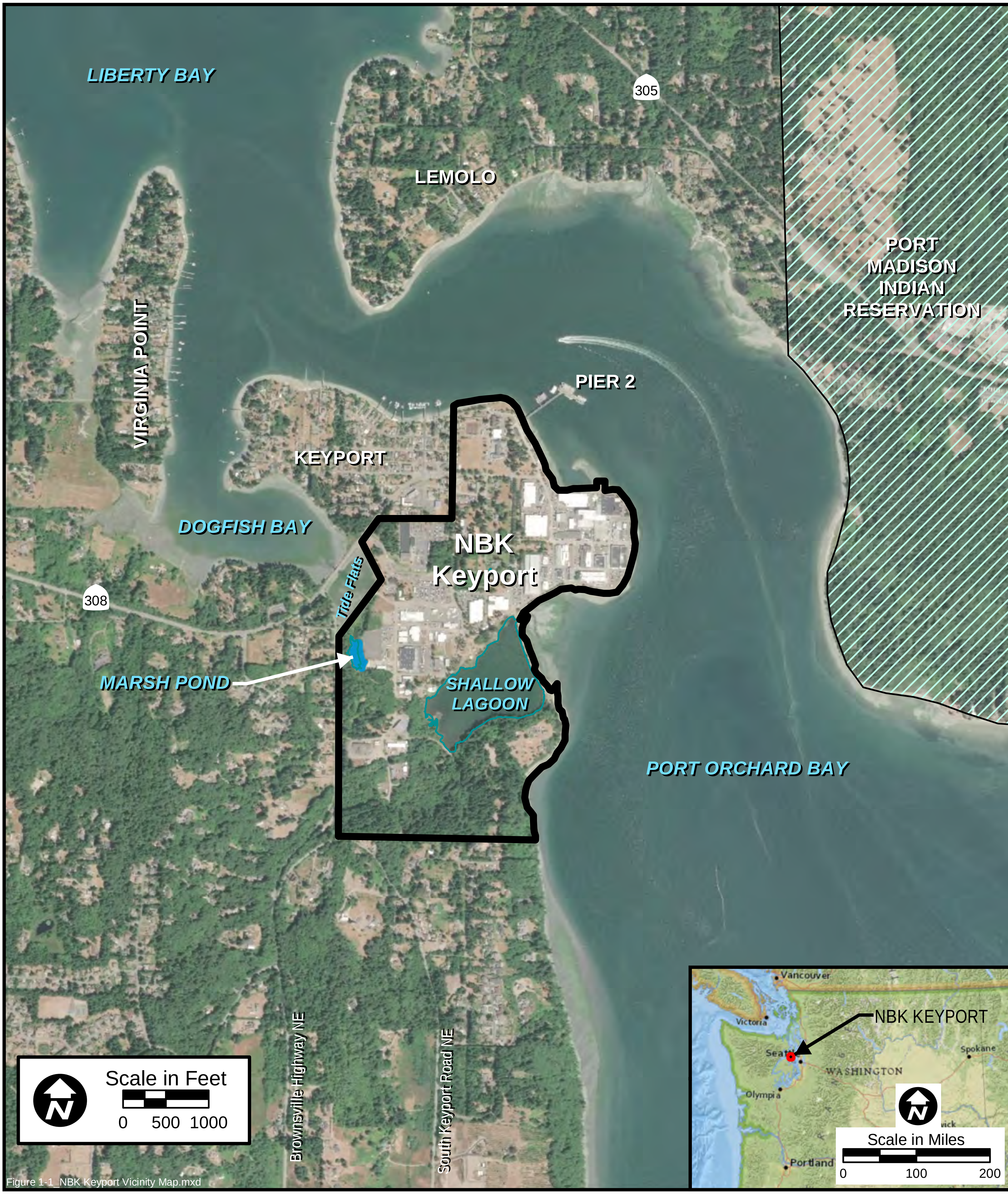
NBK Keyport is bordered by Liberty Bay on the north and northwest and Port Orchard Inlet on the northeast and east, and is adjacent to the town of Keyport (see Figure 1-1). Several areas and sites at NBK Keyport have been impacted by historical activities, resulting in environmental releases and hazardous substances, pollutants, or contaminants remaining above levels that allow for UU/UE. The areas and sites comprising OU 1 and OU 2 sites at NBK Keyport include the following:

- OU 1:
    - Area 1 – Former Landfill
- OU 2:
    - Area 2 – Van Meter Road Spill/Drum Storage Area
    - Area 3 – Otto Fuel Leak Area (no further action; not subject to FYR)
    - Area 5 – Sludge Disposal Area (no further action; not subject to FYR)
    - Area 8 – Plating Shop Waste/Oil Spill Area
    - Area 9 – Liberty Bay (no further action; not subject to FYR)

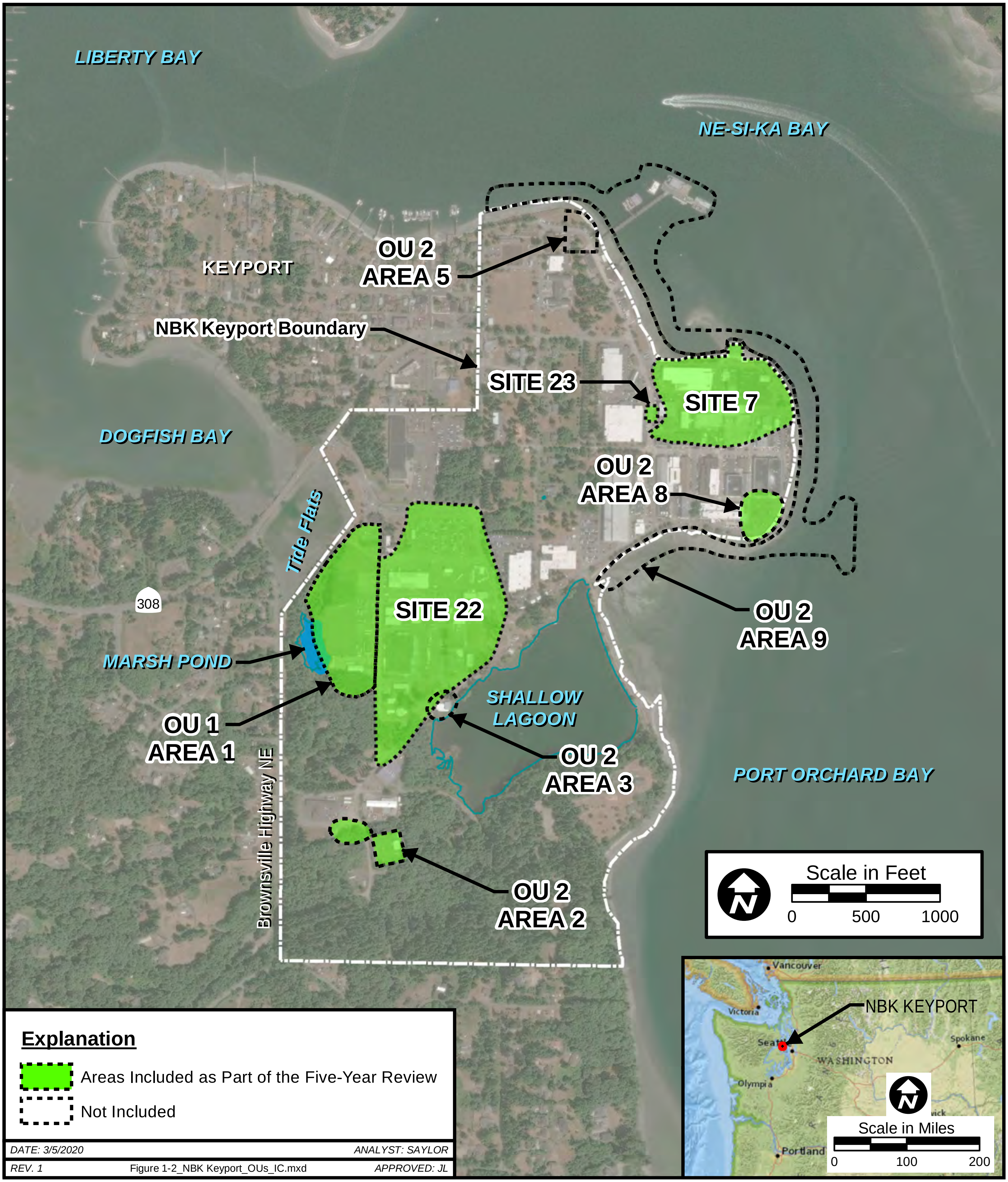
This FYR report covers the remedies selected in the Record of Decisions (RODs) for OU 1 and OU 2 (U.S. Navy, EPA, Ecology, 1998 and 1994, respectively). The OU 1 ROD specifies that the site "was also called Area 1 and is currently designated Operable Unit (OU) 1", so is referred to as OU 1 from here forward. The OU 2 ROD specifies that only Area 2 and Area 8 are subject to the FYR; no further action or FYR is required for Area 3; and only confirmation sampling was required at Areas 5 and 9. Because confirmation sampling (U.S. Navy, 1996a and 1996b) at both Areas 5 and 9 indicated contamination did not exceed any associated remedial goals (RGs), no further action was also required for Areas 5 and 9. Therefore, Areas 3, 5, and 9 meet UU/UE levels and, as such, are not subject to FYRs. OU 2 Areas 3, 5, and 9 are not carried further in this FYR and were not included in previous FYRs (U.S. Navy, 2000b, 2005a, 2010a, and 2015b).

In addition to OU 1 and OU 2, one LUCs-only site was included in previously FYRs: Site 23. Although Site 23 has LUCs, it was not included in the OU 1 or OU 2 RODs, and so is not subject to the FYR process. Therefore, neither Site 23 nor any of the other LUCs-only sites (i.e., Sites 7 and 22) at NBK Keyport have been included in this FYR to better follow FYR guidance.

The areas that comprise OU 1 and OU 2 are shown on Figure 1-2. OU 1, OU 2 Area 2, and OU 2 Area 8 are shown in Figures 1-3 through 1-5, respectively. Figure 1-6 depicts the chronology of events at OU 1, OU 2 and sitewide. Table 1-1 summarizes the history of contamination, physical characteristics, primary threat, land and resource use, and removal actions performed at each of these sites. A more in-depth description of each site is available in the fourth FYR (U.S. Navy, 2015b).



U.S. NAVY	**Figure 1-1** **NBK Keyport Vicinity Map**	NBK KEYPORT FIFTH FIVE-YEAR REVIEW



Explanation

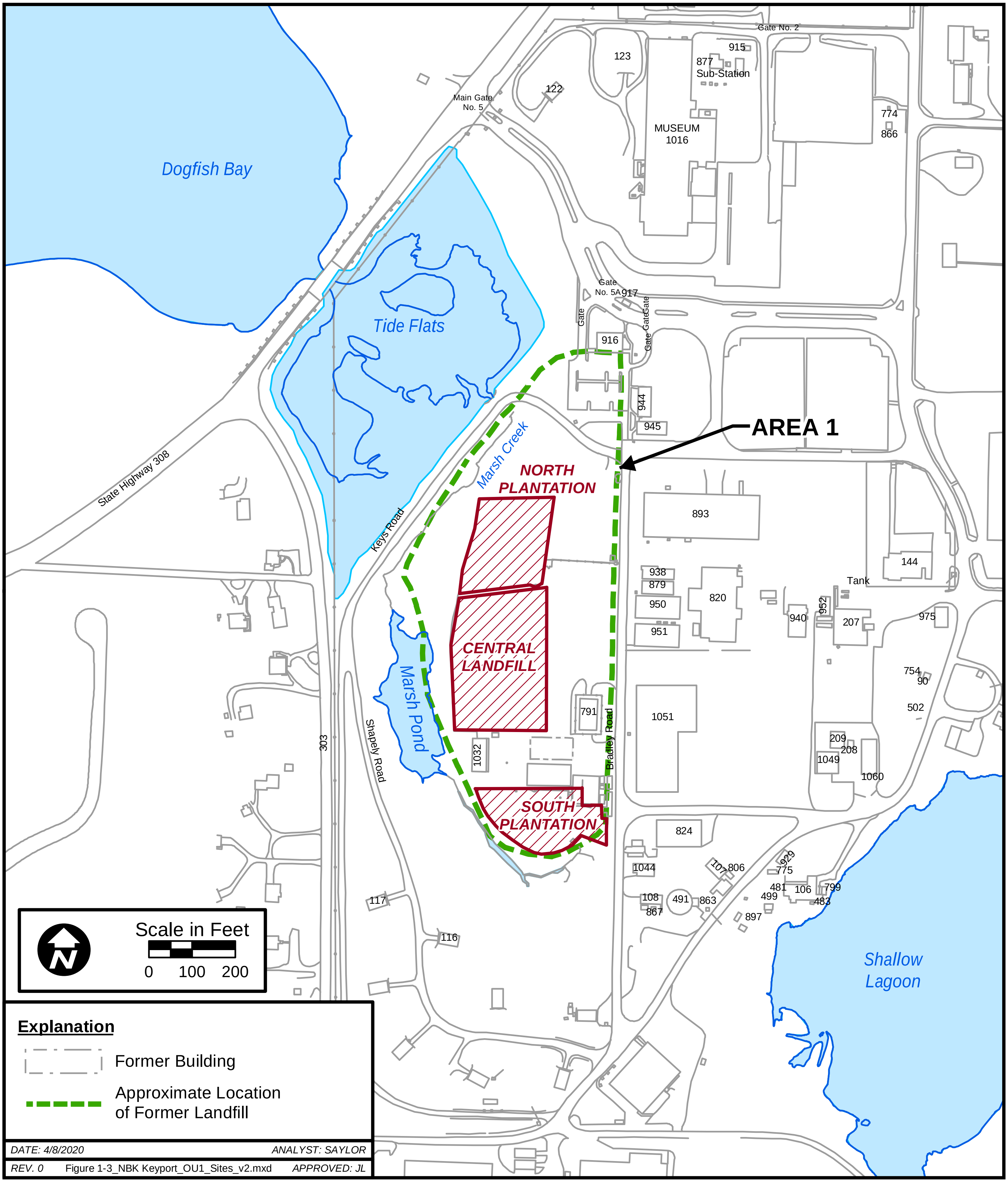
Areas Included as Part of the Five-Year Review

Not Included

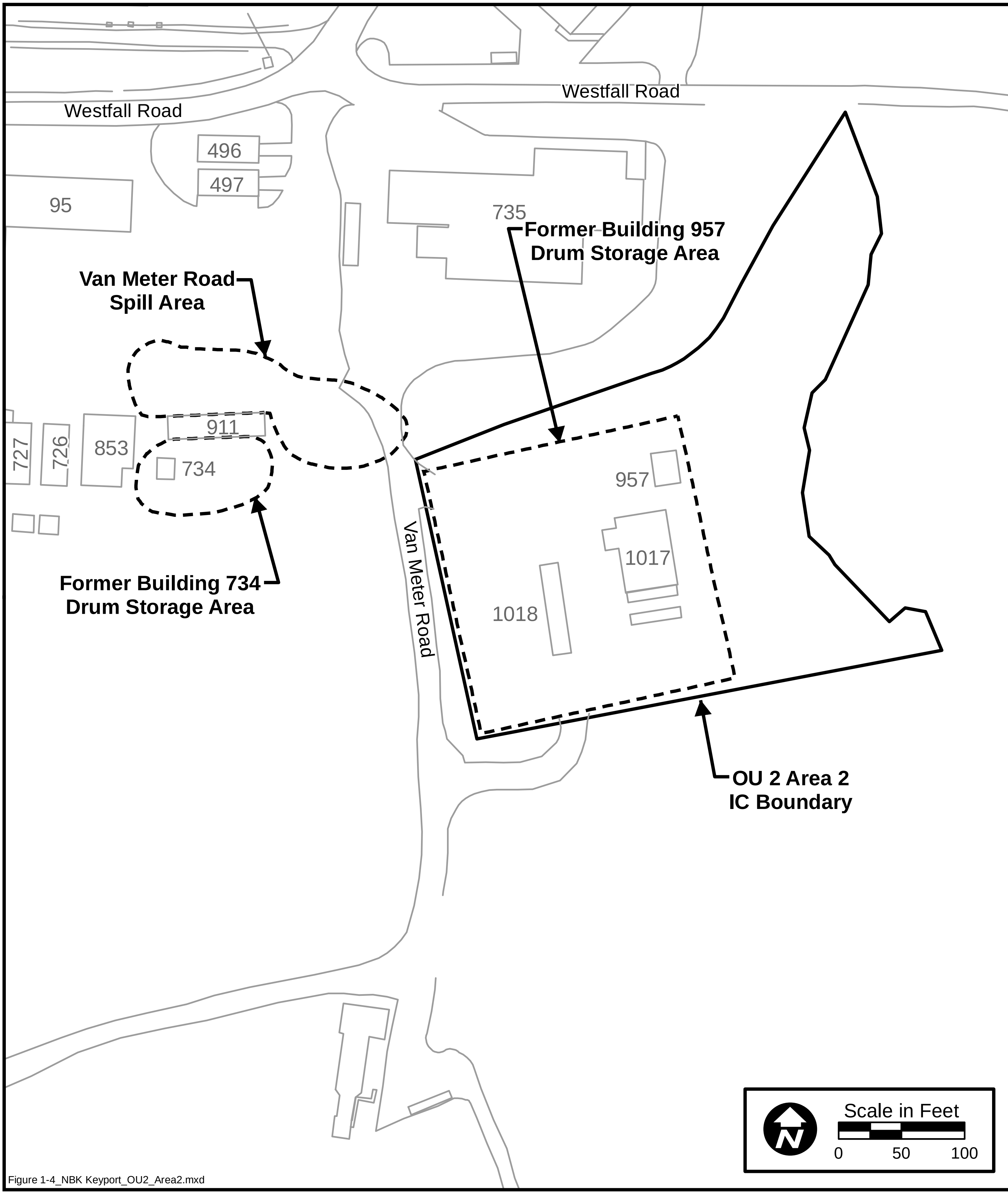
DATE: 3/5/2020 ANALYST: SAYLOR

REV. 1 Figure 1-2_NBK Keyport_OUs_IC.mxd APPROVED: JL

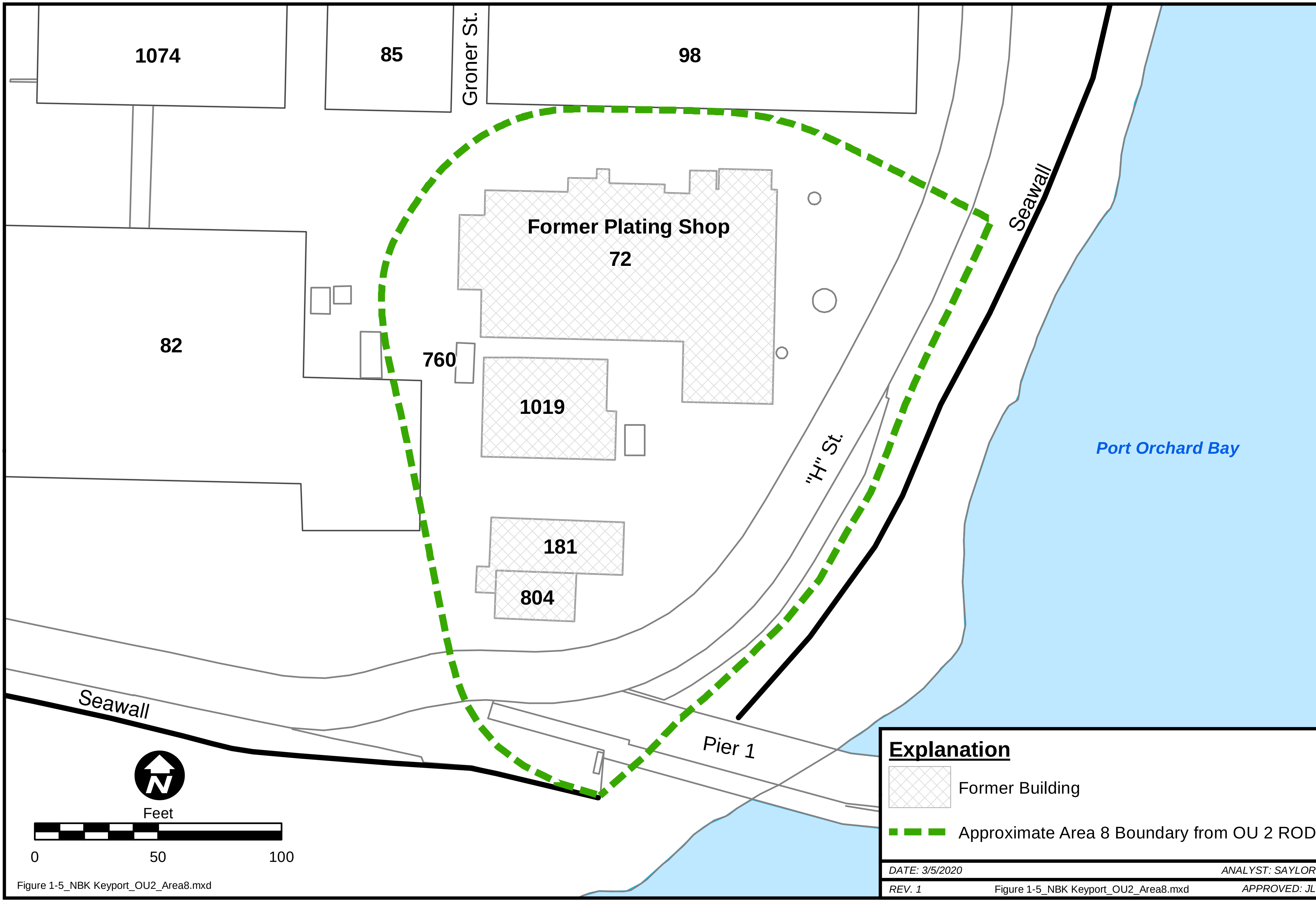
U.S. NAVY	**Figure 1-2** **Locations of OU 1, OU 2, and Institutional Control Only Sites**	NBK KEYPORT FIFTH FIVE-YEAR REVIEW



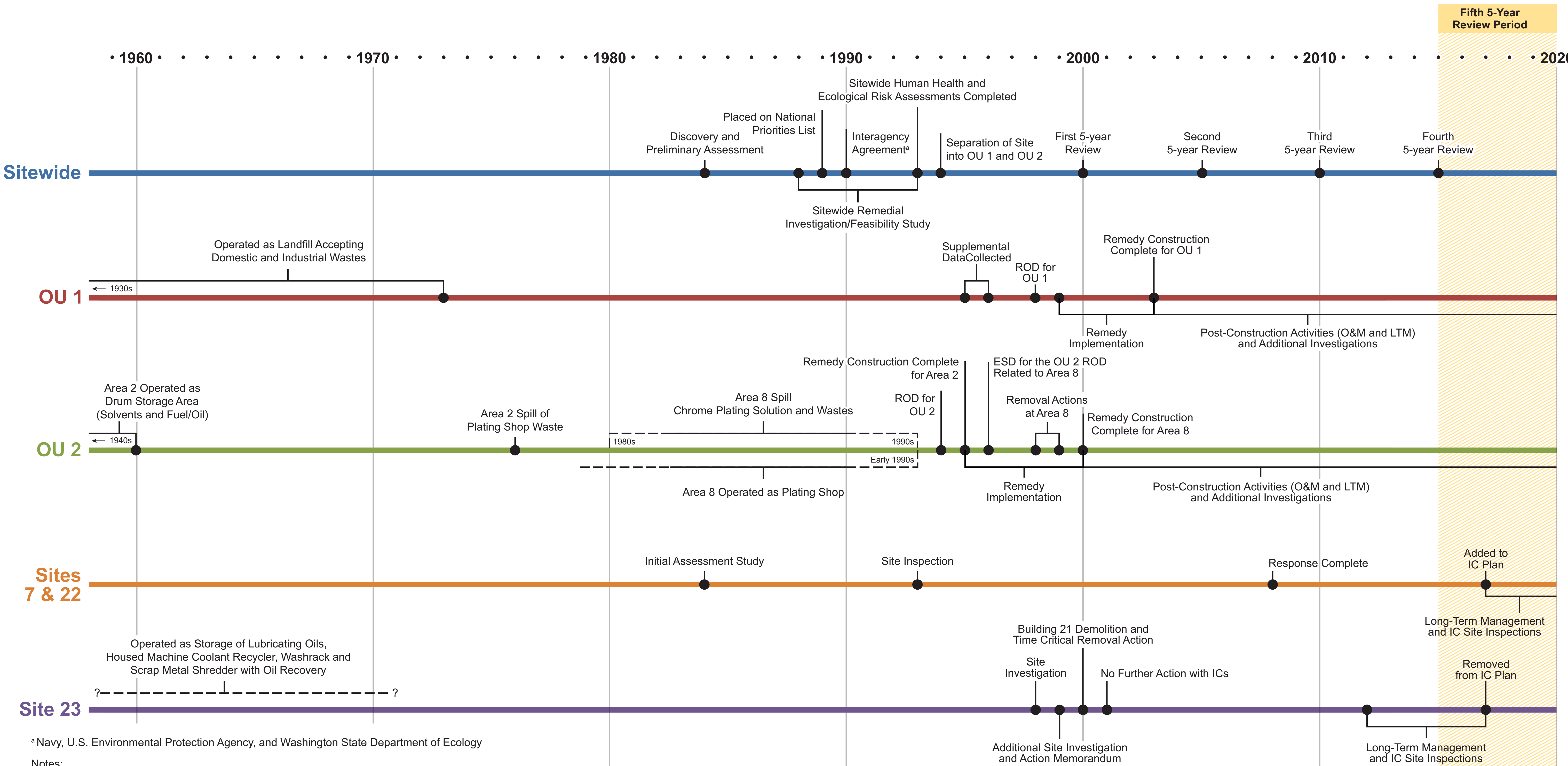
U.S. NAVY	**Figure 1-3** **OU 1 Area 1 Site Map**	NBK KEYPORT FIFTH FIVE-YEAR REVIEW



U.S. NAVY	**Figure 1-4** **OU 2 Area 2 Site Map**	NBK KEYPORT FIFTH FIVE-YEAR REVIEW



U.S. NAVY	**Figure 1-5** **OU 2 Area 8 Site Map**	NBK KEYPORT FIFTH FIVE-YEAR REVIEW



[a] Navy, U.S. Environmental Protection Agency, and Washington State Department of Ecology

Notes:

OU - Operable Unit	LTM - Long-Term Management
ROD - Record of Decision	ICs - Institutional Controls
ESD - Explanation of Significant Differences	O&M - Operatons and Maintenance

FIGURE 1-9_CHRONOLOGY_KEYPORT_5TH FYR_v3.CDR

U.S. NAVY	**Figure 1-6** **Chronology of Events at OU 1, OU 2, Sites 7 & 22, and Site 23**	NBK KEYPORT FIFTH FIVE-YEAR REVIEW

Table 1-1. Background Information Summary

Site/Area	History of Contamination	Physical Characteristics	Primary Threat	Land and Resource Use	Removal Actions Performed
Operable Unit 1					
Former Landfill	• 1930s until 1972 – Primary base landfill. Disposal area for domestic and industrial wastes generated by the base until closed. • 1930s to the 1960s – Burn pile for trash and demolition debris located at the north end of the landfill. Unburned or partially burned materials from this pile were buried in the landfill or pushed into the marsh. • 1930s to the 1960s – Trash incinerator was operated at the north end of the landfill and incinerator ash was disposed of in the landfill. •	• Covers approximately 9 acres of the western part of the base. • Is unlined, and covered with areas of grass, trees, concrete, and asphalt. • Placed in the eastern portion of a marsh and stream complex, remnants of which remain to the west, flowing through tide flats and into Dogfish Bay. • Groundwater is present in a shallow unconfined aquifer with a water table at 4 to 8 feet bgs. Shallow groundwater in this aquifer flows west towards the adjacent surface water with a deeper component of flow to the northwest.	• Chlorinated aliphatic hydrocarbons pose a risk to human health from drinking water and seafood ingestion pathways, and vapor intrusion at the landfill surface. • Polychlorinated biphenyls (PCBs) pose a risk to human health from bioaccumulation, potentially impacting the seafood ingestion pathway.	• Occupied buildings for office space and industrial uses are adjacent to the former landfill east of Bradley Road. • Two phytoremediation plantations occupy the majority of the northern and southern portions of the landfill. The central portion of the landfill is paved and currently used regularly for motorcycle training and as a parking lot.	• Removal of PCB-contaminated sediments from marsh to prevent PCBs from potentially migrating to the tide flats and Dogfish Bay.
Operable Unit 2					
Area 2 – Van Meter Road Spill/Drum Storage Area	• Comprised of three (3) areas: Building 734 former drum storage area, Building 957 former drum storage area and Van Meter Road spill area. • 1940s through the 1960s – Drum storage areas were active and reportedly stored all chemicals used at the base (including solvents and fuel/oil). An estimated 4,000 to 8,000 gallons of these chemicals were discharged to the two unpaved areas as a result of spills and leaks. • 1976 – Approximately 2,000 to 5,000 gallons of plating shop wastes spilled from a tanker truck on the pavement near Van Meter Road, impacting a nearby stream.	• Located in the southwest corner of the base and bounded to the north and east by Westfall Road, to the west by Keys Road, and to the south by a sharp topographical rise. • Van Meter Road bisects the area in a north-south direction. • Groundwater is present at a depth of approximately 4 to 8 ft bgs.	• Trichloroethene (TCE) and vinyl chloride were identified as chemicals of concern (COCs) in the drum storage areas during the Remedial Investigation/Feasibility Study (RI/FS) based on the risk analysis. • No significant risk was identified at the Van Meter Road plating shop waste spill. • No significant risk to terrestrial or aquatic organisms was identified at any of the three areas at Area 2.	• Area 2 is currently used for inert materials storage and intermittently for industrial purposes.	• None.
Area 8 – Plating Shop Waste/Oil Spill Area	• Past releases include spillage of chrome plating solution containing VOCs onto the ground; discharge of plating wastes into a utility trench; and leakage of plating solutions through cracks in the plating shop floor, waste disposal pipes, and sumps during plating shop operation. • Petroleum hydrocarbons (i.e., diesel and heavy oil) were also released to the environment from leaking underground storage tanks (USTs) and underground concrete vaults located within Area 8.	• Occupies 1 acre on the eastern portion of the base and surrounds the location of the former plating shop (Building 72). • Groundwater is present at a depth of approximately 10 ft bgs. • Shallow groundwater from the site discharges into Port Orchard Bay.	• VOCs and metals (i.e., arsenic, cadmium, and chromium) were identified as COCs in groundwater based on residential use of groundwater as drinking water and inhalation during household use. Arsenic concentrations were suspected to be related to background concentrations; and therefore, dropped as a COC. • VOCs, semi-volatile organic compounds (SVOCs), and total petroleum hydrocarbons (TPH) diesel were identified in 1998 and 1999 near the former fuel storage vaults.	• Area 8 is in a heavily industrialized part of the facility bordered by Port Orchard Bay to the south and east. • The area is used for parking and has occupied buildings for office space and industrial uses.	• Removal and disposal of "hot-spot" metals-contaminated soil. • Removal of TPH-contaminated soil, conducted under the UST Program as an independent action in accordance with Model Toxics Control Act (MTCA) regulations.

2.0 RESPONSE ACTION SUMMARY

This section summarizes remedy implementation; actions subsequent to remedy implementation; and operations, maintenance, and monitoring at OU 1 and OU 2. A more detailed narrative description of the response actions at NBK Keyport is available in Section 4 of the third FYR (U.S. Navy, 2010a). Table 2-1 provides a remedial action summary, including reasonably anticipated land use, COCs requiring action, media, cleanup levels, remedial action objectives (RAOs), remedy components, remedy construction complete, and site closeout strategy for OU 1 and OU 2 sites.

At OUs 1 and 2, the remedies include land use controls (LUCs). The terminology LUCs, includes both institutional controls (ICs) and engineering controls (ECs). Historically at NBK Keyport, the term IC has been used to identify all LUCs, and this is not consistent with the current standard usage of these terms (U.S. Navy, 2001b). For consistency with Navy guidance (U.S. Navy, 2001b), this FYR uses the term “LUC” rather than “IC” to discuss both the ICs and ECs associated with each site.

2.1 Operable Unit 1

This section discusses the remedy construction; and investigations, operations, maintenance, and monitoring for OU 1 conducted during this FYR period (see Figures 1-2 and 1-3). Remedies identified in the ROD have been implemented; construction is complete for all elements; operation, maintenance, and monitoring activities are ongoing; and LUCs are in place.

2.1.1 OU 1 Remedy Construction

Per the OU 1 ROD (U.S. Navy, EPA, Ecology, 1998), the remedy included the following components, which have been completed:

- April 1999 – Planted two phytoremediation plantations of hybrid poplar trees, referred to as the “north” and “south” plantations, designed to work in concert with monitored natural attenuation to remove and treat VOC-contaminated groundwater and reduce the long-term potential for VOC migration from the site.
- November 1999 – Upgraded the tide gate to improve the control of tidal flow between the tide flats and the marsh, thereby ensuring that the landfill is protected from tidal inundation that could erode its banks or adversely affect contaminant mobilization (U.S. Navy, 1999c).
- 1999 – Installed three wells (MW1-41 and two irrigation wells), 10 piezometers, and two lysimeters to monitor groundwater concentrations and water levels.
- 1999 – Removed PCB-contaminated sediment from a small area of the marsh near the tide flat to prevent PCB-contaminated sediment from potentially migrating to the tide flats and Dogfish Bay (U.S. Navy, 1999c).
- March 2003 – Prepared a contingent remedial action (CRA) plan, specifying the conditions under which the Navy will implement additional remedial actions if the identification of significant contaminant concentrations are found to be migrating from OU 1 to water supply wells in the area (U.S. Navy, 2003a). Consistent with CERCLA, the CRAs were evaluated against NCP criteria with awareness of the public involvement requirements of CERCLA.

The February 2012 revision of the CRA plan (U.S. Navy, 2012i) addressed recommendations from the third FYR regarding the addition of 1,4-dioxane to the CRA plan.

- January 2005 – Upgraded the asphalt landfill cover to prevent exposure from contact with soil and debris.

2.1.2 OU 1 Post-Remedy Construction Investigations

During this FYR period, additional investigations have been conducted to address recommendations from the fourth FYR (U.S. Navy, 2015b). The activities associated with, and objectives of these investigations are discussed below. The data review and evaluation results are presented and discussed in Section 4.2.

2014 Phase I Additional Investigation (U.S. Navy, 2015a): The Phase I investigation included the collection of tree core samples for analysis of chlorinated volatile organic compounds (cVOCs) to identify potential contaminant hotspots in groundwater within and adjacent to the South Plantation, and west or downgradient of the Central Landfill. Geophysical surveys were conducted in the South Plantation and a portion of the Central Landfill to identify the presence or absence of subsurface anomalies that could represent potential contaminant sources and pose health risks for workers during future intrusive investigations. Evaluation of tree core and geophysical data resulted in a refined understanding of COC distribution, used to guide sampling effort conducted during the Phase II field effort.

2016 and 2017 Phase II Additional Investigation (U.S. Navy, 2017a and 2018b): A supplemental qualitative subsurface Phase II investigation was conducted to confirm the locations, extent and magnitude of potential hotspots and evaluate potential hotspot treatments that could be used to reduce the restoration timeframe. Based on initial study findings in 2016, an additional quantitative investigation was conducted in and around the South Planation and Central Landfill in the summer and fall of 2017. These supplemental investigations resulted in a revised understanding of site hydrogeology, identifying a single water table aquifer, rather than a shallow and an intermediate aquifer. In addition, these investigations delineated the location, depth, magnitude, and extent of site contaminants, which were found to extend deeper than the current LTM monitoring well network and farther into the marsh south of the landfill than previously known.

2018 Vapor Intrusion (VI) Study (U.S. Navy, 2019a): In 2018, VI study activities were conducted at 10 buildings (i.e., Buildings 916, 944, 945, 893, 951, 824, 1051, 108, 820, and 950) east of Bradley Road, adjacent to OU 1 during both later winter and summer timeframes. The overall objectives of the VI study were to: 1) evaluate whether the VI pathway is complete between the site and nearby buildings; 2) assess whether cVOCs in groundwater have contributed to indoor air concentrations via the VI pathway; and 3) collect information to support the selection of appropriate mitigation measures, if required. A preliminary screening was conducted in March 2018 and then indoor air, outdoor air, sub-slab, and exterior soil vapor samples were collected, and differential pressure was monitored in both late winter (March 2018) and summer (July 2018) at each of the 10 buildings.

2018 Groundwater Model (U.S. Geological Survey [USGS], 2019): A detailed site-specific numerical groundwater flow and solute transport model was constructed and calibrated that can be used to update the existing CSM, inform risk decisions, and evaluate possible remedial activities at OU 1.

2018 Tidal Lag Study (USGS, 2019): In 2018, the USGS conducted a tidal lag study to: 1) better understand nearshore groundwater-seawater interactions; 2) determine the optimal schedule/timing for groundwater sampling at different wells; and 3) inform a concurrent groundwater modeling effort at OU

1. Water levels were continuously monitored in existing groundwater monitoring wells and surface-water features of interest for approximately three weeks, a period that included neap and higher amplitude spring tides. The time-series data also included specific conductance at the surface-water features. However, although time-series data was also scoped to include specific conductance at monitored well locations, the equipment failed to record these data. Therefore, a vertical profile of specific conductance measured once in the screened interval of selected monitored wells during data logger deployment was used to determine if the freshwater/saltwater interface was present and to evaluate tidal lag. Therefore, this study is currently being repeated.

2019 Source Area Investigation Study: A source investigation was conducted to gather quantitative data to verify the migration path of 1,4-dioxane from the Central Landfill hotspots; determine the source of PCB contamination in site sediments; and better define the extent of contamination at the east side of the South Plantation, in the marsh area southeast of the South Plantation, and in Marsh Creek. Lithologic data were also collected to better map the regional aquitard contact within the site boundary and to conduct fate and transport modeling. An internal draft report has not yet been prepared for this investigation, so only a preliminary summary of this data is presented in this FYR. Data from these investigations will be used to update the existing CSM, allow better evaluation of remedy effectiveness, and support a focused feasibility study designed to evaluate alternatives for the treatment of identified hotspots to reduce restoration timeframe.

The conceptual site model (CSM) continues to be reevaluated based on data obtained from these supplemental investigations.

2.1.3 OU 1 Operations, Maintenance, and Monitoring

Operation and Maintenance. Since the fourth FYR (U.S. Navy, 2015b), the Navy has continued operation and maintenance (O&M) of the OU 1 remedy. The O&M at OU 1 consists of the following:

- Phytoremediation tree health maintenance
- Tide gate inspection and maintenance

Phytoremediation O&M activities have been conducted since the trees were planted in 1999. The primary objective is to establish and maintain mature, healthy stands of trees to maximize contaminant uptake by the trees. Inspections are scheduled to occur eight times per year. The plantations are inspected/ monitored for overall condition, including general physical health, insect damage, water stress, nutrient deficiency, and disease symptoms. Scheduled maintenance actions include weeding, thinning, pruning, and identifying and reporting any pests found on a regular basis and applying fertilizer as directed by the Navy. Additional maintenance activities/corrective actions occur as necessary, such as treating infestations with pesticide and/or herbicide applications to maintain healthy stands of trees.

Tide gate inspection and maintenance occurs four times per year and has been performed since the tide gate was upgraded in 1999. The primary objective is to ensure that the tide gate is working as intended and designed to limit tidal flooding of the marsh, which could cause erosion of the landfill and/or adversely affect planation tree health. Routine tide gate maintenance, cleaning and testing are conducted during each inspection and include removing any biofouling, sediment or debris lodged or accumulated on any parts of the tide gate or upper culvert grate.

All inspection and maintenance activities since the last FYR were generally performed in accordance with the Inspection and Maintenance Plan (U.S. Navy, 2012h), Quality Control Plan (U.S. Navy, 2014b) and the revised O&M Plan (U.S. Navy, 2017d). This O&M Plan applies to long-term O&M of the phytoremediation plantations and tide gate system at OU 1 and includes recommendations from the 2015 and 2016 Annual O&M Reports (U.S. Navy, 2016a and 2017d), the Spring 2016 OU 1 LTM Report (U.S. Navy, 2017e), and the fourth FYR (U.S. Navy, 2015b).

Monitoring. As part of the remedy, a long-term monitoring (LTM) program was initiated in 1999, including phytoremediation monitoring, risk and compliance monitoring, and intrinsic bioremediation monitoring. Since the fourth FYR (U.S. Navy, 2015b), the Navy performed LTM, phytoremediation monitoring, and CRA monitoring of the OU 1 remedy in 2015 and 2016, as in past years. In 2017, activities to support site characterization were added to the LTM program with the concurrence of the Keyport EPA and Ecology Project Managers. In 2018 LTM at Keyport OU 1 was cancelled with the concurrence of the Keyport EPA and Ecology Project Managers, given the drastic change in the CSM and ongoing investigations. However, the LTM contractor was used to perform various sampling efforts in 2018 to support further site characterization. In 2019, the LTM program reverted to the 5-year sampling effort specified in the LTM Plan to support FYR evaluation. Intrinsic bioremediation monitoring by the USGS was conducted from 2002 through 2015, which consistently indicated that bioremediation was active at the site, so monitoring was discontinued, having met the objective in the ROD.

Long-Term Monitoring

The LTM program at OU 1 involves periodic sampling of groundwater, seep water, marine sediment, and marine tissue (clam). It also involves periodic water level measurements in wells set in the upper and intermediate portions of the aquifer to monitor the groundwater flow direction. The overall objective of the LTM program is to monitor trends in COC concentrations and evaluate whether the selected remedy meets the RAOs. Activities conducted under the LTM program since the fourth FYR (U.S. Navy, 2015b) have consisted of the following:

- Periodic groundwater elevation measurements throughout OU 1 in monitoring wells and piezometers screened in the upper and intermediate portions of the aquifer.
- Groundwater sampling and chemical analysis from monitoring wells screened within the upper, intermediate, and deeper portions of the water table aquifer, and in the deep, regional aquifer (deep aquifer wells are discussed under the CRA program section).
- Sampling and chemical analysis of surface water at specific locations and seep water at one location.
- Sampling and chemical analysis of sediment from specific locations.
- Sampling and chemical analysis of marine tissue (i.e., clams) from specific locations.

As discussed in the preamble to this monitoring section, LTM was discontinued in 2017, with more focused monitoring events performed in support of the site recharacterization. LTM will be resumed once the LTM plan has been revised in collaboration with the EPA, Ecology and Suquamish Tribe. The actual data collected during this FYR period are discussed in Section 4.2.

All OU 1 monitoring activities since the last FYR were performed in accordance with the regulator-approved LTM Work Plans (U.S. Navy, 2012h and 2017c) as amended by written approval and are based on regulator-approved recommendations in the fourth FYR. The current monitoring frequency exceeds the requirements specified in the ROD for groundwater, surface water, and seep water sampling, as requested by Ecology and with Navy concurrence. The frequency of sediment sampling meets the ROD-specified frequency of once every five years. Figure 2-1 depicts the various media monitoring locations sampled at OU 1 during this FYR period and Table 2-2 presents a list of these monitoring locations along with when these locations were sampled during this FYR period. The most recent monitoring results are discussed in Section 4.2. Details regarding groundwater elevation monitoring and chemical analysis monitoring of media are discussed below.

Groundwater Elevations. Groundwater level measurements are being collected biennially in even years concurrent with LTM sampling. This exceeds the ROD requirement of once every five years, but was requested by Ecology. These data are used to estimate groundwater gradient and flow directions beneath and downgradient of the former landfill in both the upper and intermediate portions of the aquifer. An effort is made to collect measurements near the time of low tide and data are reported with a reference to the tidal stage.

Groundwater Sampling and Chemical Analysis. Groundwater sampling monitors the extent and magnitude of VOC contamination in the upper and intermediate portions of the water table aquifer, and the deeper, regional aquifer beneath and downgradient of the former landfill. In addition to VOCs, wells MW1-09, MW1-38, MW1-39, Public Utility District (PUD), and Navy Supply Well #5 are also sampled to monitor for 1,4-dioxane. The analytical results are compared to the groundwater RGs established in the ROD (based on drinking water and seafood ingestion pathways), or in the case of 1,4-dioxane, the MTCA Method B cleanup level, since 1,4-dioxane monitoring was added via recommendations in the second and third FYRs. Long-term groundwater contamination trends are tracked to evaluate if the remedy is working as expected and/or if RGs/MTCA has been met.

Surface Water Sampling and Chemical Analysis. Five surface water samples and one seep sample (i.e., SP1-1) are sampled annually from three surface water locations and once every five years from two surface water locations, to monitor the fate, transport, and natural attenuation of VOCs in surface water. The seep is sampled once every five years for VOCs, and has been sampled biennially for PCBs since 2017. These sampling stations are in a series aligned upstream to downstream, beginning in the marsh pond adjacent to the landfill, through the outlet channel to the tide flats, and out to Dogfish Bay. Surface water samples are analyzed for VOCs and seep water samples are analyzed for VOCs and PCBs.

Sediment Sampling and Chemical Analysis. Sediment locations are distributed throughout the marsh, tide flats, and Dogfish Bay to monitor the fate and transport of contaminants migrating from the landfill through the marsh pond. Sediment samples from these locations are analyzed for PCBs and total organic carbon (TOC) once every five years and a one-time sample was collected at SP1-1 in 2019 to determine if a correlation exists between seep water and sediment PCB concentrations.

Marine Tissue Sampling and Chemical Analysis. Marine tissue sampling is conducted twice every five years at one location (i.e., TF21) with samples collected in 2017 and 2019 during this FYR period. Marine tissue (i.e., clam tissue) is analyzed for PCBs (U.S. Navy, 2017a).

Phytoremediation Monitoring

Phytoremediation monitoring activities since the last FYR have included the following:

- Periodic groundwater elevation measurements in monitoring wells and piezometers set in the upper portion of the aquifer in and around the plantations;

- Periodic groundwater sampling and chemical analysis from wells primarily in and around the plantations; and
- Periodic surface water and seep water sampling and chemical analysis from stations in the vicinity of the plantations.

Periodic groundwater elevation measurements in monitoring wells and piezometers throughout OU 1 occurred quarterly through 2011. The third FYR (U.S. Navy, 2010a) recommended reducing phytoremediation water-level measurements to once every 5 years to match the ROD-specified frequency. However, since most phytoremediation wells are also used for LTM and groundwater monitoring is conducted every two years, the Navy concluded that it was most efficient to sample wells and collect groundwater elevations throughout OU 1concurrently. These groundwater elevation measurements have been used to assess changes to the groundwater flow pattern in the shallow portion of the aquifer attributable to the phytoremediation plantations. Groundwater elevations are collected from all monitoring well and piezometer locations, as shown on Figure 2-1. Piezometers and passive diffusion samplers (a.k.a., peepers) are used to monitor intrinsic bioremediation at OU 1, so are discussed under the intrinsic bioremediation monitoring section.

All OU 1 phytoremediation chemical analysis monitoring activities since the last FYR were performed in accordance with the regulator-approved LTM Work Plans (U.S. Navy, 2012h and 2017c) and are based on recommendations in the third and fourth FYRs. The current monitoring frequency exceeds the requirements specified in the ROD. The most recent phytoremediation monitoring results are discussed in Section 4.2.

Contingent Remedial Action Monitoring

The CRA monitoring program was implemented in conjunction with the risk and compliance and phytoremediation monitoring programs. CRA monitoring includes sampling monitoring wells downgradient of the landfill to monitor for migration of contamination toward off-base domestic wells (U.S. Navy 2012i). All OU 1 CRA monitoring activities since the last FYR were performed in accordance with the regulator-approved LTM Work Plans (U.S. Navy, 2012h and 2017c). The current CRA plan provides a decision matrix for comparison of specific VOC and 1,4-dioxane concentrations in groundwater samples from “sentinel” wells that would trigger additional action to protect human health, such as hooking up affected properties to the public water supply or installing a new drinking water well at an affected properties to tap into the deeper, regional aquifer.

Wells included in CRA monitoring are MW1-09, MW1-38, MW1-39, Navy Supply Well #5, and the offsite PUD well. Groundwater samples collected under this program are analyzed for VOCs and 1,4-dioxane. Figure 2-1 depicts the location of CRA monitoring wells at OU 1 and Table 2-2 presents a list of these monitoring wells along with when these wells were sampled during this FYR period (U.S. Navy, 2003a).

Intrinsic Bioremediation Monitoring

The purpose of intrinsic bioremediation monitoring is to periodically: 1) ensure that intrinsic biodegradation conditions at the ROD-defined landfill source zones (North and South Plantations) remain favorable for degradation of cVOCs and 2) assess whether phytoremediation adversely affects conditions favorable to intrinsic biodegradation. As described in the summary data assessment report (U.S. Navy, 1997b) and OU 1 ROD (U.S. Navy, EPA, and Ecology, 1998), groundwater oxidation reduction (redox) conditions at the site appear to be generally favorable for complete degradation of cVOCs into their innocuous byproducts—carbon dioxide, water, and chloride. The favorable conditions identified are strongly reducing groundwater beneath the source area (which is favorable for reductive dechlorination of TCE and some DCE), followed by mildly reducing groundwater downgradient of the source area (which is favorable for direct oxidation of DCE and vinyl chloride). Because phytoremediation activities could potentially affect redox conditions at the site, the ROD specified that performance monitoring should include the redox conditions beneath the plantations to check for potential adverse effects from phytoremediation. The ROD also allowed for an evaluation of natural attenuation processes in the event that the phytoremediation component of the remedy was discontinued.

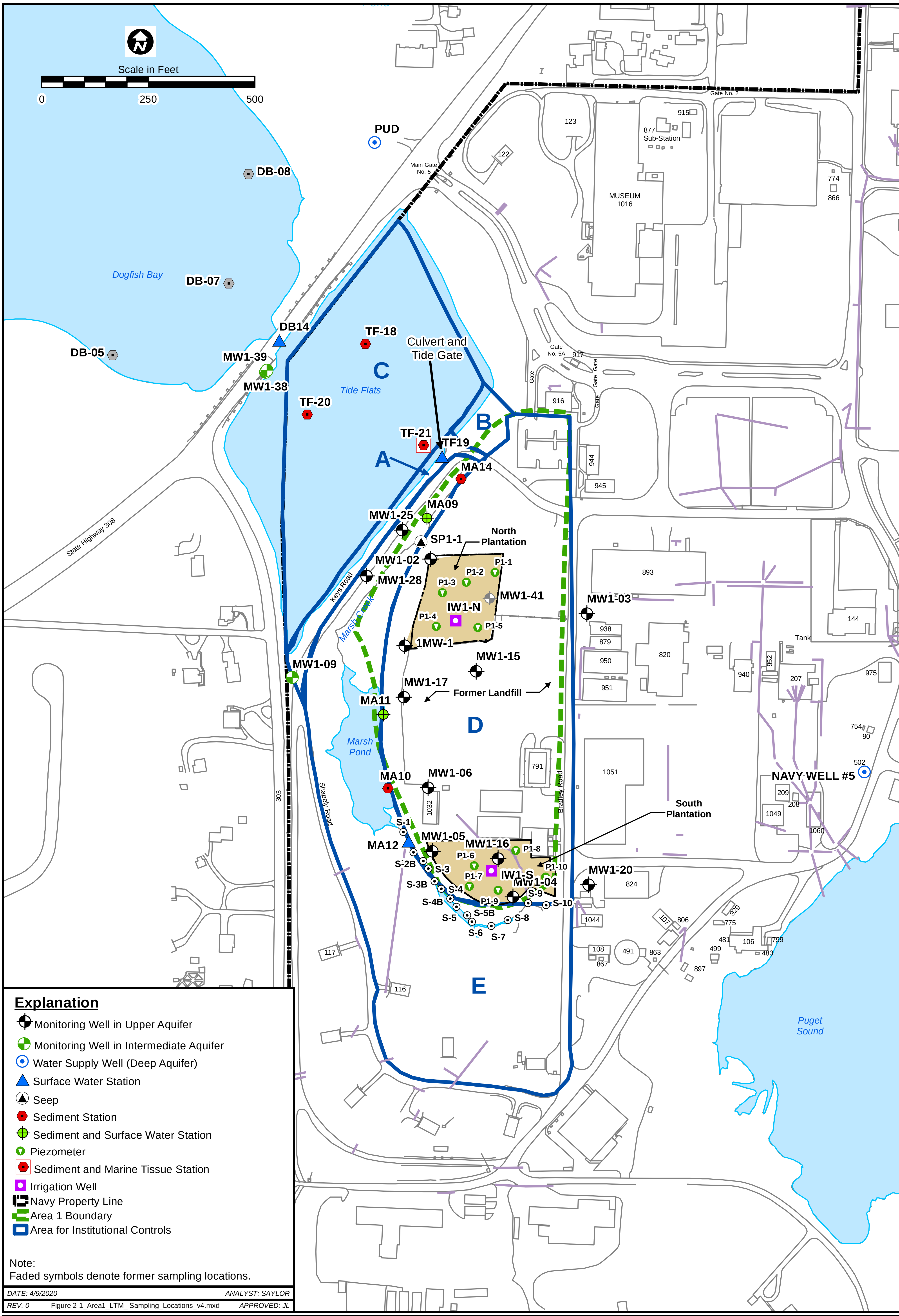
In 1995, the Navy began a cooperative effort with the USGS to investigate various natural attenuation mechanisms at OU 1 (USGS, 2003). The USGS monitored cVOC concentrations and geochemical conditions in groundwater and surface water on an annual basis from 2001 through 2015 to verify that conditions remain favorable for biodegradation. The USGS monitoring program was discontinued after the 2015 sampling event because the Navy concluded that the monitoring program had met its original objectives. The following monitoring wells and piezometers were measured for groundwater elevation and sampled for geochemical parameters, ethane, ethene, and cVOCs in 2015:

- Thirteen monitoring wells (i.e., 1MW-1, MW1-2, MW1-3, MW1-4, MW1-5, MW1-16, MW1-17, MW1-20, MW1-25, MW1-28, MW1-38, MW1-39, MW1-41 and background well MW1-33, which has been abandoned).
- Nine piezometers (i.e., P1-1, P1-3, P1-4, P1-5, P1-6, P1-7, P1-8, P1-9, and P1-10).

The following passive diffusion sampling sites were analyzed for cVOCs in groundwater in 2015:

- Fourteen passive diffusion (peepers) sampling locations (i.e., S-1, S-2, S-2B, S-3, S-3B, S-4, S-4B, S-5, S-5B, S-6, S-7, S-8, S-9, and S-10).

Although USGS did not analyze for cVOCs from wells 1MW-1, MW1-2, MW1-4, MW1-5, and MW1-16, these wells were sampled annually under the phytoremediation monitoring program. Figure 2-1 depicts all sampling locations and Table 2-2 presents a list of these sampling locations along with when these locations were sampled during this FYR period.



U.S. NAVY

Figure 2-1
OU 1 Area 1 LTM Sampling Locations

NBK KEYPORT
FIFTH
FIVE-YEAR REVIEW

Land Use Controls. As part of the remedy, LUCs were initiated in 2000 to prevent undue exposure to landfill contaminants in the future. These LUCs included tide gate inspections, preventing the installation of drinking water wells, preventing interference with remedial activities, and preventing development or activity that would disrupt the natural attenuation processes or disturb the landfill, tide flat, or adjoining marsh and shoreline in a manner that could lead to unacceptable risks to human health.

The updated IC Plan (U.S. Navy, 2017b) describes in detail the current land use and users, objectives of the LUCs, and implementation of the LUCs for OU 1. During this FYR period, annual LUC inspections were conducted to document that LUCs are being maintained and have met the following expectations stated in the OU 1 ROD:

- No new water wells have been installed, except for monitoring wells or wells that may be needed for future remedial actions.
- Access controls have been maintained and have prevented access.
- Current land use remains unchanged, or if changes have been made, the change has been reviewed and approved in collaboration with Ecology and the EPA.
- The asphalt landfill cover surface is present and documented to: 1) not require major repairs, or 2) repairs are recommended.
- No new drinking water wells have been installed on Navy property or within 1,000 feet of the landfill.
- Administrative procedures are in place to control digging at the landfill, and have been followed.

The objectives of the LUCs for areas within OU 1 identified in Figure 2-1 are as follows:

- **Area A** – Land use restrictions that prevent construction of water wells, except for monitoring wells or wells that may be needed for future remedial actions. This area is downgradient of the landfill.
- **Area B** – Land use restrictions that prevent construction of water wells, except for monitoring wells or wells that may be needed for future remedial actions. This area is, or may be, downgradient of the landfill.
- **Area C** – Land use restrictions that address procedures for controlling construction or maintenance activities to prevent activities that would interfere with or compromise the monitoring or other remedial actions for the site. The Navy will be able to conduct construction or maintenance activities. Prior approval of Ecology and EPA will be required for construction or maintenance activities that could affect the monitoring or remedy.
- **Area D** – Land use restrictions and requirements that address maintenance of the landfill cover (including the asphalt cover) and procedures for controlling activities that involve digging or construction at the landfill that could cause exposures to contaminants in soil, groundwater, or vapor within or from the landfill (see 2017 IC Plan for full description).
- **Area E** – Land use restrictions that address procedures for controlling construction or maintenance activities that would (1) disturb the wetlands adjacent to the landfill and could cause exposures to contaminants from the landfill that may be present in the sediments or surface water, or (2) interfere with or compromise the monitoring or other remedial actions for the site. The Navy will be able to conduct necessary construction or maintenance activities subject to (1)

taking measures to protect workers and prevent short-term and long-term risks from landfill contaminants and (2) complying with requirements of pertinent wetlands regulations.

- **All Areas** – NBK Keyport will remain a secure facility, limiting access to individuals with bona fide business with the Navy, or invitees. Should the United States decide to cease using the property for military operations (but continue to manage it), the need for and appropriate degree of fencing and securing measures will be reviewed and reestablished at such time by the Navy, with concurrence by Ecology and EPA.

The results of the annual LUC inspections are discussed in Section 4.3.

2.2 Operable Unit 2

This section discusses the remedy construction; investigations subsequent to remedy construction conducted during this FYR period; and operations, maintenance, and monitoring for OU 2 Areas 2 and 8 (see Figures 1-2, 1-4, and 1-5). The remedy for OU 2 has been implemented, construction is complete for all elements, operation, maintenance, and monitoring activities are ongoing, and LUCs are in place.

2.2.1 OU 2 Remedy Construction

Per the OU 2 ROD (U.S. Navy, EPA, and Ecology, 1994), the remedy includes the following components:

Area 2:

- Install additional upgradient wells to confirm no upgradient source of COCs exists.
- Monitor natural attenuation.
- Implement LUCs to protect human health.

Area 8:

- July 1998 and March 1999 – Building 72 demolition and hot-spot soil removal based on cadmium and chromium concentrations exceeding MTCA Method B cleanup levels for soil ingestion.
- Monitor natural attenuation.
- Implement LUCs to protect human health.
- Assess human health and ecological risks based on tissue and sediment data.
- Perform a risk assessment, if warranted.
- Implement contingent groundwater control actions, if Area 8 groundwater discharge to the adjacent beach is demonstrated to represent a risk to human health or the environment.

In addition to the remedy components listed above, VOCs, SVOCs, and TPH as diesel in soil were characterized in 1998 and 1999 at OU 2 Area 8. The monitoring for the independent remedial actions under MTCA for diesel contamination has been completed, as detailed in the fourth FYR (U.S. Navy, 2015b). An Explanation of Significant Differences (ESD) was issued for OU 2 Area 8 in 1996, after initial monitoring requiring chromium speciation indicated that total chromium concentrations could be assumed to be 100 percent hexavalent chromium. Therefore, chromium speciation was discontinued based on the ESD.

2.2.2 OU 2 Post-Remedy Construction Investigations

No additional actions or investigations were conducted at OU 2 Area 2 during this FYR period.

Additional investigations conducted during this FYR period at OU 2 Area 8 include:

- 2015 through 2020 marine investigations and subsequent human health and ecological risk assessments,
- 2017 and 2019 VI investigations, and
- 2018 USGS tidal lag study.

The activities associated with, and objectives of these Area 8 investigations are discussed below. The data review/results are presented and discussed in Section 4.2.

Area 8 Marine Investigation and Subsequent Risk Assessments. A marine investigation report was completed in 2016 (U.S. Navy, 2016d), which documents the results of tissue, sediment, seep water, outfall, and surface water sampling conducted in 2015 and 2016 at the Area 8 beach. The report documents the results of clam tissue and sediment sampling (at ROD-established sampling locations [Stations SS01 to SS09]) and one-time sampling of clam tissue, sediment, seep water, marine water, and outfalls from new locations across the Area 8 beach. The purpose of the investigation was to collect additional data to determine the nature and extent of metals contamination at the Area 8 beach and to support human health and ecological risk assessment. In addition, because of some uncertainty associated with the northern extent of impacted seeps and sediments, additional data collection efforts were conducted to fully characterize the extent of contamination. The marine investigation report includes sampling methodology and data reporting only, without data interpretation, as the project team decided that data interpretation should be informed by the results of the associated risk assessments.

Subsequently, the Human Health Risk Assessment (HHRA)/Ecological Risk Assessment (ERA) (U.S. Navy, 2018a) was conducted to estimate human health and ecological risks associated with exposure to potentially contaminated media (i.e., clam tissue, sediment, seep water, outfall, and surface water) at the Area 8 beach, per the recommendations of the third and fourth FYRs (U.S. Navy, 2010a and 2015b). The specific objectives were to: 1) characterize human health and ecological site risks relative to background; 2) confirm the extent of contamination and update the conceptual site model; and 3) assess the need to implement contingent groundwater control actions based on the results of the risk assessments.

Due to potential risks to benthic organisms determined in the ERA, an ERA addendum was conducted based on Ecology's Sediment Management Standards (SMS) regulation (i.e., an applicable or relevant and appropriate requirement [ARAR] under the OU 2 ROD) which allows the use of bioassay analysis in cases where chemical concentrations in sediment samples exceed the published numeric standards. Samples that pass the bioassay analysis are considered to not pose an unacceptable risk to benthic organisms.. The primary objective of the ERA addendum was to collect additional data needed to fully evaluate the potential risks to the benthic community from COCs originating from OU 2 Area 8 and finalize the ERA. To meet this objective, eight (8) OU 2 Area 8 sediment samples (including one duplicate), one (1) OU 2 Area 8 seep water sample, three (3) reference area sediment samples, and one (1) reference area seep water sample, were collected in June 2019, and tested under a bioassay program developed in collaboration with by EPA, Ecology and the Suquamish Tribe in July and August 2019.

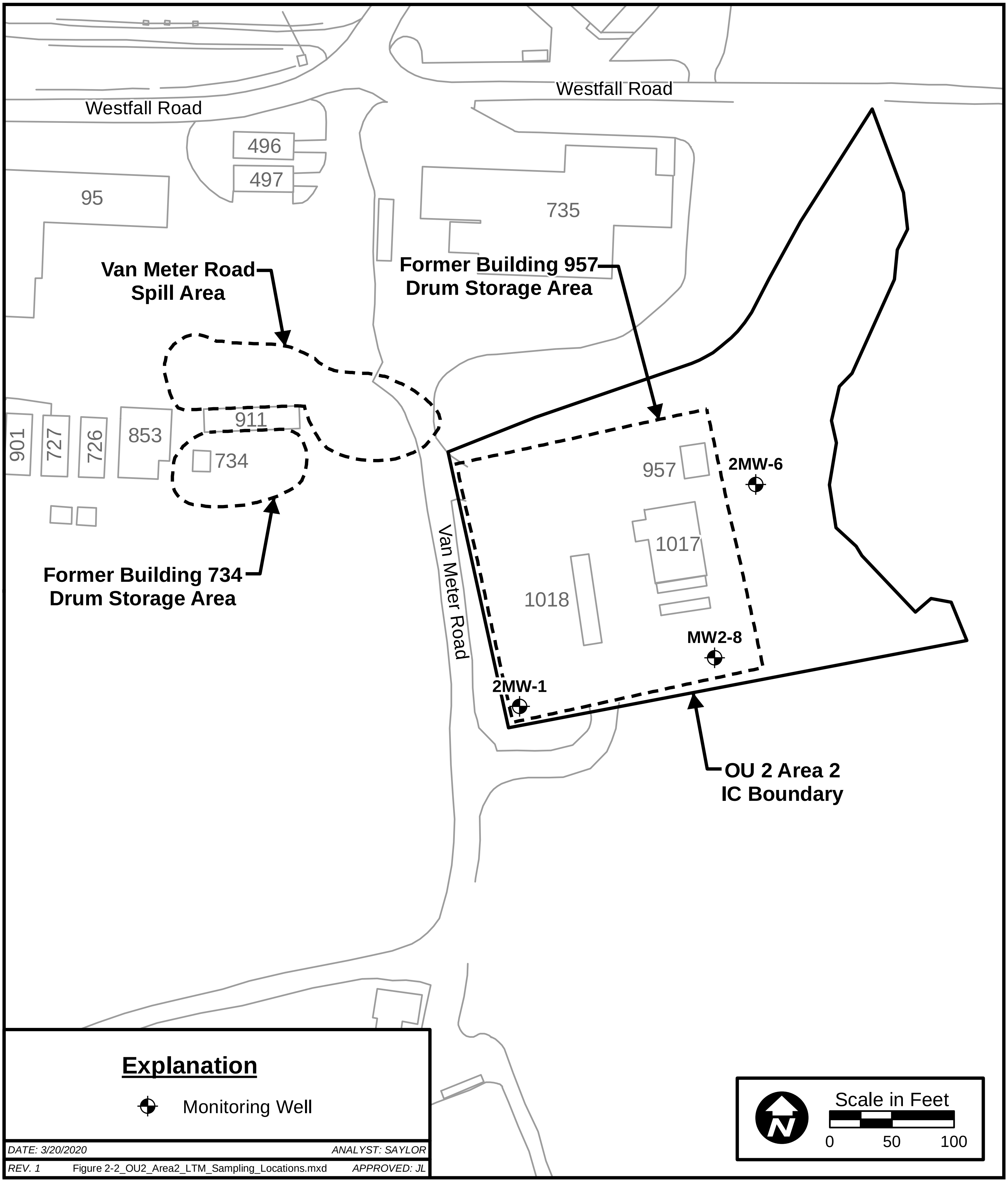
2017 and 2019 Vapor Intrusion Investigations. A VI Study (U.S. Navy, 2018c) was conducted in fall 2017 at OU 2 Area 8 in response to the fourth FYR (U.S. Navy, 2015b), recommending a VI evaluation, including soil gas sampling adjacent to occupied buildings within 100 feet of monitoring wells exhibiting TCE concentrations exceeding 5 µg/L (i.e., VI default screening level). The objectives of the study were to determine: 1) if the concentrations of VOCs in soil vapor samples indicate the potential for VI into nearby buildings warranting further investigation, and 2) if the lateral or vertical distribution of VOCs in soil vapor are indicative of preferential vapor migration pathways that warrant further investigation. To address these questions, the scope of work consisted of collection and analysis of soil vapor samples from six (6) locations adjacent to buildings near known cVOC concentrations in groundwater. Based on the results and conclusions/recommendations of the 2017 investigation, an additional investigation of the VI pathway and VOC migration along preferential pathways was conducted in April and July 2019 in and around Buildings 82, 85, 98, and 1074 adjacent to OU 2 Area 8. The overall objectives of the VI study were to: 1) evaluate whether the VI pathway is complete between the site and nearby buildings; 2) assess whether the cVOCs in groundwater at OU 2 Area 8 have contributed to indoor air concentrations via the VI pathway; and 3) collect information to support the selection of appropriate mitigation measures, if required.

USGS Tidal Lag Study. A tidal lag study was conducted by USGS from October to November 2017 to determine the optimal time during the semi-diurnal and neap-spring tidal cycles to sample groundwater for freshwater contaminants at OU 2 Area 8 monitoring wells. For the study, groundwater levels and specific conductance, along with marine water levels (tidal levels) in five monitoring wells (i.e., MW8-8, MW8-9, MW8-11, MW8-12, and MW8-14) were measured every 15 minutes during a 3-week duration to determine how nearshore groundwater responds to tidal forces. Monitoring wells included in the tidal lag study are shown on Figure 2-3. Time series data were collected during a period that included neap and spring tides. Vertical profiles of specific conductance were also measured in the screened interval of each monitoring well prior to instrument deployment to determine if a freshwater/saltwater interface was present in the monitoring well at that particular time.

2.2.3 OU 2 Operations, Maintenance, and Monitoring

Since the fourth FYR (U.S. Navy, 2015b), the Navy has continued monitoring the OU 2 remedy. The monitoring and LUC programs at OU 2 are described below.

OU 2 Area 2 Monitoring. Since the OU 2 ROD (U.S. Navy, EPA, and Ecology, 1994), groundwater monitoring (i.e., LTM) has been conducted at OU 2 Area 2 to establish trends in COC concentrations and determine when LUCs can be discontinued. During this FYR period, the LTM program at Area 2 involved periodic sampling of groundwater from three point of compliance monitoring wells (i.e., 2MW-1, 2MW-6, and MW2-8) for vinyl chloride and 1,4-dioxane, with comparison of results to the RG for vinyl chloride and to the MTCA Method B cleanup level for 1,4-dioxane. The LTM program also involves periodic water level measurements to monitor the groundwater flow direction. Figure 2-2 depicts the LTM sampling locations for OU 2 Area 2. The results of the LTM program are discussed in Section 4.2.



U.S. NAVY	**Figure 2-2** **OU 2 Area 2 LTM Sampling Locations**	NBK KEYPORT FIFTH FIVE-YEAR REVIEW

OU 2 Area 2 Land Use Controls. As part of the remedy, LUCs were implemented to prevent residential land use and construction of domestic wells. The updated IC Plan (U.S. Navy, 2017b) describes in detail the current land use and users, objectives of the LUCs, and implementation of the LUCs for OU 2 Area 2. During this FYR period, annual LUC inspections were conducted to document that LUCs are being maintained and have met the following expectations stated in the OU 2 ROD:

- No new water wells have been installed, except for monitoring wells or wells that may be needed for future remedial actions.
- Access controls have been maintained and have prevented access.
- Current land use remains unchanged (i.e., industrial or commercial purposes only), or if changes have been made, the change has been reviewed and approved in collaboration with Ecology and the EPA.
- Administrative procedures are in place to control digging at Area 2, and have been followed.

The results of the annual LUC inspections are discussed in Section 4.3.

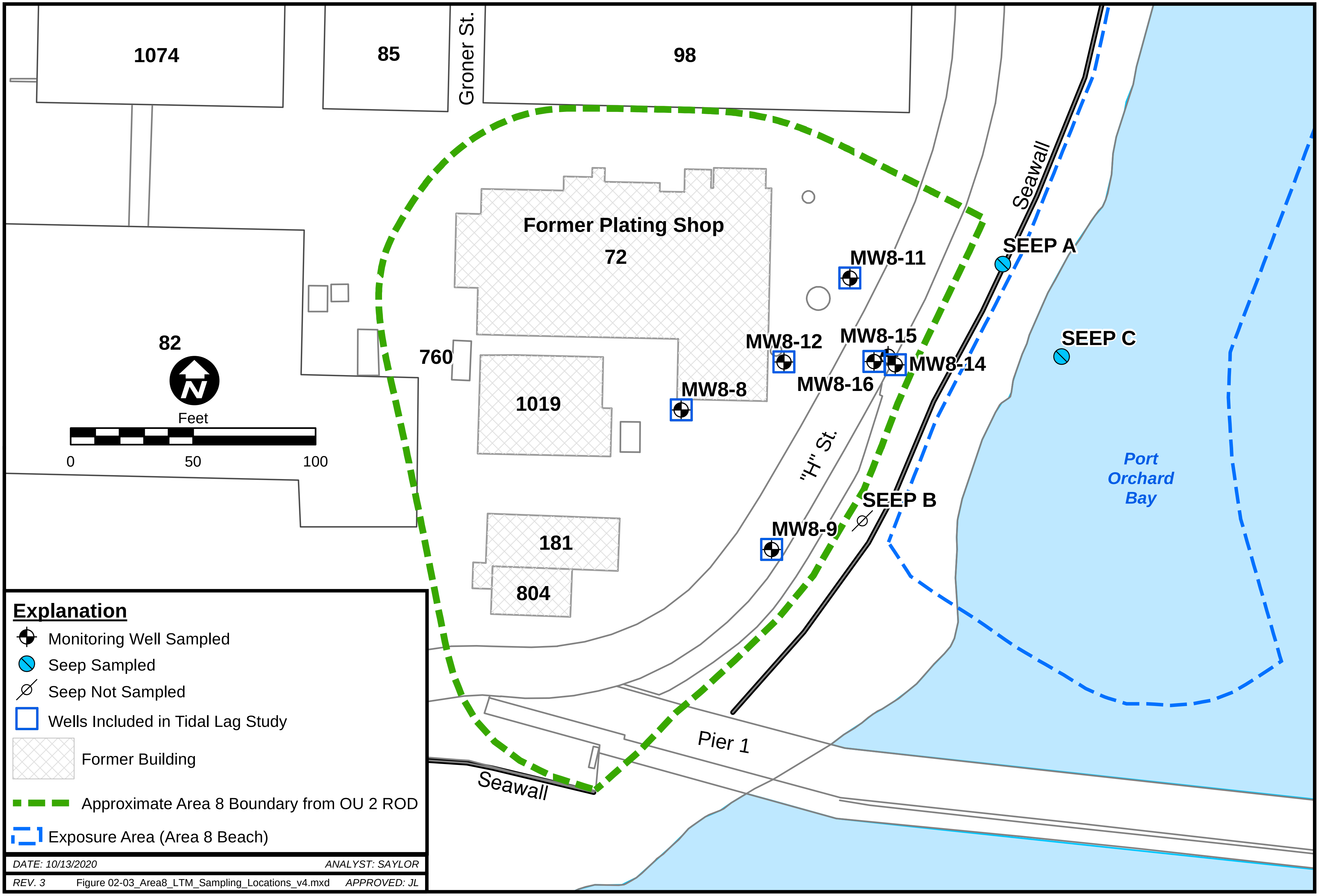
OU 2 Area 8 Monitoring. Since the OU 2 ROD (U.S. Navy, EPA, and Ecology, 1994), LTM has been conducted at Area 8 and included groundwater, seep water, surface water, sediment, and tissue sample collection and analysis. During this FYR period, all Area 8 monitoring activities were performed in general accordance with the regulator-approved LTM Work Plans (U.S. Navy, 2012h and 2017c). Groundwater monitoring is conducted on an annual basis and samples are collected and analyzed for VOCs, 1,4-dioxane, dissolved low-level mercury, and dissolved metals. Figure 2-3 depicts the locations for various media monitoring currently conducted at OU 2 Area 8. The results of the LTM program are discussed in Section 4.2.

OU 2 Area 8 Land Use Controls. As part of the remedy, LUCs were initiated in 2000 to prevent exposure to soil and groundwater during hypothetical future residential land use.

The updated IC Plan (U.S. Navy, 2017b) describes in detail the current land use and users, objectives of the LUCs, and implementation of the LUCs for OU 2 Area 8. During this FYR period, annual LUC inspections were conducted to document that LUCs are being maintained and have met the following expectations stated in the OU 2 ROD:

- Access controls have been maintained and have prevented access.
- No new water wells have been installed, except for monitoring wells or wells that may be needed for future remedial actions.
- Current land use remains unchanged (i.e., industrial or commercial purposes only), or if changes have been made, the change has been reviewed and approved in collaboration with Ecology and the EPA.
- Administrative procedures are in place to control digging at Area 8, and have been followed.

The results of the annual LUC inspections are discussed in Section 4.3.



U.S. NAVY	**Figure 2-3** **OU 2 Area 8 LTM Sampling Locations**	NBK KEYPORT FIFTH FIVE-YEAR REVIEW

Table 2-1. Summary of Remedial Action for OUs 1 and 2

OU, Site	Reasonably Anticipated Land Use	COC Requiring Action	Media	RGs	RAOs[a]	Remedy Component	Remedy Construction Complete	Long-Term Management or Site Closeout Strategy
OU 1	Active military installation	VOCs	Soil, waste, vapor	No RGs were established in ROD.	• Prevent human exposure to soil and landfill waste. • Prevent human exposure to landfill vapor. • Prevent unacceptable risks to humans from soil and air above state MTCA B Levels.	• Upgrade and maintain the landfill cover – Initial upgrade construction is complete and maintenance ongoing. • LUCs: ongoing.	Yes	• Maintain soil cover and phytoremediation plantation, as needed. • Conduct annual LUC monitoring.
		1,1-DCA 1,2-DCA 1,1-DCE cis-1,2-DCE trans-1,2-DCE PCE 1,1,1-TCA TCE Vinyl chloride PCBs 1,4-dioxane (Not identified in ROD)	Ground-water	800 µg/L 5 µg/L 0.5 µg/L 70 µg/L 100 µg/L 5 µg/L 200 µg/L 5 µg/L 0.5 µg/L 0.04 µg/L 0.44 µg/L (MTCA Method B Cleanup Level)	• Prevent human exposure to groundwater as drinking water. • Prevent unacceptable risks to humans and aquatic organisms due to migration of groundwater into adjacent aquatic environments.	• Treat VOC hot spots in the landfill by phytoremediation: ongoing, including additional site characterization at south plantation for remedy optimization. • Conduct LTM, including phytoremediation monitoring, intrinsic bioremediation monitoring, and risk and compliance monitoring: ongoing until RGs are met. • LUCs: ongoing. • Take contingent remedial actions for off-base domestic wells, if necessary: ongoing monitoring.	Yes	• Conduct LTM until RGs are met. • Conduct annual LUC monitoring.
		1,1-DCA 1,2-DCA 1,1-DCE cis-1,2-DCE trans-1,2-DCE PCE 1,1,1-TCA TCE Vinyl chloride PCBs	Surface Water	None 59 µg/L 1.9 µg/L None 33,000 µg/L 4.2 µg/L 41,700 µg/L 56 µg/L 1.9 µg/L 0.04 µg/L	• Prevent unacceptable risks to humans due to ingestion of seafood. • Prevent unacceptable risks to aquatic organisms due to surface water exposure.	• Upgrade the tide gate: construction complete. • Conduct LTM: ongoing until RGs are met.	Yes	• Conduct LTM until RGs are met. • Conduct annual LUC monitoring.
		1,1-DCA 1,2-DCA 1,1-DCE cis-1,2-DCE trans-1,2-DCE PCE 1,1,1-TCA TCE Vinyl chloride PCBs	Sediment	State Sediment Quality Standards/Bioassays[b]	• Prevent unacceptable risks to humans due to ingestion of seafood as defined by concentrations in littleneck clams (see tissue). • Prevent unacceptable risks to aquatic organisms due to sediment exposure.	• Remove PCB-contaminated sediments from seep location: completed. • Upgrade the tide gate: construction complete. • Conduct LTM: ongoing LTM to ensure that contaminant concentrations have not increased from the time of the ROD.	Yes	• Conduct LTM to monitor migration. • Conduct annual LUC monitoring.
		1,1-DCA 1,2-DCA 1,1-DCE cis-1,2-DCE trans-1,2-DCE PCE 1,1,1-TCA TCE Vinyl chloride PCBs	Marine Tissue	304 mg/kg 0.33 mg/kg 0.051 mg/kg 30 mg/kg 61 mg/kg 0.59 mg/kg 61 mg/kg 2.8 mg/kg 0.016 mg/kg 0.015 mg/kg	• Prevent exposure to humans due to ingestion of seafood above a cumulative incremental cancer risk of 1 x 10^{-5} or above a noncancer hazard index of 1.0. • Prevent exposure to aquatic organisms above the ecological risk-based screening levels (Appendix J of U.S. Navy [1997a]).	• Upgrade the tide gate: construction complete. • Conduct LTM: ongoing LTM to ensure that contaminant concentrations have not increased from the time of the ROD.	Yes	• Conduct LTM to evaluate potential bioaccumulation of PCBs. • Conduct annual LUC monitoring.

Table 2-1 (continued). Summary of Remedial Action for OUs 1 and 2

OU, Site	Reasonably Anticipated Land Use	COC Requiring Action	Media	RGs	RAOs[a]	Remedy Component	Remedy Construction Complete	Long-Term Management or Site Closeout Strategy
OU 2, Area 2	Active military installation	TCE Vinyl chloride	Ground-water	5 µg/L 0.1 µg/L (assumed PQL at the time of the ROD; current PQLs can achieve current RG of 0.029 µg/L)	• Prevent human exposure to groundwater as drinking water and inhalation of volatiles while showering. • Reduce concentrations of contaminants in groundwater to drinking water quality.	• Install additional upgradient wells to confirm no upgradient source of COCs exists: construction complete. • Conduct LTM: ongoing until RGs are met for vinyl chloride (already met for TCE). • LUCs: ongoing.	Yes	• Conduct LTM until RGs are met. • Conduct annual LUC monitoring.
		Arsenic Benz(a)pyrene Beryllium Vinyl chloride	Soil	MTCA Method B Cleanup Levels	• Prevent human exposure to soil or vegetables grown in soil (residential).	• LUCs: ongoing.		• Conduct annual LUC monitoring.
OU 2, Area 8	Active military installation	Cadmium Chromium III[c] Chromium VI[c] Chromium (total) 1,1-DCE cis-1,2-DCE PCE 1,1,1-TCA TCE	Ground-water	5 µg/L 16,000 µg/L 80 µg/L 50 µg/L 7 µg/L 70 µg/L 5 µg/L 200 µg/L 5 µg/L	• Prevent human exposure to groundwater as drinking water. • Protect sediments and surface water quality offshore of Area 8 in Port Orchard Bay from contaminants in groundwater that could cause future adverse impacts or human health risks.	• Install additional monitoring wells: construction complete. • Conduct LTM of groundwater, seep water, sediment, and tissue in the intertidal zone of Area 8: ongoing until RGs are met. • LUCs: ongoing. • Assess risks to human health and the environment using the sediment and tissue monitoring data: completed and presented in this FYR report. • Implement contingent groundwater control actions if Area 8 groundwater is demonstrated to be a significant source of the chemicals that cause risk in sediments or tissue: to be completed based on recent ecological risk assessment.	Yes	• Conduct LTM until RGs are met. • Conduct annual LUC monitoring.
		Arsenic[d] Cadmium Chromium VOCs SVOCs	Soil	MTCA Method B Cleanup Levels	• Prevent human exposure to soil. • Protect groundwater and surface water quality from soil containing COCs.	• Soil hot spot removal: construction complete. • LUCs: ongoing.		• Conduct annual LUC monitoring.

[a]The RAO statements included in this table are summary versions of the RAO statements from the OU 1 and OU 2 RODs. Please refer to the RODs for the complete text of each RAO statement.
[b]Washington State Sediment Quality Standards (SQS) value of 12 mg/kg for PCBs was set at the time of the signed ROD. Current SQS values are applicable to all other COCs as established in the ROD. Bioassays will be performed if chemical results fail the SQS as established on page 95 of the ROD.
[c]Trivalent and hexavalent chromium (chromium III and VI, respectively) were dropped from COC list.
[d]Concentrations were found to be below background, so contaminant was dropped from COC list.
COC – chemical of concern
DCA – dichloroethane
DCE – dichloroethane
GRO – gasoline range organic
LTM – long-term monitoring
LUC – land use control
MTCA – Model Toxics Control Act
NTCRA – non-time critical removal action
PCB – polychlorinated biphenyl
PCE – perchloroethene
RG – remedial goal

Table 2-1 (continued). Summary of Remedial Action for OUs 1 and 2

ROD – Record of Decision
SI – site inspection
SVOC – semi-volatile organic compound
TCA – trichloroethane
TCE – trichloroethene
TCRA – time critical removal action
TPH – total petroleum hydrocarbon
VOC – volatile organic compound

Table 2-2. Summary of LTM Program at OU 1 During this FYR Period

Sampling Location	Year				
	2015	2016	2017	2018	2019
Groundwater					
1MW-1	–	✓	–	–	✓
MW1-02	–	✓	✓	✓	✓
MW1-04	✓	✓	✓	–	✓
MW1-09	–	✓	–	–	✓
MW1-14	–	–	–	✓	✓
MW1-25	–	–	–	✓	✓
MW1-28	–	–	–	✓	✓
MW1-29	–	–	–	–	✓
MW1-38	–	✓	–	–	✓
MW1-39	–	✓	–	–	✓
MW1-41	–	–	–	✓	✓
MW1-60	–	–	–	✓	–
MW1-05	✓	✓	✓	–	–
MW1-16	✓	✓	✓	–	–
MW1-17	✓	✓	✓	–	–
MW1-20	✓	✓	✓	–	–
MW1-03	–	✓	–	–	–
MW1-06	–	✓	–	–	–
MW1-15	–	✓	–	–	–
IW1-N	–	✓	–	–	–
IW1-S	–	✓	–	–	–
PUD	✓	✓	✓	–	✓
Navy #5	✓	✓	✓	–	✓
P1-01	✓	–	–	✓	✓
P1-02	–	–	–	–	✓
P1-03	✓	–	–	–	✓
P1-04	✓	–	–	–	✓
P1-05	✓	–	–	–	✓
P1-06	✓	✓	–	–	–
P1-07	✓	✓	–	–	–
P1-08	✓	✓	–	–	–
P1-09	✓	✓	–	–	–
P1-10	✓	✓	–	–	–

Table 2-2 (continued). Summary of LTM Program at OU 1 During this FYR Period

Sampling Location	Year				
	2015	2016	2017	2018	2019
Passive Diffusion Sampling Locations					
S-1	✓	–	–	–	–
S-2	✓	–	–	–	–
S-2B	✓	–	–	–	–
S-3	✓	–	–	–	–
S-3B	✓	–	–	–	–
S-4	✓	–	–	–	–
S-4B	✓	–	–	–	–
S-5	✓	–	–	–	–
S-5B	✓	–	–	–	–
S-6	✓	–	–	–	–
S-7	✓	–	–	–	–
S-8	✓	–	–	–	–
S-9	✓	–	–	–	–
S-10	✓	–	–	–	–
Seep					
SP1-1	–	–	✓	–	✓ (also SED)
Sediment (SED), Surface Water (SW), and/or Tissue (T)					
DB14	–	–	–	–	SW
MA09	SW	SW	SW	–	SW/SED
MA11	SW	SW	SW	–	SW
MA12	SW	SW	SW	–	SW
TF19	–	–	–	–	SW
MA14	–	–	–	–	SED
TF21	–	–	T	–	SED

SW – surface water
SED – sediment
T – marine tissue

3.0 PROGRESS SINCE LAST FIVE-YEAR REVIEW

Per EPA FYR Guidance (EPA, 2016), Table 3-1 details the protectiveness statements and determinations from the *Fourth Five-Year Review for NBK Keyport* (U.S. Navy, 2015b).

3.1 Status of Recommendations

In total, eight recommendations are presented in the *Fourth Five-Year Review for NBK Keyport* (U.S. Navy, 2015b) to ensure future long-term protectiveness of the remedies. Table 3-2 lists these recommendations and provides the current status of each recommendation (e.g., under discussion, ongoing, addressed in next FYR, considered but not implemented, or completed).

3.2 Additional Actions Taken

In addition to the recommendations and current status of these recommendations summarized in Table 3-2, the Navy has taken additional actions at OUs 1 and 2 to ensure the protectiveness of the remedies. These additional actions are described in the following subsections.

3.2.1 Analyte Change History Review

In late 2019, during preparation of this FYR, the Navy initiated a review of the history of changes in the groundwater LTM programs over time for the sites in Operable Units (OUs) 1 and 2. The purpose of the research was to compare the analyte suites and sampled wells associated with the LTM program specified in the RODs, with the current monitoring program being performed at OU 1 and OU 2 Areas 2 and 8 to evaluate the timing and rationale for post-ROD changes to the chemical analyte suites, sampled wells RGs and monitoring frequencies over time.

This research included post-ROD changes to groundwater, seep water, surface water, sediment, and clam tissue monitoring (U.S. Navy, 2019g).

3.2.2 Tidal Lag Studies at OU 1 and OU 2

During this FYR period the Navy contracted the USGS to perform tidal lag studies at both OU 1 and OU 2 Area 8. These studies were performed in support of groundwater LTM. The study performed at OU 1 was flawed and is being repeated. The study performed at OU 2 Area 8 provided refined information regarding how groundwater levels throughout OU 2 Area 8 respond to tidal fluctuations. This information was then used to determine the optimal times during the semi-diurnal and the neap-spring tidal cycle to sample for COCs in groundwater beneath the site. The optimal times for sampling are presumed to be when fresh water flowing seaward is least impeded by elevated tides, and those times are related to predicted tide levels by tidal lags, the durations between low tides and corresponding low groundwater levels. Specifically, the groundwater monitoring plan need to consider the timing of minimum groundwater levels following low tides as well as the relative proportions of fresh groundwater and seawater in wells throughout both the semi-diurnal and longer-term spring-neap tidal cycles. This information allows collection of groundwater samples and water level measurements that are least affected by groundwater-seawater interactions.

The tidal lag study was completed at OU 2 Area 8 during this FYR period (USGS, 2018), while the original study for OU 1 was in progress (USGS, 2019) and is currently being repeated.

Table 3-1. Protectiveness Statement(s) and Determination(s) from the Fourth Five-Year Review

Operable Unit/Site	Protectiveness Determination	Protectiveness Statement(s)
1	Short-Term Protective	The remedy at OU 1 is protective in the short term. Exposure pathways that could result in unacceptable risks are being controlled and monitored while further information is obtained. The office worker exposures to potential COCs in indoor air at buildings east of Bradley Road are protective in the short term because the mass of contamination is over 100 feet away from the occupied buildings, and most of the buildings are large and well ventilated. Damage to the landfill cap is limited, and the remedy remains protective. In addition, an investigation of the former landfill to study the feasibility of optimizing the remedial action at the south plantation will be conducted. To ensure future long-term protectiveness, further information will be obtained by implementing Recommendations 2 and 3 presented in Section 8. Recommendation 2 calls for repair of damage to the landfill cap, and Recommendation 3 calls for performing the initial step of the VI evaluation, including soil gas sampling adjacent to occupied buildings within 100 feet of monitoring wells with TCE concentrations exceeding 5 µg/L.
2	Short-Term Protective	The remedy at OU 2 is protective in the short term. The remedy has been implemented and performed as intended by the ROD at Area 2. The remedy implemented at OU 2 Area 2 is protective of human health and the environment because RGs have been met for TCE and risk-based levels (MTCA Method B cleanup level) have been met for cis-1,2-DCE in groundwater, and exposure pathways that could result in unacceptable risks are being controlled and monitored. The remedy implemented at OU 2 Area 8 is protective in the short term. Exposure pathways that could result in unacceptable risks are being controlled and monitored while further information is obtained. The office worker exposures to potential COCs in indoor air at buildings are protective in the short term because the occupied buildings within 100 feet of the contaminant plume are large and well ventilated. To ensure future long-term protectiveness, further information will be obtained by performing the initial step of the VI evaluation, including soil gas sampling adjacent to occupied buildings within 100 feet of monitoring wells with TCE concentrations exceeding 5 µg/L, sampling marine surface water, sediment, and clam tissue to generate new data representative of current COC levels from the intertidal zone, and completing human health and ecological risk assessments (as required by the ROD) on the new data generated.
Sitewide	Short-Term Protective	The overall sitewide remedies are protective in the short term. Exposure pathways that could result in unacceptable risks are being controlled and monitored while further information is obtained. To ensure future long-term protectiveness, further information will be obtained at OU 1 and OU 2 Area 8.

Table 3-2. Status of Recommendations from the Fourth Five-Year Review

Item No.	Issue	Recommendation	Current Status	Current Implementation Status Description	Reference or Completion Date (if applicable)
Sitewide					
1	Changes to LTM are recommended in this FYR report, and the reporting limit for 1,4-dioxane is not low enough to meet the MTCA Method B value of 0.44 µg/L.	Revise the OU 1 and OU 2 LTM plans in collaboration with EPA, Ecology, and the Suquamish Tribe based on the FYR recommendations. Include in the plans the use of a laboratory analytical method that can achieve a reporting limit of 0.4 µg/L for 1,4-dioxane in groundwater to meet the MTCA Method B value of 0.44 µg/L.	Completed	The LTM plan covering OU 1 and OU 2 was updated in 2017 during this FYR period and was reviewed by EPA, Ecology, and the Suquamish Tribe. Comments received from these reviews were incorporated into the final plan. The revised plan explicitly incorporated changes recommended by the fourth FYR. During monitoring within this FYR period, a lab was chosen that could consistently achieve the target reporting limit of 0.4 µg/L for 1,4-dioxane in groundwater. The most recent LTM reports covering sampling in 2019 are not yet published, however comprehensive data sets showing report limits through 2019 are included in Appendices C, E, and G of this FYR.	U.S. Navy, 2017c
2	Ecology requested more rigorous LTM trend graphs for all areas. The use of one value to represent all reporting limits unrealistically biases the trend graphs.	LTM trend graphs will be completed according to Ecology's guidance on remediation by natural attenuation of petroleum-contaminated groundwater. It is recommended that the actual reporting limits are used in the trend graphs, rather than using one value to represent all reporting limits. For those reporting limits that are unrealistically biasing trends, it is recommended that the non-detected result be removed in consultation with Ecology.	Addressed in Next FYR	The trend analysis presented in OU 1 LTM reports prepared during this FYR period utilize a value of half of the reporting limit when analytes are not detected. The spring 2016 LTM report cites Ecology guidance as the basis for this approach; however, the guidance does not recommend using half of the reporting limit for analytes not detected. The 2016-2018 OU 2 Area 8 LTM Reports use the reporting limits in the trend graphs for contaminants detected at concentrations below laboratory reporting limits (referred to as "non-detect" from here forward) results, which is a revised approach from LTM reports prior to the fourth FYR. The Navy is currently revising the LTM QAPP in collaboration with the project team. Trend analysis methods will be revised and the revised method approved by Ecology during this process. The 2019 LTM report and trend graphs were not available at the time of preparation of this FYR.	U.S. Navy, 2017d, 2019c, 2018e, 2017f,

Table 3-2 (continued). Status of Recommendations from the Fourth Five-Year Review

Item No.	Issue	Recommendation	Current Status	Current Implementation Status Description	Reference or Completion Date (if applicable)
				OU 1	
3	Several deficiencies in the landfill cover were identified.	Perform landfill cover repairs. Ensure that future institutional control inspections of the landfill are comprehensive.	Addressed in Next FYR Completed	To allow for slow release of vapors to the atmosphere such that vapor concentrations do not build up and migrate laterally in the soil away from the landfill boundary, a landfill venting evaluation has been awarded and landfill venting and cover upgrades will begin in FY 2021. The following question was added to the annual IC Inspection Form starting in 2016: "For Area D, the former landfill, is there significant damage (e.g., cracking, seam separation, root damage, etc.) to asphalt surfaces that permits direct-contact exposure to underlying soils or that may significantly increase filtration of surface water/stormwater?"	U.S. Navy, 2016a, 2017b
4	Evaluation against current VI guidance has identified potential data gaps regarding worker exposure to potential VOCs in indoor air at facility buildings near OU 1.	Perform the initial step of a VI evaluation, including soil gas sampling adjacent to occupied buildings within 100 feet of groundwater wells exhibiting TCE concentrations exceeding 5 µg/L.	Completed	Soil vapor sampling was conducted along Bradley Road during the 2016 Phase II investigation and identified the migration of landfill COCs to the east. Based on recommendations from the Phase II investigation, indoor air, outdoor air, sub-slab, and exterior soil vapor samples were collected, and differential pressure was monitored in both late winter (March 2018) and summer (July 2018) in all buildings immediately east and northeast of the landfill. All indoor air concentrations were less than Ecology's Method C (industrial) screening levels and sub-slab and exterior soil vapor concentrations were less than Ecology's Method C (industrial) screening levels for eight of the ten buildings. For the remaining two buildings, indoor air concentrations were less than industrial screening levels, however there were a few sub-slab samples with concentrations greater than industrial screening levels. Detailed assessment of the magnitude, frequency, and nature of these detected concentrations in sub-slab vapor result in a conclusion that the potential for unacceptable VI risk at these two buildings is low. Therefore, the 2018 study concluded that no VI risk is present, so no further actions are necessary.	U.S. Navy 2017a, 2019a

Table 3-2 (continued). Status of Recommendations from the Fourth Five-Year Review

Item No.	Issue	Recommendation	Current Status	Current Implementation Status Description	Reference or Completion Date (if applicable)
5	Phytoremediation at OU 1 is not as effective at the south plantation as the north plantation. Although the ROD requirements are being met and the remedy remains protective in the short term, the expected restoration timeframe exceeds a timeframe that is considered reasonable by Ecology and EPA. In addition, surface water ARARs at station MA12 are consistently being exceeded.	a. Continue additional investigation to refine the conceptual site model regarding contaminant distribution at the south plantation and around well MW1-17. b. Clarify remedial action objectives as intended by the ROD, including the surface water remediation goals and points of compliance for marsh water. c. Evaluate the feasibility of optimizing the remedial action at the south plantation to shorten the restoration timeframe.	Ongoing	In response to recommendation a., an additional investigation was conducted in 2017 and provided new data towards revision of the conceptual site model covering the south planation and the central landfill area east of well MW1-17. Based on the results of this investigation, further investigation was performed in 2019, focused primarily on the north plantation area. These results are currently being used to update the conceptual site model. As agreed to by the Project Team, next steps for OU 1 include items b and c of this recommendation, once sufficient data has been obtained to support the decision.	U.S. Navy, 2018b, 2019e
6	PCB data from seep SP1-1, and in sediment at two stations, imply that PCB concentrations may be increasing.	Collect additional sediment samples at and in the vicinity of seep SP1-1 during the Phase II investigation and use the data to assess whether expanded, ongoing PCB monitoring should be initiated and risk assumptions reviewed.	Completed	Five sediment samples were collected on September 6 and 7, 2017 to assess PCB concentrations at historical sediment sample locations, and at one new location. Only the PCB concentrations in the sediment sample from location MA-09 exceeded the ROD RG, indicating that the lateral extent of PCBs exceeding the RG is limited to the vicinity of this station. Because the highest current PCB concentrations are not higher than those found at the time of the ROD and are limited to the immediately vicinity of station MA-09, the report recommended that the risk assessment regarding PCBs not be reopened in sediment until additional PCB concentration trend data are available. Additional data were collected at the same stations in 2019 (outside of the data review window for this FYR), and risk assessments are underway, with additional data collection planned in 2021.	U.S. Navy, 2018b, 2019e

Table 3-2 (continued). Status of Recommendations from the Fourth Five-Year Review

Item No.	Issue	Recommendation	Current Status	Current Implementation Status Description	Reference or Completion Date (if applicable)
			OU 2 Area 8		
7	Evaluation against current VI guidance has identified potential data gaps regarding worker exposure to potential VOCs in indoor air at facility buildings.	Perform the initial step of a VI evaluation, including soil gas sampling adjacent to occupied buildings within 100 feet of groundwater wells exhibiting TCE concentrations exceeding 5 µg/L.	Completed	Seven soil-gas samples were collected in 2017. Between three and five of the 11 target VOC analytes were detected in each of the seven samples collected. The data indicated that additional investigation of the VI pathway at Area 8 was warranted based on a strict comparison of the measured concentrations of target VOCs to screening levels (i.e., MTCA Method C). Detected concentrations of VOCs in five of seven samples exceeded their respective screening level, with the concentrations of TCE in two samples exceeding the screening level for this compound by nearly two orders of magnitude. Based on the 2017 results, an indoor air VI study was performed in 2019 in 4 buildings adjacent to Area 8. Interpretation and reporting of the results was underway at the time of this FYR. The VI investigation concluded VI is not occurring in any of the buildings, however, because some subslab vapor samples exceeded conservative vapor intrusion screening levels, the Navy intends to periodically inspect/monitor changes in building conditions that could affect the VI pathway.	U.S. Navy, 2018c, 2019f

Table 3-2 (continued). Status of Recommendations from the Fourth Five-Year Review

Item No.	Issue	Recommendation	Current Status	Current Implementation Status Description	Reference or Completion Date (if applicable)
8	The human health and ecological risk assessments for intertidal sediment required by the ROD have been completed, but data gaps were identified.	In conjunction with EPA, Ecology, and the Suquamish Tribe, collect necessary data and complete the human health and ecological risk assessments for intertidal sediment. Assess the need to implement contingent groundwater control actions based on the results of the risk assessments.	Completed	Human health and ecological risk assessments were completed during this FYR period and included additional intertidal sample collection. The HHRA concluded that despite the presence of several COCs in Area 8 beach intertidal sediment and clam tissue samples at concentrations exceeding background and reference area concentrations, the incremental site risk over reference area risk for Suquamish subsistence and recreational receptors met target health goals. As such, the project team agreed that no additional investigation or groundwater controls were necessary to protect human health. The 2018 HHRA/ERA concluded that Area 8 groundwater discharging as seeps from the former plating facility may present a risk to benthic organisms at the Area 8 beach. Elevated cadmium concentrations occur in sediment and chronic exposure to accumulated contaminants in sediment pose a risk to benthic organisms based on the bioassay endpoints. Therefore, the ERA concluded that the existing remedy is not protective of ecological receptors. Based on these results, the Navy is required by the ROD to implement contingent groundwater control actions. To support selection of a contingent groundwater control measure, a Supplemental Remedial Investigation will begin in 2021.	U.S. Navy 2018a, 2019b

4.0 FIVE-YEAR REVIEW PROCESS

4.1 Community Notification, Involvement, and Interviews

There are specific requirements pursuant to CERCLA Section 117(a), as amended, for certain reports to be released to the public and the public notified of proposed cleanup plans and remedial actions. The community notification and involvement activities for NBK Keyport are described below.

4.1.1 History of Community Involvement

The community has historically been informed of progress at NBK Keyport through fact sheets, public notices, open houses, public meetings, and bus tours of the sites. The community had substantial input into the remedy for OU 1 (i.e., the former landfill) causing the Navy to re-evaluate the proposed plan and segregate OU 1 from OU 2 to allow for continued public input at OU 1. The proposed plans for OUs 1 and 2 were circulated for public comment prior to finalization of the RODs. Key documents have been made available for review at Navy facilities; the Kitsap Regional Library in Bremerton, Washington; and the Poulsbo Branch Library in Poulsbo, Washington. In addition, a NAVFAC Northwest website repository was added, with the previous FYRs, current questionnaire, and LUC documentation, to support involvement in this FYR. The link to the website repository is: https://www.navfac.navy.mil/navfac_worldwide/pacific/fecs/northwest/about_us/northwest_documents/environmental-restoration/nbk_keyport.html.

A community relations plan was prepared in 1990 and most recently updated in 2008. In 1988, a Technical Review Committee was established, with representatives from the public and government entities. In March 1995, the Technical Review Committee was replaced with a Restoration Advisory Board (RAB). The RAB members included representatives of the Navy, regulatory agencies, civic groups, private citizens, tribal governments, local governments, and environmental activist groups. The RAB remained active through all phases of remedy constriction and implementation, but was ultimately disbanded in October 2004 due to lack of continued interest in maintaining the RAB.

The town of Keyport also has the Keyport Improvement Club (KIC), which was incorporated in 1921. Here is the link to their website: http://www.keyport98345.com/. KIC is a group of volunteers who work on events and projects to strengthen the community and make life better for Keyport residents. KIC serves as an unofficial link between the Keyport community and larger organizations such as Kitsap County government departments, the Navy, the Port of Keyport, and the Red Cross. KIC conducts periodic meetings to discuss community issues and concerns and also organizes community meetings, as needed, to connect Keyport to the larger network of Kitsap County. The Navy Remedial Project Manager (RPM) provides status updates to the tenant Commanding Officer (CO) of Naval Undersea Warfare Center (NUWC) Keyport regarding installation restoration activities at NBK Keyport, who then briefs KIC members, as requested. KIC has also invited NUWC Keyport personnel and the CO to attend their meetings and update them with regard to the CERCLA sites.

4.1.2 Community Involvement during the Five-Year Review Period

During this FYR period, the Navy RPM provided a summary of the current site status for the CO to brief the community, at the communities' request. The CO presented this information to the Keyport community on January 10, 2017. In addition, KIC was contacted and provided an avenue for obtaining public input on the progress of the remedies at NBK Keyport.

A public notice was published by the Navy, informing the community that the Navy was intending to initiate this fifth FYR for NBK Keyport. The public notice was published in the following newspapers:

- *Kitsap Sun* (on September 6,7 and 8, 2019)
- *North Kitsap Herald* (on September 6, 13 and 20, 2019)
- *Central Kitsap Reporter* (on September 6, 8, 13 and 20, 2019)

The proofs of these public notices are provided as Appendix A. The public notice was also posted on the KIC website on October 7, 2019. The notification provided information on why the FYR was being conducted; what sites were included in the FYR; when the FYR would be completed; how the public could receive additional information; and established a 30-day review period for the public to provide questions or comments on the FYR process for NBK Keyport. The Navy did not receive any feedback or comments as a result of the public notice of intent.

Similar to the notice of intent to conduct the FYR, a notice of completion for the FYR will be published in the *Kitsap Sun, North Kitsap Herald, and Central Kitsap Reporter* as well as posted on the KIC website. The notice will include the protectiveness determinations and statements and website link to the completed FYR Report.

4.1.3 Interviews during the Five-Year Review Period

As part of the FYR process, a variety of organizations and groups, including the EPA, Ecology, Kitsap Public Health District, the Suquamish Tribe, and community members, were contacted to participate in the interview process. A set of interview questions were developed and tailored to specific categories of interview candidates (i.e., either regulatory agency, community member, or Tribe). The interview questions and instructions were transmitted via email to the regulatory agencies and Tribe on October 15, 2019. The community member questionnaire was posted to the NAVFAC Northwest website on October 28, 2019. Instructions and link to the questionnaire were subsequently provided to KIC members via the KIC Secretary. In total, three (3) completed interview questionnaires were received and are provided in Appendix B. Table 4-1 lists the findings and recommendations detailed in each of these completed questionnaires. Highlights of the interview responses are summarized in the following sections.

Regulatory Agencies. Interview questions were sent to seven (7) regulatory agency personnel, including EPA, Ecology, Kitsap Public Health District. A total of two (2) completed questionnaires were received, both from Ecology (i.e., the Ecology Project Manager and Ecology Sediment Specialist).

The Ecology Project Manager indicated that he is very familiar with the OU 1 and OU 2 RODs and has been involved with the OUs as regulatory oversight. He noted that the remedy for OU 1 has failed to meet the RAOs. The site does not seem to pose immediate danger to human health and environment, but may pose risk in the long-term/future. The site is going through re-characterization, source area assessments, and Tier II ecological and human health risk assessments.

He indicated that the remedy for OU 2 Area 2 remains effective, but has not achieved cleanup levels or is taking longer to achieve cleanup levels. He stated that the remedy for OU 2 Area 8 is not effective. Recent groundwater seeps bioassay results as part of ERA demonstrated adverse effects to ecological receptors. In addition, the site groundwater will not achieve drinking water quality standards in a reasonable timeframe, which calls into question the remedy of monitored natural attenuation (MNA). The remedy needs to be revised for groundwater treatment/control besides MNA and LUCs to obtain RAOs.

Overall, he felt that the progress made by the Navy at OU 1 has been good. However, it appeared that the entire site (not only the southern plantation which has the highest contamination) has some hot spot areas that need remediation. In addition, it appears the soil mound north of northern plantation is contaminated with TPH and PCBs (i.e., new findings). It needs further investigation and assessment to determine if this contamination poses any risks or hazards to human health and environment.

He indicated that the monitoring data and reports at OU 1 and OU 2 have been of acceptable quality. He stated that the Navy has made significant progress on the recommendations from the fourth FYR. All recommendations have been addressed to some degree; although, some milestone dates may have been missed. There are still issues at both OU 1 and OU 2 and Ecology expects this FYR will include more robust recommendations to move these sites closer to meeting RAOs. He also was aware of all the investigations being conducted at OU 1 and OU 2 Area 8. He noted that it was unknown whether per- and polyfluoroalkyl substances (PFAS) contamination exists or affects protectiveness at this time. He was aware that the Navy has performed a preliminary assessment (PA) for Keyport without any stakeholder involvement. He expects that the Navy will involve Ecology and the stakeholders in the next phase of assessment or investigation.

The Ecology Sediment Specialist indicated that he began providing technical support to the Ecology Project Manager since October 2015, specifically for sediment issues at OU 1 and OU 2 Area 8. He clarified that he was not familiar with OU 2 Area 2. This Ecology respondent indicated that while OU 1 seems to not pose any immediate risks to human health or the environment, recent sampling results suggest that the contamination present may pose risks in the long-term/future. He believed that the recently proposed Tier II HHRA and ERA, site re-characterization and source area assessment will provide important information related to remedy effectiveness and protectiveness. The respondent noted that the recent results from the groundwater seep bioassays as part of the OU 2 Area 8 ERA demonstrate adverse effects to receptors, suggesting that the remedy is not protective. At OU 2 Area 8, MNA has not been effective in achieving drinking water quality standards in groundwater or preventing impacts to sediments and shellfish.

The Ecology Sediment Specialist noted that the emergence of PFAS calls in question the protectiveness of the remedies, in particular at OU 2 Area 8. The presence of a metal plating shop upgradient of the beach is concerning, due to the use of PFAS as a fire suppressant during the electroplating process. Metal plating facilities have been identified as potential source areas during the PFAS PA at Puget Sound Naval Shipyard. He requested that Ecology's Project Manager be included in the next phase of PFAS assessment or investigation.

Both Ecology respondents indicated that they were not aware of any complaint, violation, or incident related to NBK Keyport or any community concerns. One respondent mentioned that he was only aware of the concerns raised by the Suquamish Tribe during the project meetings.

Tribe Personnel. No responses were received from the Suquamish Tribe representatives. Their comments regarding the protectiveness of the remedies at OUs 1 and 2 have been received through review of this FYR Report. The Tribe does not agree with the Navy’s Short-Term Protective determination for OU 1, and feels that a protectiveness determination for OU 1 cannot be made at this time, believing a protectiveness statement of “protectiveness deferred” is more appropriate. However, the Tribe does concur with the “Short-Term Protective” and “Not Protective” determinations for OU 2 Areas 2 and 8, respectively. Detailed comments made by the Tribe are included in Appendix K.

Table 4-1. Summary of Concerns and Recommendations from the FYR Interview Questionnaires

No.	Stakeholder	Concerns	Recommendations
1	Regulatory Agency (Ecology Project Manager)	• OU 1: The entire site (not only the southern plantation which has the highest contamination), has some hot spot areas that need remediation. In addition, it appears the soil mound north of northern plantation is contaminated with TPH and PCBs (i.e., new findings). It needs further investigation and assessment to see if this contamination poses any risks or hazards to human health and environment. • OU 2 Area 8: The remedy is not effective. Recent groundwater seeps bioassay results (as part of ERA) demonstrated adverse effects to ecological receptors. In addition, site groundwater will not reach drinking water quality standards in a reasonable timeframe, which calls into question the remedy of MNA. The remedy needs to be revised for groundwater treatment/control besides MNA and LUCs to obtain RAOs. • Concerned if PFAS contamination exists or affects protectiveness at this time. Ecology expects all the stakeholders to be involved in the assessment going forward.	• OU 1: Update the CSM such that remedial actions can be implemented to remediate not only the hot spots (i.e., source areas), but also the other areas, as needed, such that the surface water, sediment, and groundwater can be returned to their beneficial uses within a reasonable timeframe. • OU 2: Needs to implement a groundwater remedy to protect the affected ecological receptors and restore the site groundwater to drinking water quality standards.
2	Regulatory Agency (Ecology Sediment Specialist)	• OU 1: The soil mound in the north plantation contains recently discovered TPH and PCB contamination, which will likely require further investigation. • OU 2 Area 8: Recent results from the groundwater seep bioassays as part of ERA demonstrate adverse effects to receptors, suggesting that the remedy is not protective. MNA has not been effective in achieving drinking water quality standards in groundwater or preventing impacts to sediments and shellfish. • PFAS as a contaminant of concern may call in to question the protection of the remedies (in particular at OU 2 Area 8).	• OU 1: Complete a site re-characterization to refine the CSM and initiate a Tier II HHRA and ERA. • OU 2: Complete the HHRA and ERA, specifically seep bioassay's following project team's recommendation, that identified risks to sediment benthic organisms. • Request Ecology's project manager be included in the next phase of PFAS assessment or investigation.
3	Community Member	• OU 1: There has been nothing of any great effect done to reduce the runoff from the former landfill into the "tide flats" and then into Dogfish Bay. • Concerned that human receptors are unable to consume shellfish from Dogfish Bay.	• Navy to attend meeting of the KIC. • Additional information on the real effects of the former landfill runoff on local water bodies, such as Dogfish Bay.

Community Members. A completed community interview questionnaire was received from one (1) community member. The community member is a resident of Dogfish Bay and feels it has been significantly affected by the OU 1 former landfill. The community member felt that there has not been anything done to reduce the runoff from the former landfill into the tide flats and then into Dogfish Bay. The community member felt the need for more active remediation measures. The respondent wanted the OU 1 and OU 2 sites cleaned up, so the community has the ability to consume the shellfish from Dogfish Bay. The community member also requested additional information on the real effects of run off into Dogfish Bay. The respondent also requested that the Navy attend KIC meetings.

4.2 Data Review

The following section presents a review and evaluation of the analytical data collected during this FYR period at OU 1, OU 2 Area 2, and OU 2 Area 8 of NBK Keyport.

4.2.1 OU 1

The following section provides a review of the data generated during this FYR period, including from the 1) LTM program; 2) Phase I and Phase II Site Characterizations; 3) Source Area Investigation conducted in 2019; 4) VI study; and 5) USGS tidal lag study.

Long-Term Monitoring Program. As part of the LTM program, groundwater, surface water, seep water, and sediment samples were collected during this FYR period. Historical and recent monitoring data in all media for OU 1 are summarized in Appendix C.

Groundwater. During this FYR period, groundwater was sampled annually from June 2015 through June 2017. In 2017, activities to support site characterization were also added to the LTM program with the concurrence of the Keyport EPA and Ecology Project Managers. In 2018, LTM at Keyport OU 1 was cancelled with the concurrence of the Keyport EPA and Ecology Project Managers, given the drastic change in the CSM and ongoing investigations and the recommendation of the 2017 Annual O&M Report based on ongoing investigations (i.e., the Phase I and II Site Characterizations and 2019 Source Area Investigation). However, the LTM contractor was used to perform various sampling efforts in 2018 to support further site characterization. In 2019, the LTM program reverted to the 5-year sampling effort specified in the LTM Plan to support FYR evaluation.

Groundwater elevations are collected from across OU 1 every two years. The most recent groundwater elevations and potentiometric map is from September 2018 and presented as Figure 4-1. As shown in Figure 4-1, the shallow groundwater flow direction is predominantly towards the west across the site, with shallow groundwater flow at the south end of the landfill generally towards the west to southwest towards the marsh pond and groundwater flow at the north end of the landfill generally towards the northwest towards the tide flats. This general shallow groundwater flow pattern or direction is consistent with historical potentiometric maps for the site. Deeper within the upper aquifer, groundwater flow follows a regional flow direction to the northwest everywhere beneath the landfill. This hydrogeological model of multiple superimposed groundwater flow components within an aquifer system is consistent with the standard models of flow systems within regional drainage basins (see Figure 6.4, Fetter, 1980). At sites like OU 1 with substantial local relief and high annual precipitation, local groundwater flow

U.S. NAVY	**Figure 4-1** **OU 1 Shallow Groundwater Potentiometric Head Contours and Groundwater Flow September 2018**	NBK KEYPORT FIFTH FIVE-YEAR REVIEW

systems become superimposed on the regional flow system. Local, near-surface flow systems are driven by recharge at local topographic highs and discharge at topographic lows. At OU 1, the effect of this local flow system is movement of shallow groundwater and contaminants from the landfill footprint into adjacent surface water, with groundwater flow vectors roughly normal to the flowline of Marsh Creek and the ephemeral stream south of the South Plantation. Because the flowlines of these surface water features vary from east-west to south-north, very localized groundwater flow vectors are observed, ranging from nearly due south in the eastern portion of the South Plantation to due west across much of the Central Landfill. Deeper in the aquifer, below the influence of local topographic relief, the regional flow direction to the northwest dominates, seemingly enhanced by paleotidal and paleofluvial channeling in the Olympia Formation.

Historical investigations relied upon in the OU 1 ROD and subsequent LTM program interpreted a relatively laterally continuous aquitard at approximately 15 ft bgs separating an “upper aquifer” and an “intermediate aquifer.” Although this aquitard was inferred to be missing in some areas of the site, and “leaky,” the interpretation of the presence of the aquitard influenced the selection of screened intervals for monitoring wells targeting the two aquifers. Most of the monitoring wells that are currently part of the LTM program and are located within the footprint of the landfill have screen depths ending at 15 ft bgs or shallower. However, laterally continuous fine-grained units above the Lawton Clay and Clover Park Aquitard that could be interpreted as a shallow aquitard were not observed to the total explored depth in the 2017 and 2019 investigations (discussed later in this subsection). In contrast to the interpretation from the ROD, two distinct water-bearing zones were not identified during the 2017 and 2019 investigations. The upper portion of the water-bearing zone was found to be contiguous with, and discharging to, the original salt marsh, which was filled and paved. The “intermediate aquifer” defined in the ROD was found to be vertically interconnected with the original marsh deposits, forming a single water bearing zone above the Clover Park/Lawton Clay aquitard.

Groundwater data for OU 1 have been collected under four monitoring programs: phytoremediation monitoring, risk and compliance monitoring, CRA monitoring, and intrinsic bioremediation monitoring. Results of cVOCs, 1,4-dioxane, and PCBs analyses in groundwater are discussed in the following subsections.

<u>Chlorinated Volatile Organic Compounds</u>
At OU 1, groundwater results for nine target cVOCs (1,1-dichloroethane [DCA], 1,2-DCA, 1,1-DCE, cis-1,2-DCE, trans-1,2-DCE, tetrachloroethene [PCE], 1,1,1-trichloroethane [TCA], TCE, and vinyl chloride) have been included in LTM Reports. Groundwater monitoring data for target VOCs, organized by area (i.e., north landfill area, south landfill area, etc.) and depth (i.e., shallow versus deeper wells), are provided on Table C-1 in Appendix C, and discussed in the subsections below. Figure 4-2 presents the cVOC and 1,4-dioxane concentrations in groundwater during this FYR period. Of note, 1,1-DCA and 1,2-DCA are not presented in Figure 4-2 because both COCs have been below their respective groundwater RGs of 800 and 5 μg/L during this entire FYR period.

Shallow Monitoring Wells
Shallow monitoring wells in the North, Central and South Landfill Areas were sampled during this FYR period, as summarized below.

MW1-39

Sampling Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride	1,4-Dioxane
06/22/16	0.5 U	0.93	0.5 U	0.5 U	0.5 U	0.5 U	**1.8**	**0.85**
06/17/19	0.2 U	0.65	0.2 UM	0.2 U	0.2 U	0.2 UM	**1.6**	0.42 M

MW1-38

Sampling Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride	1,4-Dioxane
06/22/16	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	**2.2**
06/19/19	0.2 UM	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.022 M	**1.7**

MW1-02

Sampling Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride	1,4-Dioxane	Total PCB Aroclors	Total PCB Congeners
06/21/16	**1.2**	**330 D**	11	0.5 U	0.5 U	1.2	**89 D**	NS	NS	NS
06/19/17	**0.65**	**200 D**	6.6	0.5 U	0.5 U	2.1	**54**	NS	NS	NS
09/19/18	NS	NS	NS	NS	NS	NS	NS	**5.9**	0.01 U	0.0012
06/18/19	**0.63**	**160 D**	7	0.5 U	0.2 U	1.1	**79 DM**	**7.6**	NS	NS

P1-03

Sampling Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride	1,4-Dioxane
06/27/19	0.2 UM	0.085 JM	0.2 UM	0.5 UM	0.2 U	0.2 UM	0.02 UM	**8.6**

MW1-28

Sampling Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride	1,4-Dioxane
09/19/18	NS	NS	NS	NS	NS	NS	NS	**7.4**
06/24/19	**5.1**	**1,500 D**	74 D	0.5 U	0.2 U	0.2 U	**590 D**	**31 D**

P1-04

Sampling Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride	1,4-Dioxane
06/17/19	**1.5**	**480 D**	11	0.5 U	0.2 UM	0.28	**150 D**	**24 D**

MW1-29

Sampling Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride	1,4-Dioxane
06/17/19	NS	NS	NS	NS	NS	NS	NS	0.2 UM

MW1-09

Sampling Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride	1,4-Dioxane
06/22/16	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.4 U
06/27/19	0.2 U	0.2 UM	0.2 UM	0.2 UM	0.2 UM	0.2 UM	0.02 UM	0.2 U

1MW-1

Sampling Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride	1,4-Dioxane
06/21/16	0.5 U	13	25	0.5 U	0.5 U	0.5 U	**230 D**	NS
06/11/19	0.12 JM	9.9	23	0.5 U	0.2 U	0.2 U	**230 D**	**0.56**

MW1-60

Sampling Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride	1,4-Dioxane
09/18/18	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	NS

MW1-17

Sampling Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride	1,4-Dioxane
06/24/15	**2.1 D**	**630 D**	0.46 JD	1 U	1 U	1 U	**120 JD**	NS
06/21/16	**1.6**	**440 D**	0.45 J	0.5 U	0.5 U	0.5 U	**100 D**	NS
06/19/17	**1.2**	**440 D**	0.39 J	0.5 U	0.5 U	0.5 U	**72**	NS

MW1-05

Sampling Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride	1,4-Dioxane
06/24/15	0.5 U	0.53	0.08 J	0.5 U	0.5 U	0.29 J	**7.7 J**	NS
06/22/16	0.11 J	5.5	1.2	0.5 U	0.5 U	0.46 J	**64**	NS
06/19/17	0.09 J	5.7	1.1	0.5 U	0.5 U	0.58	**53**	NS

MW1-25

Sampling Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride	1,4-Dioxane
09/20/18	NS	NS	NS	NS	NS	NS	NS	**31**
06/20/19	**2.9**	**1,100 D**	20	0.5 UM	0.2 U	0.43	**270 D**	**12/27 HDJ**

MW1-14

Sampling Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride	1,4-Dioxane	Total PCB Aroclors	Total PCB Congeners
09/19/18	NS	NS	NS	NS	NS	NS	NS	NS	0.83 PDJ	**108.3**
06/11/19	NS	NS	NS	NS	NS	NS	NS	0.28 M	NS	NS

P1-02

Sampling Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride	1,4-Dioxane
06/19/19	0.2 UM	0.1 J	0.2 U	0.5 U	0.2 U	0.2 U	0.064	**7.7**

P1-01

Sampling Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride	1,4-Dioxane	Total PCB Aroclors	Total PCB Congeners
09/19/18	NS	NS	NS	NS	NS	NS	0.02 UJ	0.0046	0.02 UJ	0.0046
06/11/19	0.2 U	0.077 JM	0.2 UM	0.5 U	0.2 U	0.2 U	0.02 UJ	0.26 M	NS	NS

MW1-03

Sampling Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride	1,4-Dioxane
06/22/16	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NS

MW1-41

Sampling Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride	1,4-Dioxane
09/19/18	NS	NS	NS	NS	NS	NS	NS	**28**
06/19/19	0.2 U	0.16 J	0.2 U	0.2 U	0.2 U	0.2 U	0.12	**5.1 J**

P1-05

Sampling Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride	1,4-Dioxane
06/27/19	0.2 UM	0.13 JM	0.38	0.5 UM	0.2 U	0.2 UM	0.02 UM	**6.6 D**

MW1-16

Sampling Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride	1,4-Dioxane
06/24/15	0.5 U	1.1	0.93	0.5 U	0.5 U	0.31 J	**0.54 J**	NS
06/22/16	0.5 U	2	1.3	0.5 U	0.5 U	0.16 J	**1.5**	NS
06/19/17	0.5 U	0.69	0.41 J	0.5 U	0.5 U	0.5 U	**0.54**	NS

MW1-20

Sampling Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride	1,4-Dioxane
06/24/15	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	NS
06/22/16	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NS
06/19/17	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NS

MW1-04

Sampling Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride	1,4-Dioxane
06/24/15	**2.9 D**	**1,800 D**	16 D	2.5 U	2.5 U	**1,600 D**	**96 D**	NS
06/23/16	**2.9 D**	**1,800 D**	14 D	2.5 U	2.5 U	**1,700 D**	**85 D**	NS
06/19/17	**6.6 JD**	**5,600 D**	56 D	10 U[1]	10 U	**11,000 D**	**240 D**	NS
06/19/19	**1.3**	**580 D**	7.3	0.5 U	0.2 U	**680 D**	**34**	0.2 U

Explanation

- Piezometer
- Monitoring Well
- Base Boundary
- OU1 Area 1 Boundary
- Plantation Area
- Approximate Groundwater Flow Direction
- Approximate Location of Historical Shoreline

Notes:
All concentrations are in µg/L.
*There is no remedial goal for 1,4-dioxane; however, results are compared to the MTCA Method B Cleanup Level of 0.44 ug/L to allow for data evaluation.

Bold indicates detected value is equal to or exceeds the groundwater remedial goal.

µg/L – microgram per liter or parts per billion
D – result reported from a diluted analysis
DCE – Dichloroethene
J – analyte positively identified, but result is estimated
M – Manual integrated compound
NS – Not analyzed
P – The relative percent difference is greater than 40% between the results on the two PCB analytical columns
TCE – Trichloroethene
U – analyte was not detected at or above the indicated practical quantitation limit
U[1] – not detected at value shown and value exceeds remediation goal
UJ – analyte not detected, but the reported quantitation/detection limit is estimated

Analyte	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride	1,4-Dioxane	Total PCBs
Remedial Goals*	0.5	70	100	5	200	5	0.5	0.44	0.044

Figure 04-02_OU1_A1_Results_v3.mxd

U.S. NAVY	**Figure 4-2** **OU 1 cVOC and 1,4-Dioxane Concentrations in Groundwater as Part of LTM Program (2015-2019)**	NBK KEYPORT FIFTH FIVE-YEAR REVIEW

North Landfill Area

The following shallow North Landfill Area monitoring wells were sampled during this FYR period: 1MW-1 (2016, 2019), MW1-02 (2016, 2017, 2019), MW1-03 (2016), and MW1-41 (2019). In 1MW-1, concentrations of vinyl chloride were detected above the groundwater RG of 0.5 μg/L in 2016 and 2019. In MW1-02, concentrations of cis-1,2-DCE, 1,1-DCE, and vinyl chloride were detected above their respective groundwater RGs of 70, 0.5, and 0.5 μg/L in 2016, 2017, and 2019. No other cVOCs were detected above their groundwater RGs in 2016, 2017, and 2019.

The following shallow North Landfill Area piezometers were sampled in 2019: P1-01, P1-02, P1-03, P1-04, and P1-05. In P1-04, concentrations of cis-1,2-DCE, 1,1-DCE, and vinyl chloride were detected above their respective groundwater RGs of 70, 0.5, and 0.5 μg/L. No other cVOCs were detected above their groundwater RGs in 2019.

Central Landfill

MW1-17 was the only shallow monitoring well that was sampled during this FYR period in the Central Landfill (2015, 2016, 2017). In MW1-17, concentrations of cis-1,2-DCE, 1,1-DCE, and vinyl chloride were detected above their respective groundwater RGs of 70, 0.5, and 0.5 μg/L in 2015, 2016, and 2017. No other cVOCs were detected above their groundwater RGs in 2015, 2016, and 2017.

South Landfill Area

The following shallow South Landfill Area monitoring wells were sampled during this FYR period: MW1-04 (2015, 2016, 2017, 2019), MW1-05 (2015, 2016, 2017), MW1-16 (2015, 2016, 2017), and MW1-20 (2015, 2016, 2017). In MW1-04, concentrations of TCE, cis-1,2-DCE, 1,1-DCE, and vinyl chloride were detected above their respective groundwater RGs of 5, 70, 0.5, and 0.5 μg/L in 2015, 2016, 2017, and 2019. In MW1-05 and MW1-16, vinyl chloride was detected above its groundwater RGs in 2015, 2016, and 2017. No other cVOCs were detected above their groundwater RGs in 2015, 2016, 2017, and 2019.

Intermediate and Deeper Monitoring Wells

The following deeper groundwater monitoring wells were sampled during this FYR period: MW1-09 (2016, 2019), MW1-25 (2019), MW1-28 (2019), MW1-29 (2019), MW1-38 (2016, 2019), MW1-39 (2016, 2019), and MW1-60 (2018). In MW1-25 and MW1-28, concentrations of cis-1,2-DCE, 1,1-DCE, and vinyl chloride were detected above their respective groundwater RGs of 70, 0.5, and 0.5 μg/L in 2019. In MW1-39, concentrations of vinyl chloride were detected above the groundwater RG in 2016 and 2019. No other cVOCs were detected above their groundwater RGs in 2016, 2018, and 2019.

Deep Domestic Wells

The following deep regional aquifer domestic water supply wells were sampled during this FYR period: Navy Well #5 southeast of the landfill (2015, 2016, 2017) and the PUD Well northeast of the landfill (2015, 2016, 2017, 2019). No cVOCs were detected above their groundwater RGs in 2015, 2016, 2017, or 2019 (see Appendix C).

1,4-Dioxane

In 2016, 2018, and 2019, groundwater was sampled for 1,4-dioxane at various Central and North Landfill Area monitoring wells, domestic wells, and piezometers within OU 1. Groundwater data for 1,4-dioxane are presented in Figure 4-2 and provided on Table C-2 in Appendix C. Concentrations of 1,4-dioxane were detected above the MTCA Method B cleanup level of 0.44 µg/L at 1MW-1 (2019), MW1-02 (2018, 2019), MW1-41 (2018, 2019), MW1-25 (2018, 2019), MW1-28 (2018, 2019), MW1-38 (2016, 2019), MW1-39 (2016), P1-02 (2019), P1-03 (2019), P1-04 (2019), and P1-05 (2019).

PCBs

In September 2018, groundwater was sampled for PCBs at three North Landfill Area monitoring wells (i.e., MW1-02, MW1-14, and P1-01) to assess the PCB concentrations in the North Plantation to determine potential source areas for PCBs in downgradient sediment. Groundwater data for PCBs are provided on Tables C-3 and C-4 in Appendix C and shown in Figure 4-2. Total PCB concentrations (i.e., Aroclors and congeners) were detected above the MTCA Method B cleanup level of 0.044 µg/L at MW1-14 (i.e., at 0.83 PDJ µg/L). Note that the ARAR values upon which these RGs were based have changed since the time of the ROD. See Section 5.4 for additional details regarding these ARAR changes.

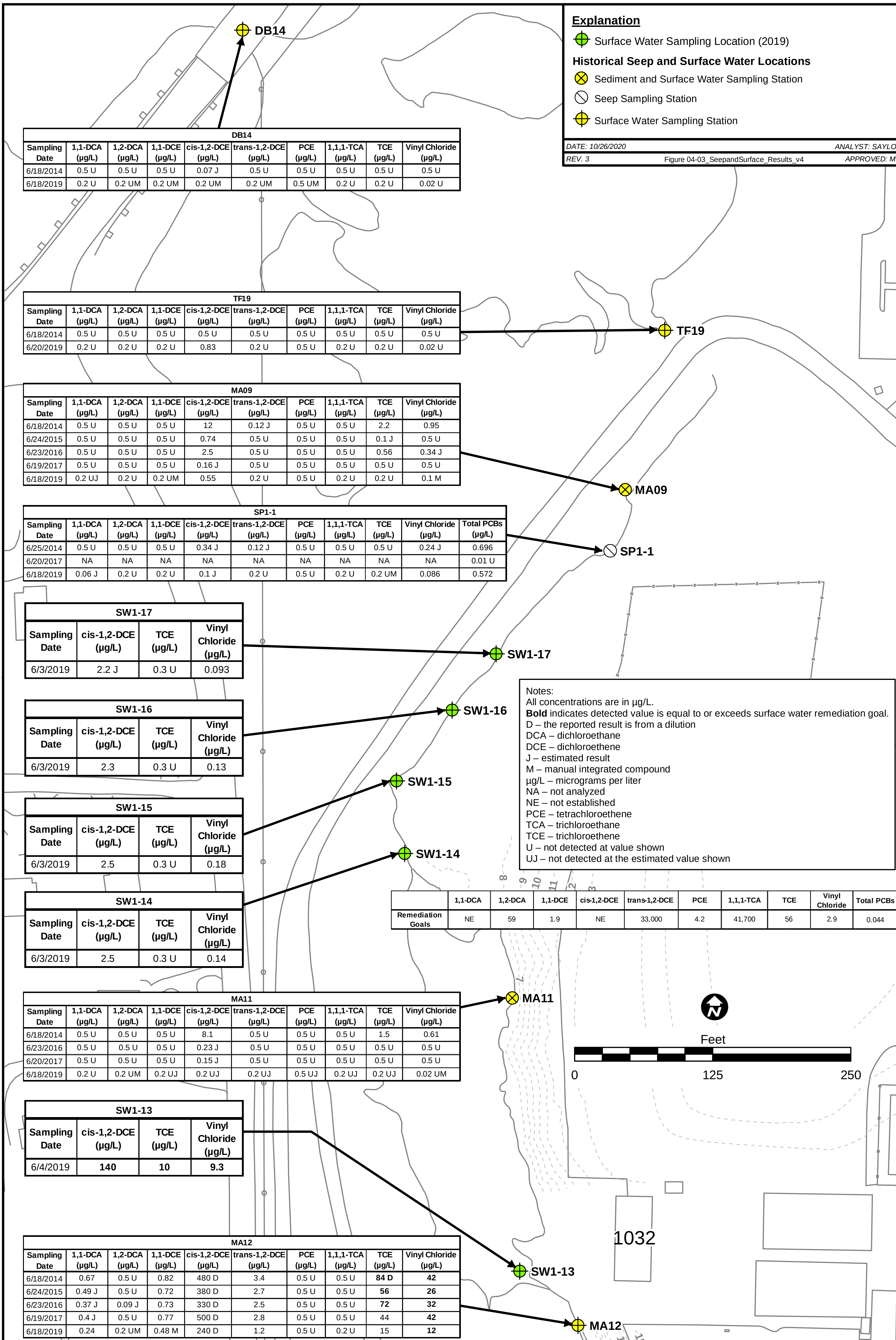
Chlorinated VOCs in Surface Water and Seep Water. In 2015, 2016, 2017, and/or 2019, surface water was sampled for cVOCs at sampling stations MA09, MA11, and MA12. In 2019, additional cVOC surface water samples were collected at stations TF19 and DB14, and a seep water sample was collected for cVOCs at SP1-1. Surface water and seep water locations are shown on Figure 4-3 and data for cVOCs are provided on Table C-5 in Appendix C.

At MA12, TCE was detected above its surface water RG of 56 µg/L in 2016 and vinyl chloride was detected above its surface water RG of 2.9 µg/L in 2015, 2016, 2017, and 2019. No other cVOCs were detected above their surface water RGs in any of the other surface water and seep water samples collected in 2015, 2016, 2017, and/or 2019.

PCBs in Seep Water and Sediment. In June 2017 and June 2019, seep water was sampled for PCB Aroclors at SP1-1 (see Figure 2-1). In 2019, the SP1-1 seep water sample was also sampled for PCB congeners. Seep water data for PCB Aroclors and PCB congeners are provided on Tables C-6 and C-7 in Appendix C. In June 2017, PCB Aroclors were not detected above laboratory limits of detection (LODs) in seep water at SP1-1. In June 2019, both total PCB Aroclors and total PCB congeners were detected at concentrations above the RG of 0.044 µg/L in seep water at SP1-1.

According to the LTM Work Plans (U.S. Navy, 2012h and 2017c), sediment sampling is conducted at the time of the FYR; thus, sediment sampling was conducted in June 2019. Sediment samples were collected from sampling stations SP1-1, MA09, MA14, and TF21 and analyzed for PCB Aroclors and PCB congeners (see Figure 2-1). The sediment data for PCB Aroclors and PCB congeners are provided on Tables C-8 and C-9 in Appendix C. Concentrations of both total PCB Aroclors and total PCB congeners (as mg/kg organic carbon) exceeded the SQS of 12 mg/kg organic carbon in sediment collected from SP1-1. None of the remaining sediment samples exceeded SQS criteria.

Phase I and Phase II Site Characterization. The Navy’s 2012 evaluation of natural attenuation and intrinsic biodegradation at the landfill (U.S. Navy, 2012c) concluded that the RGs for discharge to surface water adjacent to the South Plantation would not be met within a reasonable restoration



Explanation

Surface Water Sampling Location (2019)

Historical Seep and Surface Water Locations

Sediment and Surface Water Sampling Station

Seep Sampling Station

Surface Water Sampling Station

DATE: 10/26/2020 | ANALYST: SAYLOR
REV. 3 | Figure 04-03_SeepandSurface_Results_v4 | APPROVED: MM

DB14

Sampling Date	1,1-DCA (µg/L)	1,2-DCA (µg/L)	1,1-DCE (µg/L)	cis-1,2-DCE (µg/L)	trans-1,2-DCE (µg/L)	PCE (µg/L)	1,1,1-TCA (µg/L)	TCE (µg/L)	Vinyl Chloride (µg/L)
6/18/2014	0.5 U	0.5 U	0.5 U	0.07 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
6/18/2019	0.2 U	0.2 UM	0.2 UM	0.2 UM	0.2 UM	0.5 UM	0.2 U	0.2 U	0.02 U

TF19

Sampling Date	1,1-DCA (µg/L)	1,2-DCA (µg/L)	1,1-DCE (µg/L)	cis-1,2-DCE (µg/L)	trans-1,2-DCE (µg/L)	PCE (µg/L)	1,1,1-TCA (µg/L)	TCE (µg/L)	Vinyl Chloride (µg/L)
6/18/2014	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
6/20/2019	0.2 U	0.2 U	0.2 U	0.83	0.2 U	0.5 U	0.2 U	0.2 U	0.02 U

MA09

Sampling Date	1,1-DCA (µg/L)	1,2-DCA (µg/L)	1,1-DCE (µg/L)	cis-1,2-DCE (µg/L)	trans-1,2-DCE (µg/L)	PCE (µg/L)	1,1,1-TCA (µg/L)	TCE (µg/L)	Vinyl Chloride (µg/L)
6/18/2014	0.5 U	0.5 U	0.5 U	12	0.12 J	0.5 U	0.5 U	2.2	0.95
6/24/2015	0.5 U	0.5 U	0.5 U	0.74	0.5 U	0.5 U	0.5 U	0.1 J	0.5 U
6/23/2016	0.5 U	0.5 U	0.5 U	2.5	0.5 U	0.5 U	0.5 U	0.56	0.34 J
6/19/2017	0.5 U	0.5 U	0.5 U	0.16 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
6/18/2019	0.2 UJ	0.2 U	0.2 UM	0.55	0.2 U	0.5 U	0.2 U	0.2 U	0.1 M

SP1-1

Sampling Date	1,1-DCA (µg/L)	1,2-DCA (µg/L)	1,1-DCE (µg/L)	cis-1,2-DCE (µg/L)	trans-1,2-DCE (µg/L)	PCE (µg/L)	1,1,1-TCA (µg/L)	TCE (µg/L)	Vinyl Chloride (µg/L)	Total PCBs (µg/L)
6/25/2014	0.5 U	0.5 U	0.5 U	0.34 J	0.12 J	0.5 U	0.5 U	0.5 U	0.24 J	0.696
6/20/2017	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01 U
6/18/2019	0.06 J	0.2 U	0.2 U	0.1 J	0.2 U	0.5 U	0.2 U	0.2 UM	0.086	0.572

SW1-17

Sampling Date	cis-1,2-DCE (µg/L)	TCE (µg/L)	Vinyl Chloride (µg/L)
6/3/2019	2.2 J	0.3 U	0.093

SW1-16

Sampling Date	cis-1,2-DCE (µg/L)	TCE (µg/L)	Vinyl Chloride (µg/L)
6/3/2019	2.3	0.3 U	0.13

SW1-15

Sampling Date	cis-1,2-DCE (µg/L)	TCE (µg/L)	Vinyl Chloride (µg/L)
6/3/2019	2.5	0.3 U	0.18

SW1-14

Sampling Date	cis-1,2-DCE (µg/L)	TCE (µg/L)	Vinyl Chloride (µg/L)
6/3/2019	2.5	0.3 U	0.14

MA11

Sampling Date	1,1-DCA (µg/L)	1,2-DCA (µg/L)	1,1-DCE (µg/L)	cis-1,2-DCE (µg/L)	trans-1,2-DCE (µg/L)	PCE (µg/L)	1,1,1-TCA (µg/L)	TCE (µg/L)	Vinyl Chloride (µg/L)
6/18/2014	0.5 U	0.5 U	0.5 U	8.1	0.5 U	0.5 U	0.5 U	1.5	0.61
6/23/2016	0.5 U	0.5 U	0.5 U	0.23 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
6/20/2017	0.5 U	0.5 U	0.5 U	0.15 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
6/18/2019	0.2 U	0.2 UM	0.2 UJ	0.2 UJ	0.2 UJ	0.5 UJ	0.2 UJ	0.2 UJ	0.02 UM

SW1-13

Sampling Date	cis-1,2-DCE (µg/L)	TCE (µg/L)	Vinyl Chloride (µg/L)
6/4/2019	**140**	**10**	**9.3**

MA12

Sampling Date	1,1-DCA (µg/L)	1,2-DCA (µg/L)	1,1-DCE (µg/L)	cis-1,2-DCE (µg/L)	trans-1,2-DCE (µg/L)	PCE (µg/L)	1,1,1-TCA (µg/L)	TCE (µg/L)	Vinyl Chloride (µg/L)
6/18/2014	0.67	0.5 U	0.82	480 D	3.4	0.5 U	0.5 U	**84 D**	**42**
6/24/2015	0.49 J	0.5 U	0.72	380 D	2.7	0.5 U	0.5 U	**56**	**26**
6/23/2016	0.37 J	0.09 J	0.73	330 D	2.5	0.5 U	0.5 U	**72**	**32**
6/19/2017	0.4 J	0.5 U	0.77	500 D	2.8	0.5 U	0.5 U	44	**42**
6/18/2019	0.24	0.2 UM	0.48 M	240 D	1.2	0.5 U	0.2 U	15	**12**

Notes:
All concentrations are in µg/L.
Bold indicates detected value is equal to or exceeds surface water remediation goal.
D – the reported result is from a dilution
DCA – dichloroethane
DCE – dichloroethene
J – estimated result
M – manual integrated compound
µg/L – micrograms per liter
NA – not analyzed
NE – not established
PCE – tetrachloroethene
TCA – trichloroethane
TCE – trichloroethene
U – not detected at value shown
UJ – not detected at the estimated value shown

	1,1-DCA	1,2-DCA	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride	Total PCBs
Remediation Goals	NE	59	1.9	NE	33,000	4.2	41,700	56	2.9	0.044

U.S. NAVY

Figure 4-3
Surface Water and Seep Locations at OU 1

NBK KEYPORT
FIFTH
FIVE-YEAR REVIEW

timeframe (i.e., 30 to 50 years). The evaluation recommended that an additional investigation of the South Plantation be performed to identify COC hotspots. This evaluation also recommended an additional investigation in the central portion of the landfill due to increasing VOC trends in well MW1-17. A two-phase approach was selected for these additional investigations, which is presented below.

Phase I. Phase I of the OU 1 site recharacterization program consisted of a screening-level investigation to identify contaminant hotspots in soil and groundwater in the South Plantation and to identify possible source material in both the South Plantation and central portion of the landfill. Phase I field activities were conducted in August 2014 and the Phase I Site Recharacterization Report was completed in May 2015. This work was briefly referenced in the fourth FYR (U.S. Navy, 2015b); however, the specific field activities and results were not presented or discussed.

Phase I included the collection and analysis of tree core samples for COCs using Missouri University of Science and Technology (MS&T) Method 9 and geophysical surveys of the South Plantation and a portion of the Central Landfill area to identify subsurface anomalies that could represent potential primary contaminant sources. An overlay of the geophysical data onto COC concentrations detected in tree core samples and groundwater sample results, as available, were used to identify and provide evidence of previously unidentified contaminant sources. Phase I of the investigation was conducted with the knowledge that in Phase II, definitive, intrusive data would be collected to identify and delineate contaminant hotspots and investigate geophysical anomalies identified during the Phase I investigation.

Phase II. The purpose of the Phase II investigation was to collect the data necessary to confirm the results of Phase I data, delineate identified hotspots and evaluate additional remedial alternatives designed to treat identified hotspots and reduce the restoration timeframe. Phase II of the OU 1 site recharacterization program was completed as two separate investigations, conducted in 2016 and 2017, respectively. The 2016 Phase II investigation consisted of a membrane interface probe (MIP) investigation and soil gas sampling activities. The 2017 Phase II investigation consisted of monitoring well installation and groundwater sampling, and soil, surface water, porewater, stormwater, and sediment sampling.

Table 4-2 summarizes the activities conducted during the Phase I and Phase II Site Characterization in the South, Central, and North Landfill Areas. Analytical results from the Phase I and Phase II Site Characterization efforts are presented on Tables D-1 through D-17 in Appendix D.

The results from both the Phase I and II investigations for the South Plantation; Central Landfill area; cVOC soil gas sampling; and PCBs in sediment and passive samplers are summarized in the following subsections.

South Plantation

During the Phase I investigation, cVOCs (specifically, PCE, TCE, cis-1,2-DCE, trans-1,2-DCE, 1,1,1-TCA, and 1,1-DCA) were detected in tree cores throughout the South Plantation. The highest concentrations were detected west-northwest of location P1-7, west of location P1-9, and from one native tree within the marsh area near the stormwater outfall. Within the South Plantation, two areas of buried metal or voids were identified. Based upon the groundwater flow direction under the plantation, both of these areas are located upgradient of P1-7, where high concentrations of COCs are present in

Table 4-2. Summary of Phase I and Phase II Site Recharacterization Activities

<table>
<tr><th rowspan="2">Activities</th><th colspan="3">OU 1 - Areas</th></tr>
<tr><th>South Plantation Area</th><th>Central Landfill Area</th><th>North Plantation Area</th></tr>
<tr><td rowspan="2">Phase I (August 2014)</td>
<td>Sampling Program:
Collect 231 core samples from 212 trees within the south plantation
Collect 21 core samples from 19 trees south and southwest of the south plantation
Land Surveying
Geophysical Surveying</td>
<td>Sampling Program:
Collect 5 core samples from 4 trees near well MW1-17 (central landfill)
Geophysical Surveying</td>
<td>Sampling Program:
Collect 10 core samples from 10 trees within the north plantation</td></tr>
<tr><td>Additional/Prior Data Evaluation:
Groundwater sampling results from wells sampled under the Navy LTM program (MW1-4, MW1-5, MW1-16, and MW1-17) in June 2014
Groundwater sampling results from USGS biodegradation study, including from piezometers (P1-6, P1-7, P1-8, P1-9, and P1-10) in June 2014 and passive diffusion bag (peeper) samplers (S-2, S-2B, S-3, S-3B, S-4, S-4B, S-5, S-5B, and S-6) in September 2014</td>
<td>Additional/Prior Data Evaluation:
Groundwater sampling results from wells sampled under the Navy LTM program (MW1-17)</td>
<td>Additional/Prior Data Evaluation:
None (tree core sampling only)</td></tr>
<tr><td>Phase II (August/September 2016)</td>
<td>Sampling Program:
Install 61 MIP borings
Collect 6 soil gas samples at locations east of the south plantation (SV-01, SV-02, SV-03, SV-04, SV-05, and SV-06)</td>
<td>Sampling Program:
Install 8 MIP borings</td>
<td>Sampling Program:
Collect 3 soil gas samples at locations east of the north plantation (SV-11, SV-12, SV-13)</td></tr>
<tr><td>Phase II (July – November 2017)</td>
<td>Sampling Program:
Collect soil and grab groundwater samples (target VOCs) from 34 direct-push soil borings
Collect subset of samples to be analyzed for: full list VOCs, SVOCs, TPH, and PCB Aroclors
Collect soil samples (target VOCs) from 10 auger borings in the south plantation, and from one boring west of the south plantation
Soil samples collected from screened intervals of wells in apparent hotspots also analyzed for physical characteristics (i.e. grain size, dry bulk density, hydraulic conductivity, effective porosity, and TOC)
Install 11 new groundwater monitoring wells and collect groundwater samples (target VOCs) from these wells
Wells in apparent hotspots also analyzed for microbial population, PFAS, and 1,4-dioxane
Collect water sample from irrigation well, IW1-S
Collect 2 stormwater samples (target VOCs) from an outfall and manhole structure within south plantation
Collect 4 push-point porewater samples (target VOCs) from south of the south plantation
Collect 12 surface water samples (target VOCs) from waterways upstream of existing sampling station MA 12.
Surveyed horizontal locations and top of casing elevations for newly installed wells and peeper sampling tubes. Collected depth-to-water measurements in new wells, subset of historical wells, and peeper tubes to prepare groundwater elevation contour map</td>
<td>Sampling Program:
Collect soil and grab groundwater samples (target VOCs) from 41 direct-push soil borings
Collect subset of samples to be analyzed for: full list VOCs, SVOCs, TPH, and PCB Aroclors
Collect soil samples (target VOCs) from 7 auger borings in the central landfill area
Soil samples collected from screened intervals of wells in apparent hotspots also analyzed for physical characteristics (i.e. grain size, dry bulk density, hydraulic conductivity, effective porosity, and TOC)
Install 7 new groundwater monitoring wells and collect groundwater samples (target VOCs) from these wells.
Wells in apparent hotspots also analyzed for microbial population, PFAS, and 1,4-dioxane
Collect 6 push point porewater samples (target VOCs) from west of the central landfill area
Surveyed horizontal locations and top of casing elevations for newly installed wells and peeper sampling tubes. Collected depth-to-water measurements in new wells and subset of historical wells to prepare groundwater elevation contour map</td>
<td>Sampling Program:
Collect 6 sediment samples for PCB congeners and PCB Aroclors at locations north of the north plantation
Utilized passive samplers (PEDs) to collect groundwater samples for total dissolved PCBs at two monitoring wells (MW1-2 and MW1-14) and two piezometers (P1-1 and P1-2)
Utilized PEDs to collect 6 porewater and 4 surface water samples for total dissolved PCBs at locations north of the north plantation (Marsh Creek and tide flats area)
Surveyed horizontal locations and top of casing elevations for newly installed wells and peeper sampling tubes. Collected depth-to-water measurements in subset of historical wells to prepare groundwater elevation contour map</td></tr>
</table>

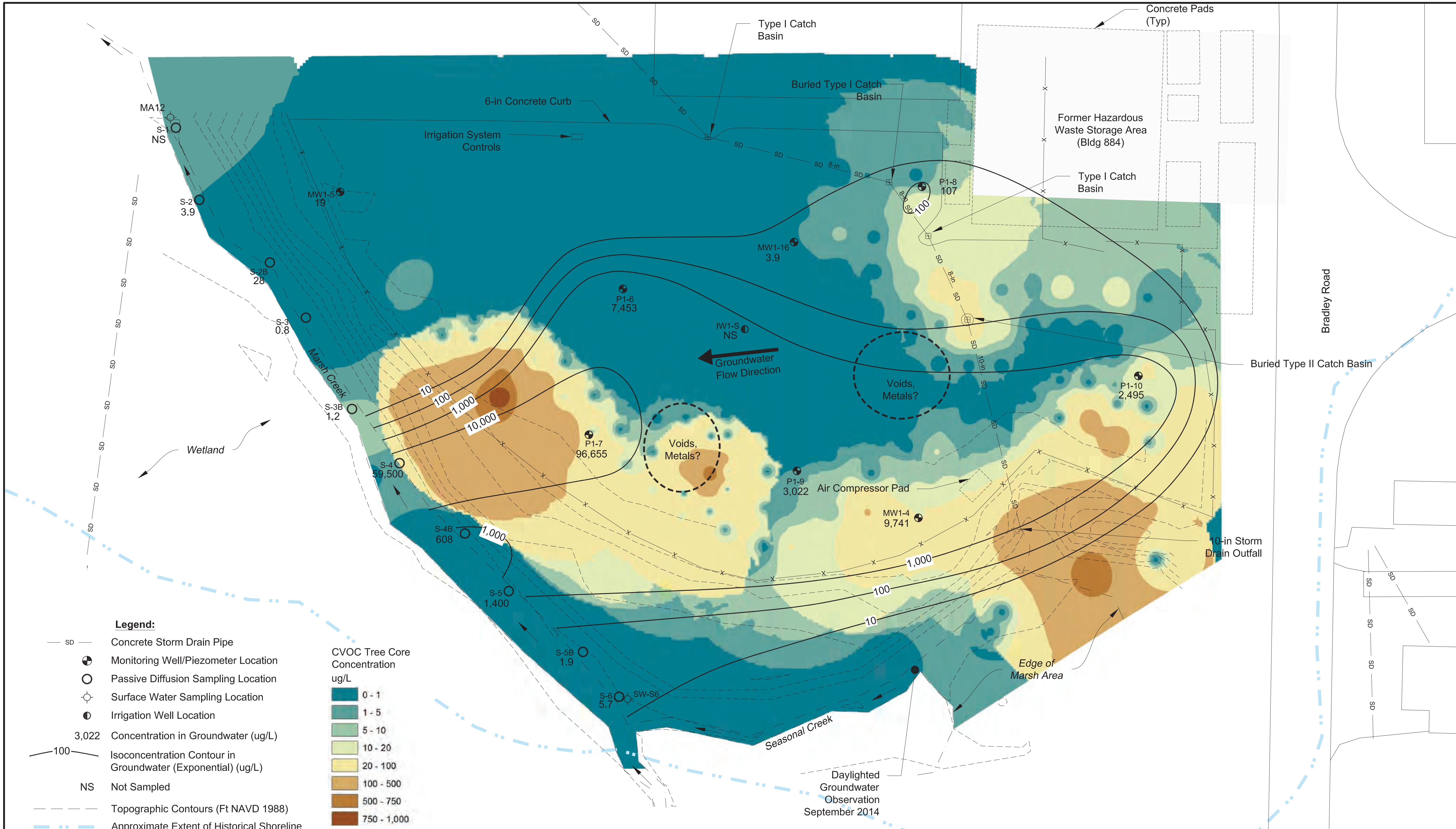
groundwater. These geophysical anomalies were not collocated with high COC concentrations in tree cores or groundwater; thus, the contaminant source is not expected to be a buried primary source. Chlorinated VOCs are detected throughout groundwater in the South Plantation with the highest concentrations detected at P1-7, P1-6, and MW1-4, and peeper location S-4.

An overlay of tree core, geophysical, 2014 groundwater monitoring results for total cVOCs from the Phase I investigation in the South Plantation is provided as Figure 4-4. As shown in Figure 4-4, cVOC tree core data and 2014 groundwater data indicate some correlation. Concentrations of TCE, cis-1,2-DCE, and trans-1,2-DCE in tree cores and groundwater generally correlate spatially in the South Plantation. Notably, concentrations of PCE, 1,1,1-TCA, and 1,1-DCA in tree cores and groundwater are not collocated. The southwestern area of the South Plantation near locations P1-7 and S-4 illustrate the greatest correlation between tree cores and groundwater, while the remainder of the South Plantation does not indicate significant correlation.

During the 2016 Phase II investigation, MIP boring locations were positioned to assess the apparent distribution of cVOCs in groundwater based on tree core sample results from the Phase I investigation and 2014 groundwater monitoring results from the LTM program. The MIP results were used to refine the apparent lateral and vertical extent of relatively higher concentrations of cVOCs in the upper portion of the aquifer. The MIP results from the Phase II investigation of the South Plantation are presented in Figure 4-5 and summarized below:

- The observations from the halogen-specific detector (XSD) responses suggest the presence of a significant residual source southeast of the Former Hazardous Waste Storage Area near the eastern edge of the landfill. The depth of the cVOC contamination appears to range from approximately 2 to 30 feet below ground surface (bgs) in the eastern portion of the South Plantation, and two hot spots at different depths were identified within this range. The XSD responses in this area indicate that contamination extends deeper than the existing monitoring well network, which extends to approximately 21 feet bgs.
- The XSD responses at the northcentral, southwestern, and southeastern portions of the South Plantation suggest the possible presence of additional source areas at depths as deep as 18 feet bgs.
- The XSD responses suggest that the deepest contamination observed does not extend into the Clover Park Silt (believed to have been encountered at approximately 31 to 33 feet bgs in the eastern portion of the South Plantation). This would indicate that the Clover Park Silt has not influenced the migration of cVOCs mass.
- The PID responses were reported at varying magnitudes at most of the MIP borings and generally corresponded with the locations and depths of the XSD responses.
- Several PID responses were observed to occur independently of XSD responses in the western portion of the South Plantation, suggesting the potential presence of contaminants other than cVOCs.

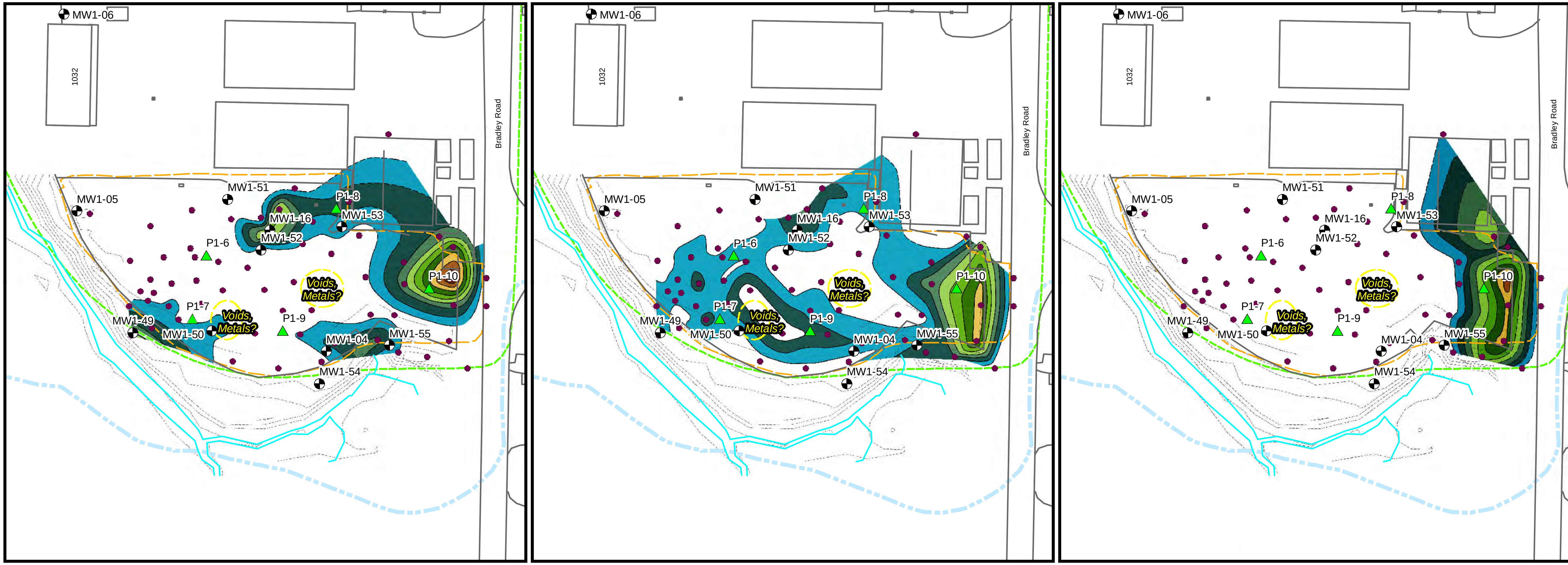
An evaluation of the general lithology was completed based on responses from the electrical conductivity probe and the hydraulic profiling tool. Notably, the Clover Park Silt was thought to be observed between approximately 28 and 40 ft bgs across the South Plantation.



U.S. NAVY

Figure 4-4
OU 1 2015 Phase I Site Characterization at South Plantation – Summary of cVOCs in Groundwater, Tree Core, and Geophysical Results

NBK KEYPORT
FIFTH
FIVE-YEAR REVIEW



0 to 9 ft bgs | 9 to 18 ft bgs | >18 ft bgs

Explanation

- MIP Locations
- Piezometer
- Monitoring Well
- Base Boundary
- OU1 Boundary
- Plantation Area
- Approximate Extent of Historical Shoreline

XSD Response (1,000 uV)

- >100-200
- >200-300
- >300-400
- >400-500
- >500-600
- >600-700
- >700-800
- >800-900
- >900-1,000
- >1,000

N

Scale in Feet

0 60 120

OU1_A1_XSD.mxd

U.S. NAVY

Figure 4-5
OU 1 2017 Phase II Site Characterization at South Plantation - XSD Isoconcentration Maps

NBK KEYPORT
FIFTH
FIVE-YEAR REVIEW

During the 2017 Phase II investigation, soil and grab groundwater samples were collected and results were used to identify cVOC hotspots in the South Plantation (see Figure 4-6). Hotspots identified in this evaluation were based on areas of dissolved COC concentrations above benchmark values (i.e., at 50,000 μg/L TCE or cis-1,2-DCE or 10,000 μg/L vinyl chloride) and areas encompassing sampling points where percent concentrations of 1,1,DCE were detected, indicating the potential for dense non-aqueous phase liquid to be present, yet no DNAPL was observed in the resulting groundwater well, suggesting the DNAPL is bound in the matrix of the formation. As shown in Figure 4-5, there are two relatively distinct hotspots in the South Plantation: one significant hotspot in the eastern portion of the landfill consistent with the XSD responses and one lesser hotspot surrounding well MW1-50.

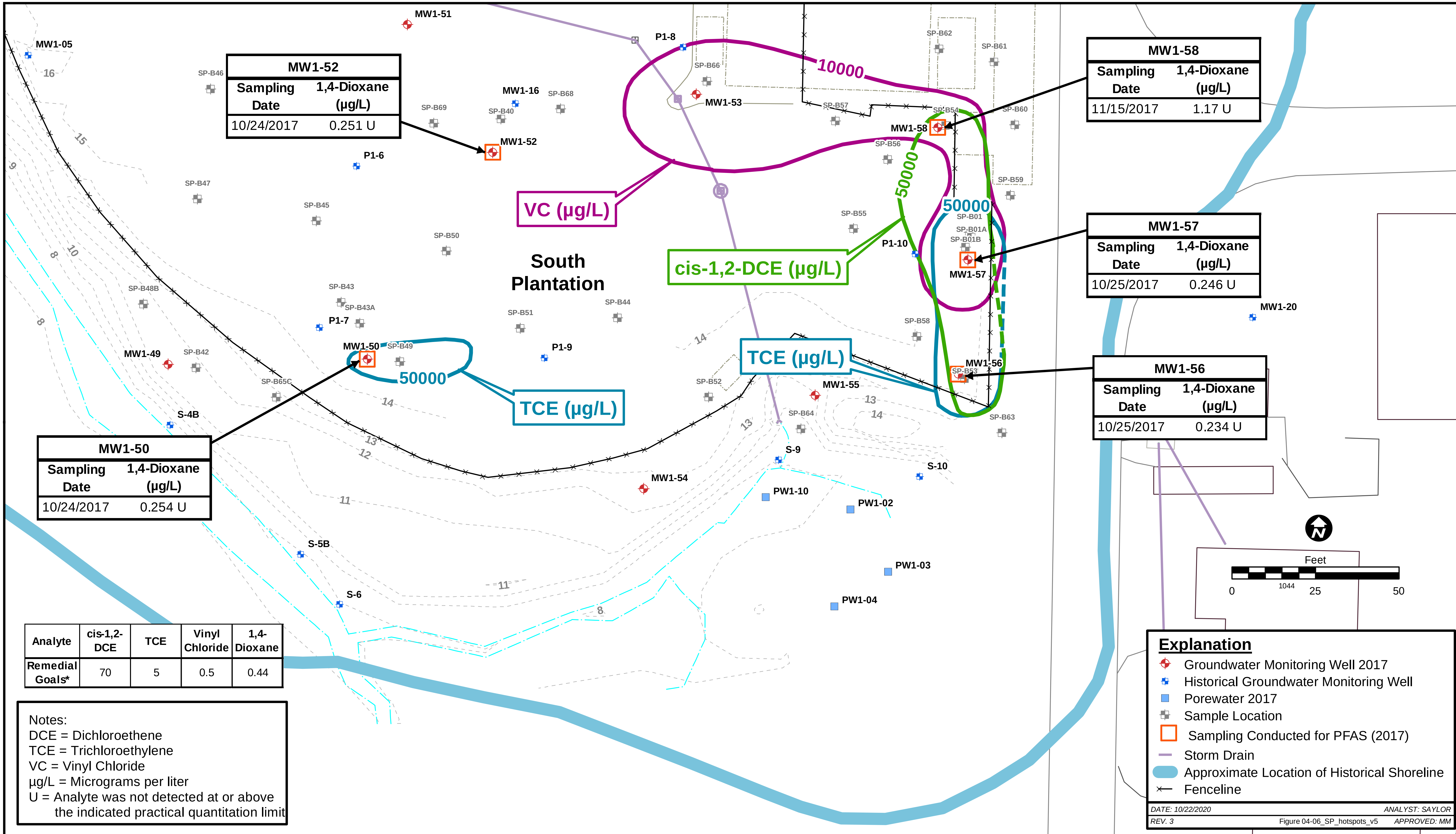
During the 2017 Phase II investigation, porewater and surface water samples were collected along the boundaries of the South Plantation (see Figure 4-7). As shown in Figure 4-7, concentrations of multiple cVOCs (i.e., TCE, cis-1,2-DCE, trans-1,2-DCE, 1,1-DCE, and vinyl chloride) exceeded their respective PALs in all porewater samples collected adjacent to the eastern portion of the South Plantation (i.e., PW1-02, PW1-03, PW1-04, and PW1-10). Concentrations of two or three of the nine cVOCs exceeded their PALs in each of the surface water samples collected adjacent to the South Plantation. Concentrations of TCE and vinyl chloride exceeded their respective PALs in 10 of the 12 surface water samples, while concentrations of cis-1,2-DCE exceeded the PAL in 4 of the 12 samples. The highest cVOC concentrations in surface water were measured immediately adjacent to the eastern portion of the South Plantation at SW1-10, near peeper stations S-4 and S-4B where the highest cVOC concentrations in porewater have historically been measured. The push-point porewater and surface water sampling results are provided on Tables D-14 and D-15 in Appendix D.

Of the two stormwater samples collected in the South Plantation area, one COC was detected (cis-1,2 DCE at a concentration of 1.14 μg/L) in the sample from the outfall, south of the eastern portion of the South Plantation, and no COCs were detected in the sample from the manhole immediately upstream of the outfall. The stormwater sampling results are presented on Table D-16 in Appendix D.

Central Landfill

During the Phase I investigation, PCE and TCE were detected in all four tree core samples collected from four native trees located downgradient of well MW1-17. Daughter products of PCE and TCE were not reported in any of the tree core samples. Data overlays were not developed for the area adjacent to well MW1-17, because the tree core data were collected from west or downgradient of the well location. Within the Central Landfill area upgradient of well MW1-17, there was a significant variation in geophysical response. The northern portion of the area appears to have more anomalies than the southern portion. The data suggest areas of voids and metal exist within the landfill. The geophysical anomalies in the South Plantation were not typically associated with higher COC concentrations in tree cores, so this line of evidence did not provide insight as to which anomalies upgradient of MW1-17 should preferentially be investigated.

During the 2016 Phase II Investigation, MIP locations were positioned in the vicinity of well MW1-17 and surrounding the motorcycle training area to assess the presence or absence of a cVOC plume migrating toward well MW1-17 and the presence or absence of a cVOC plume migrating to the northwest from former Building 884 toward well MW1-17. Comparisons of MIP results between boring locations



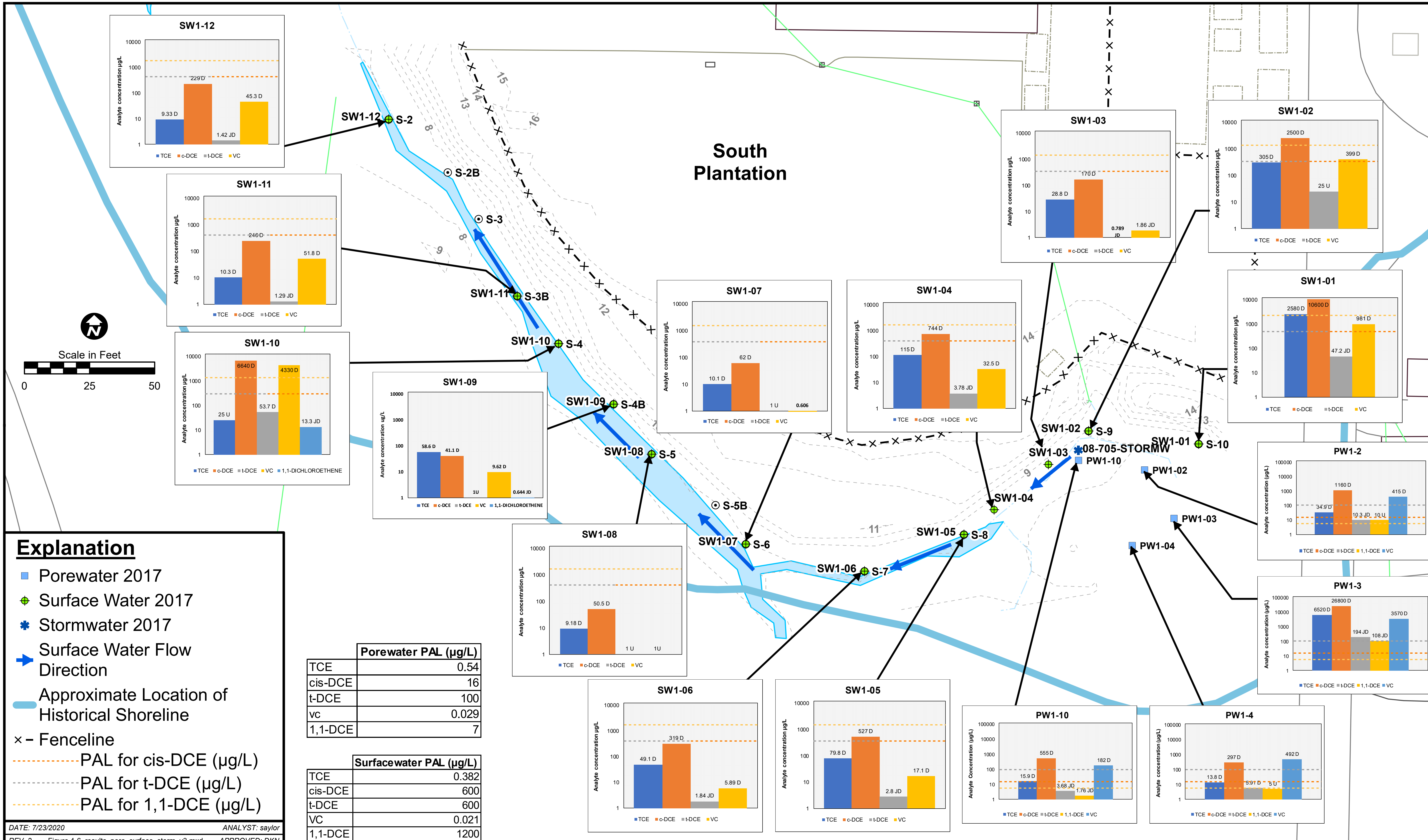
Analyte	cis-1,2-DCE	TCE	Vinyl Chloride	1,4-Dioxane
Remedial Goals*	70	5	0.5	0.44

Notes:
DCE = Dichloroethene
TCE = Trichloroethylene
VC = Vinyl Chloride
µg/L = Micrograms per liter
U = Analyte was not detected at or above the indicated practical quantitation limit

U.S. NAVY

Figure 4-6
OU 1 Area 1 2017 Phase II Site Characterization at South Plantation – Hotspots based on Maximum Concentrations in Grab Soil and Groundwater Samples

NBK KEYPORT
FIFTH
FIVE-YEAR REVIEW



	Porewater PAL (µg/L)
TCE	0.54
cis-DCE	16
t-DCE	100
VC	0.029
1,1-DCE	7

	Surfacewater PAL (µg/L)
TCE	0.382
cis-DCE	600
t-DCE	600
VC	0.021
1,1-DCE	1200

U.S. NAVY

Figure 4-7
OU 1 2017 Phase II Site Characterization at South Plantation – Porewater and Surface Water Data

NBK KEYPORT
FIFTH
FIVE-YEAR REVIEW

were used to evaluate the presence or absence of a cVOC plume in the upper portion of the aquifer in this area. The MIP results are summarized below:

- No XSD response significantly greater than the baseline was reported from the ground surface to a depth of approximately 15 feet bgs.
- The XSD responses suggest the presence of a source near MW1-17. The XSD responses suggest that the deepest contamination observed does not extend into the Clover Park Silt (believed to have been encountered at approximately 32 ft bgs). However, the elevated XSD responses at depths between approximately 17 and 20 feet bgs indicate that contamination in this area extends deeper than the existing monitoring well network, which extends to 16 feet bgs.
- The PID responses were reported at varying magnitudes at most of the MIP borings and generally corresponded with the locations and depths of the XSD responses.
- No PID responses were observed to occur independently of XSD responses.
- The Clover Park Silt was believed to have been observed between 26 and 34 feet bgs in the Central Landfill.

Figure 4-8 presents the select tree core results, groundwater results from MW1-17, and geophysical results from the Phase I investigation and XSD responses from the Phase II investigation in the Central Landfill.

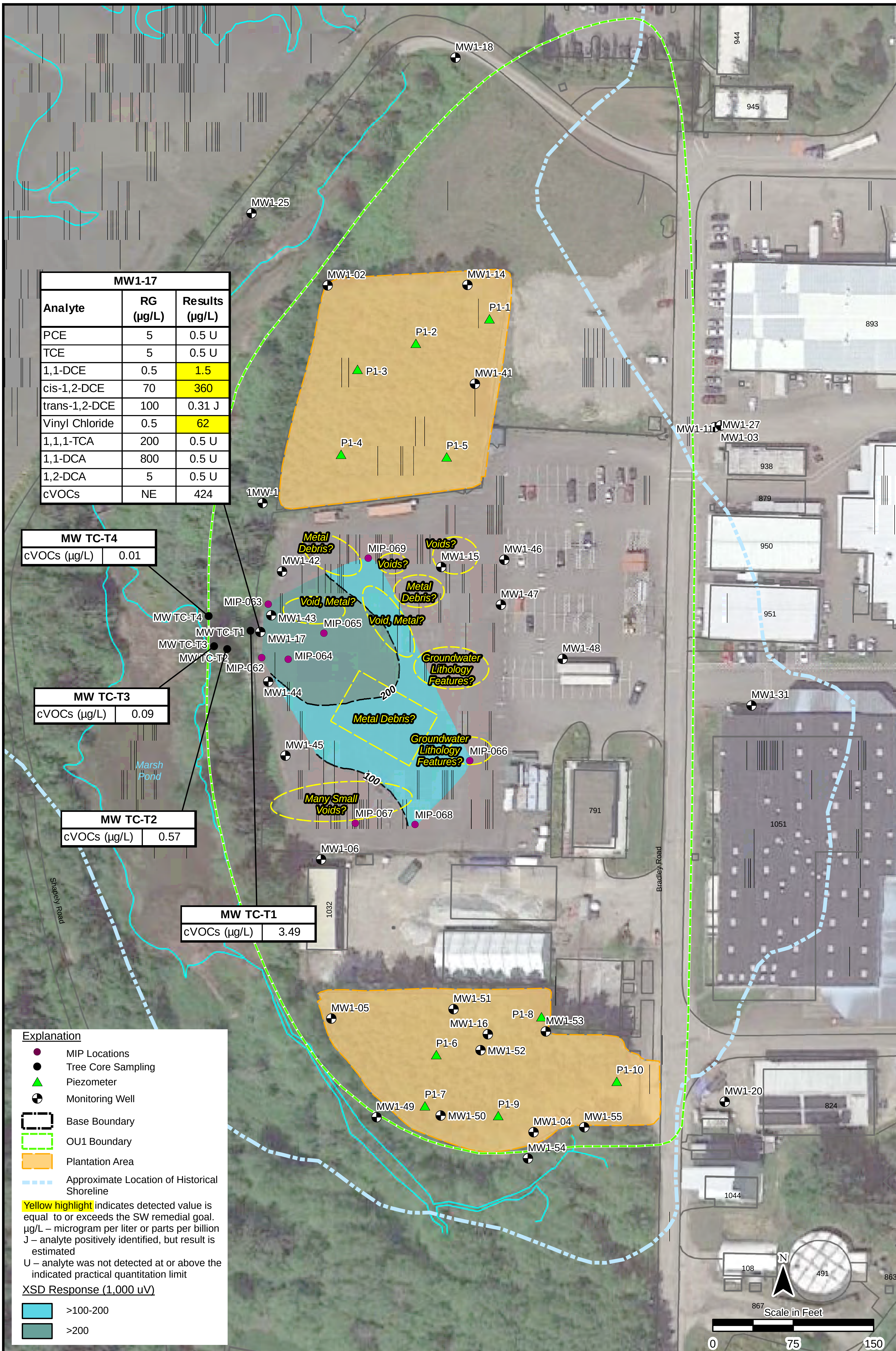
During the 2017 Phase II investigation, soil and grab groundwater samples were also collected and results were used to verify Phase I results and identify the magnitude and extent of cVOC hotspots in the Central Landfill (see Figure 4-9). Hotspots identified in this evaluation were based on areas of dissolved COC concentrations above benchmark values (i.e., at 10,000 μg/L cis-1,2-DCE or vinyl chloride or 1,000 μg/L TCE) and areas encompassing sampling points where non-aqueous phase liquid (NAPL) was observed or is indicated based on a lines of evidence analysis from EPA guidance. As shown in Figure 4-9, there was one relatively distinct hotspot in the Central Landfill, located west or upgradient of well MW1-17 surrounding wells MW1-46, MW1-47, and MW1-48.

During the 2017 Phase II investigation, push-point porewater samples were also collected from six locations west of the Central Landfill. Concentrations of cVOCs were not detected above the laboratory LOD in porewater samples from any of the sampling locations adjacent to the Central Landfill (PW1-01, PW1-05, PW1-06, PW1-07 and PW1-09).

cVOC Soil Gas Sampling

Soil gas sampling was proposed at locations along Bradley Road to evaluate the VI pathway from the landfill to occupied buildings east of Bradley Road. The sampling was designed to provide an updated evaluation of cVOC concentrations in soil gas in this area. Soil gas sampling was conducted at a total of nine sampling locations. The soil gas sampling results were compared to soil gas screening levels for sub-slab soil gas. The soil gas sampling results are presented in Figure 4-10 and summarized below:

- TCE concentrations in six of the nine samples and vinyl chloride concentrations in seven of the nine samples exceeded the applicable soil gas screening levels. Concentrations of other

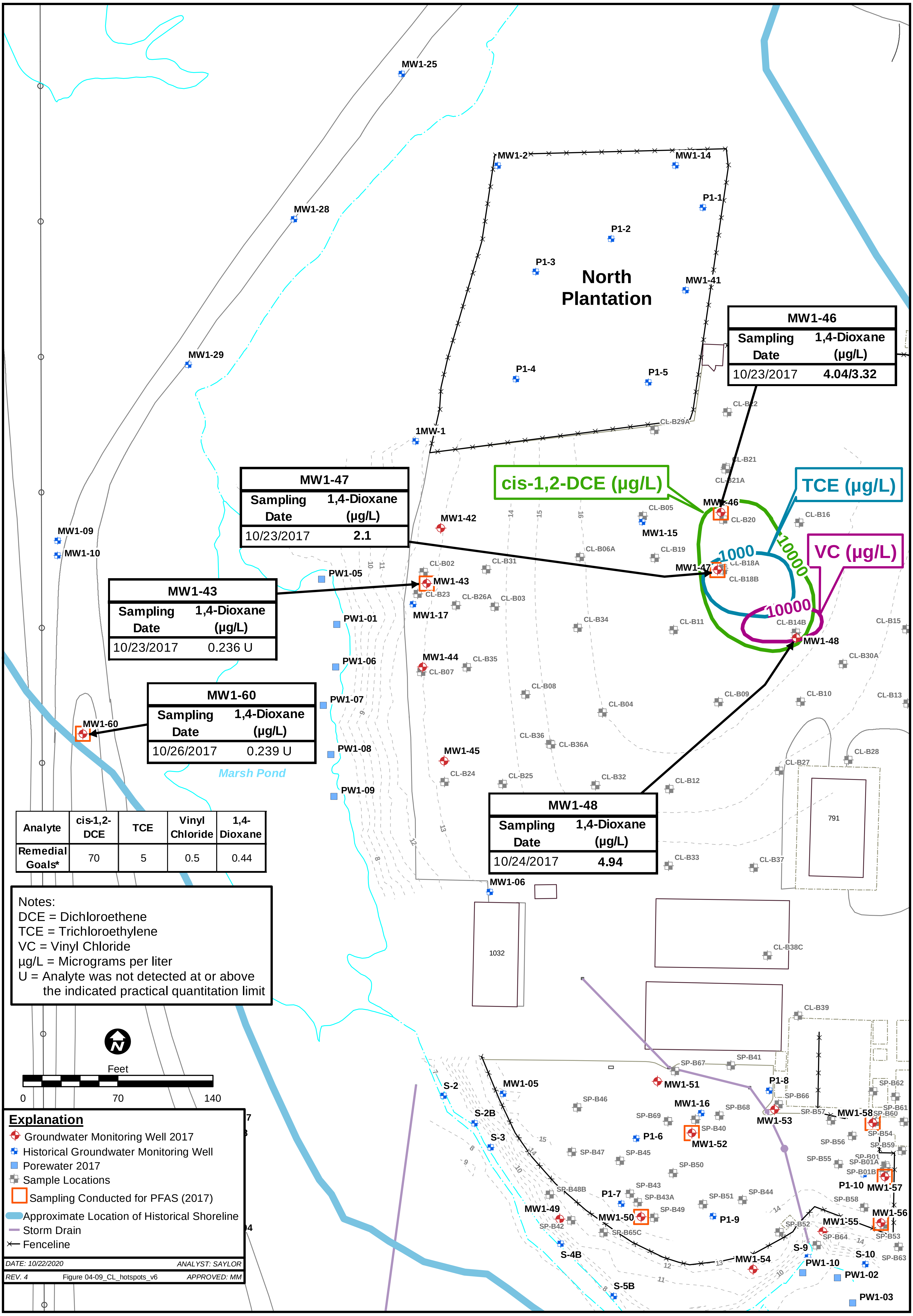


MW1-17		
Analyte	RG (µg/L)	Results (µg/L)
PCE	5	0.5 U
TCE	5	0.5 U
1,1-DCE	0.5	1.5
cis-1,2-DCE	70	360
trans-1,2-DCE	100	0.31 J
Vinyl Chloride	0.5	62
1,1,1-TCA	200	0.5 U
1,1-DCA	800	0.5 U
1,2-DCA	5	0.5 U
cVOCs	NE	424

U.S. NAVY

Figure 4-8
OU 1 Phase I & II Site Characterization at Central Landfill - Geophysical, Select Groundwater and Tree Core Sampling Results, and XSD Isoconcentration Map (greater than 15 ft bgs)

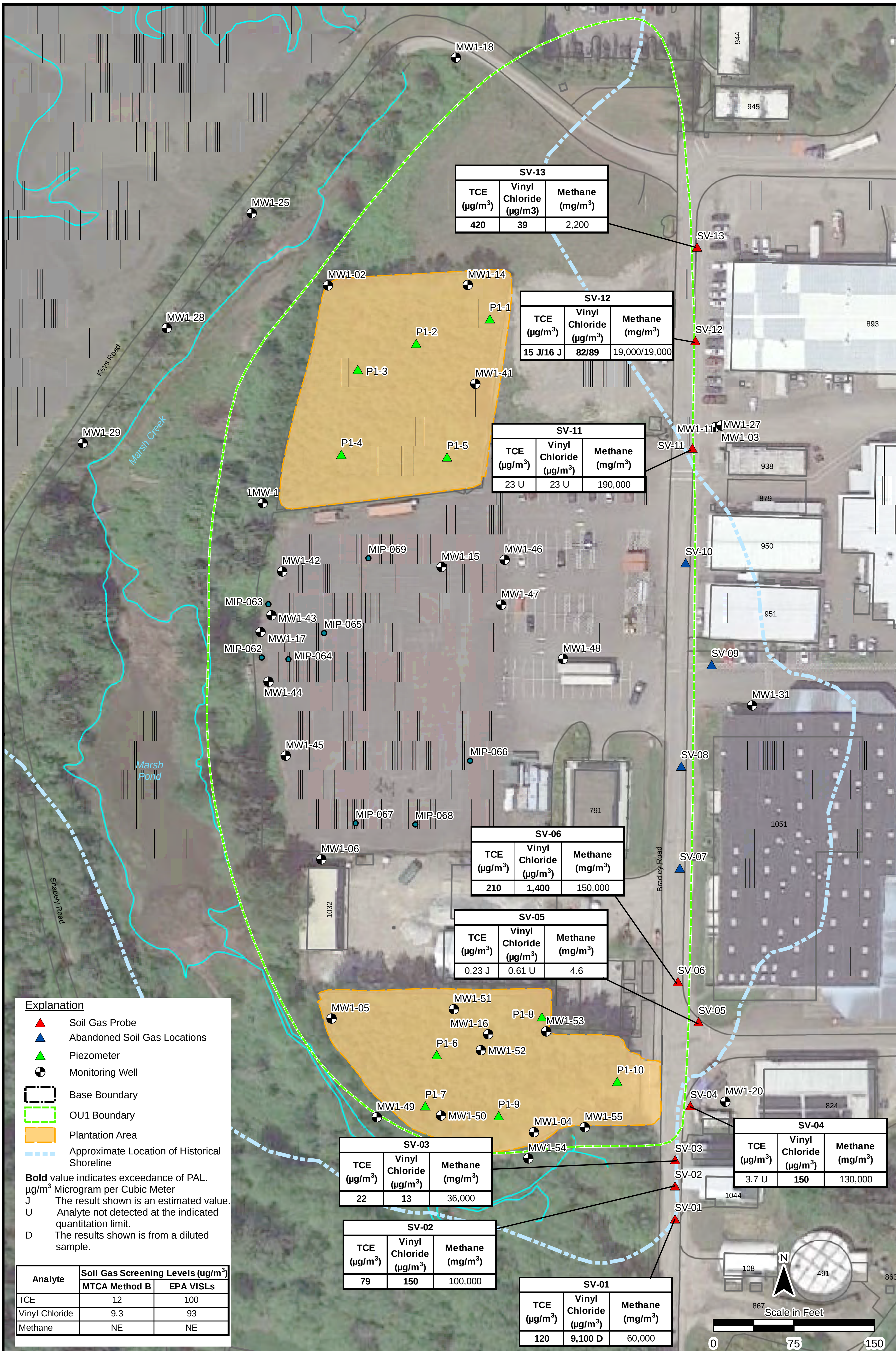
NBK KEYPORT
FIFTH
FIVE-YEAR REVIEW



U.S. NAVY

Figure 4-9
OU 1 2017 Phase II Site Characterization at Central Landfill – Hotspots based on Maximum Concentrations in Grab Soil and Groundwater Samples

NBK KEYPORT
FIFTH
FIVE-YEAR REVIEW



U.S. NAVY

Figure 4-10
OU 1 2017 Phase II Site Characterization –
Soil Gas Sampling Results of cVOCs Exceeding a Screening Level

NBK KEYPORT
FIFTH
FIVE-YEAR REVIEW

- COCs were either less than the screening levels or reported at concentrations below laboratory reporting limits (referred to as “non-detect” from here forward).
- TCE concentrations were highest at SV-13 (420 μg/m^3) and SV-06 (210 μg/m^3).
- Vinyl chloride concentrations were highest at SV-01 (9,100 μg/m^3) and SV-06 (1,400 μg/m^3).
- Methane concentrations were greater than the lower explosive limit (LEL) of 5 percent at all locations except SV-05, SV-12, and SV-13.

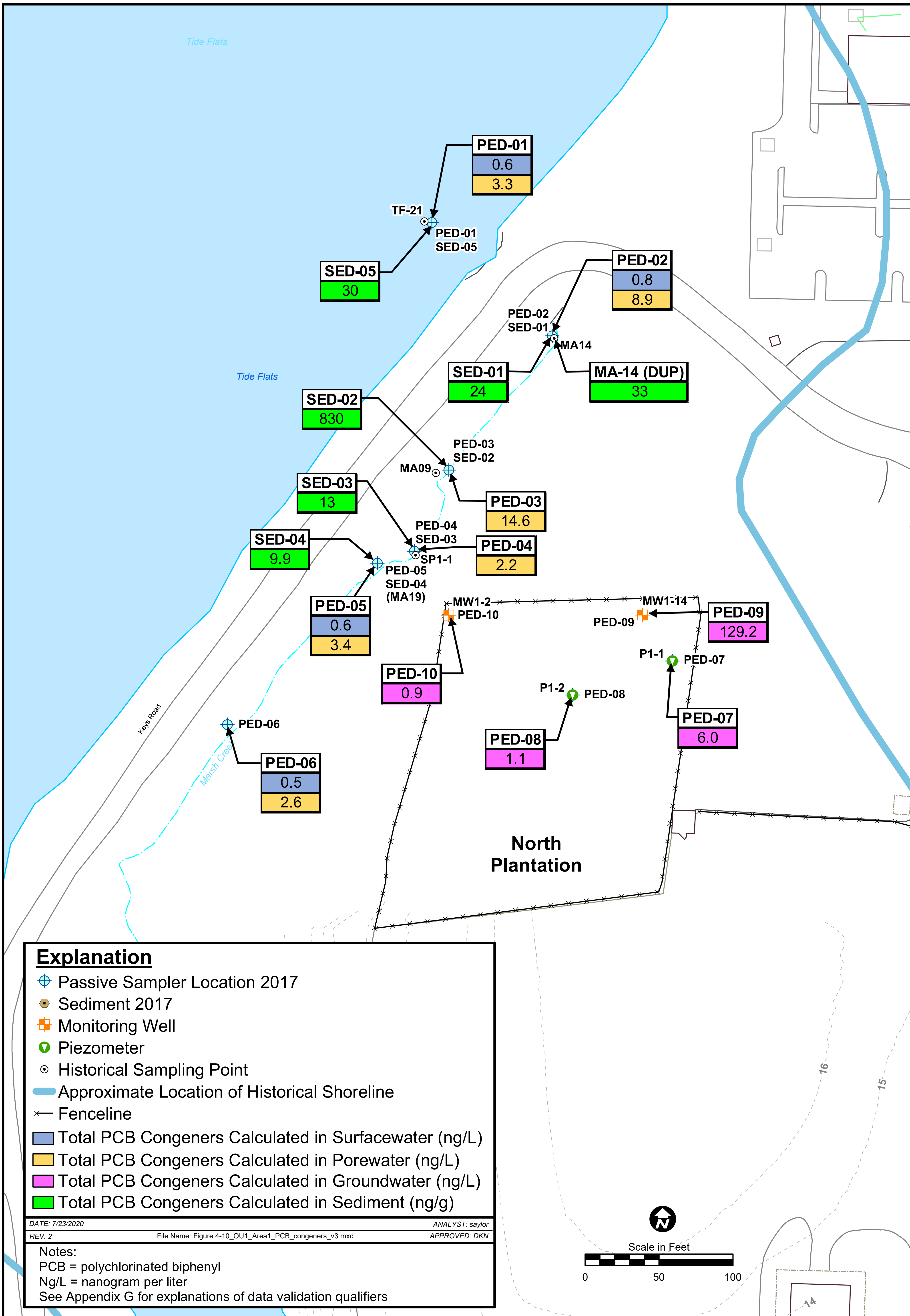
Based on these soil gas sampling results, the 2016 Phase II Investigation Report recommended further investigation of potential VI at buildings east of Bradley Road. The soil gas sampling results are provided in on Table D-17 Appendix D.

PCBs in Sediment and Passive Samplers

During the 2017 Phase II investigation, sediment samples and passive sampler samples (i.e., surface water, porewater, and groundwater) were collected within and northwest of the North Plantation to identify or determine the source of PCB contamination at seep SP1-1. Figure 4-11 presents the sediment, surface water, porewater, and groundwater results for total PCB congeners.

The total PCB (congeners) concentration for sediments in MA-09 exceeded both freshwater and marine sediment cleanup objectives (SCOs). The total PCB (congeners) concentrations at the other Marsh Creek and the tide flats sampling locations did not exceed the SCOs. Total PCB concentrations in sediments, from the summation of the congeners, are provided on Table D-11 in Appendix D. PCB Aroclors were detected also detected in MA-09 and no other sediment samples. Two Aroclors (1254 and 1260) were detected in the sample from MA-09, at concentrations of 350 μg/kg and 120 μg/kg, respectively. Overall, the 2017 PBC data are similar to pre-ROD/pre-sediment removal concentrations. PCB Aroclor concentrations are provided on Table D-12 in Appendix D.

Using the passive samplers, the highest dissolved PCB concentration in groundwater was measured in monitoring well MW1-14 (at 129.2 ng/L). The dissolved PCB concentrations in the other three groundwater samples were much less, ranging from 0.9 to 6.0 ng/L. PCBs were also measured at marsh stations MA-09 (at 14.6 ng/L) and MA-14 (at 8.9 ng/L) located downstream from seep SP1-1. The area of the seep itself (station SP1-1) exhibited porewater concentrations of 2.2 ng/L which is similar to those obtained at MA19 (3.4 ng/L) just upstream of SP1-1 and the new location further upstream at PED-06 (2.6 ng/L). A similar concentration was also measured in the tide flat (station TF-21, 3.3 ng/L). The surface waters displayed a narrow range of concentrations from 0.5 to 0.8 ng/L. The results of the calculated total PCB concentrations in the passive sampler-sampled waters are summarized in Figure 4-11 and provided on Table D-13 in Appendix D.



U.S. NAVY

Figure 4-11
OU 1 2017 Phase II Site Characterization – PCB Congeners in Sediments and Passive Samplers

NBK KEYPORT
FIFTH
FIVE-YEAR REVIEW

Summary of Phase II Investigation Results

Based on the results presented in the 2017 Phase II Site Recharacterization Report, the following conclusions were made regarding the nature and extent of contamination at OU 1:

- The highest concentrations of COCs beneath the South Plantation and in the adjacent wetlands are summarized as follows:
  - ➢ Laterally in an east-west direction, the highest COC concentrations are located beneath the eastern portion of the South Plantation, from Bradley Road on the east to approximately the centerline of former Building 884 on the west (SP-B55). In a north-south direction, these highest concentrations are found from approximately the southern edge of former Building 884 to the marsh (see Figures 4-5 and 4-6).
  - ➢ The highest COC concentrations beneath the eastern portion of the South Plantation extend vertically from the waste body of the landfill at approximately 5 to 7 ft bgs and penetrate the upper portion of what is believed to be the Lawton Clay at approximately 30 to 35 ft bgs.
  - ➢ Other areas of high COC concentrations (but lower than described above), are evident around historical well MW1-16 and from east of piezometer P1-7 westward to the marsh. In contrast to the eastern portion of the South Plantation, the highest COC concentrations in these areas appear to be shallower, typically found from 8 to 15 ft bgs.
  - ➢ Although the areas described in the items above exhibit the highest COC concentrations, exceedances of the ROD RGs are found throughout the South Plantation, and at all surface water sampling locations adjacent to the South Plantation.
- The likeliest discharge points along transport pathways from high COC concentration areas at the South Plantation to the adjacent wetlands are: 1) from the eastern portion of the South Plantation discharging to the area of the marsh immediately adjacent to Bradley Road and south of the South Plantation, east of the stormwater outfall, and 2) from the vicinity of piezometer P1-7 discharging toward monitoring well MW1-49 and peeper sampling stations S-4 and S-4B.
- In the Central Landfill, residual cVOC sources exist upgradient of well MW1-17. Residual sources are located in the vicinity of monitoring wells MW1-46, MW1-47, and MW1-48, and appear to represent more than one discrete residual source resulting in a commingled plume. The highest COC concentrations in this area are found in the depth range of 17 to 33 ft bgs.
  - ➢ Residual source(s) also exist in the area of direct-push borings CL-B03, CL-B04, CL-B35, and CL-B36. These residual sources appear to be separated from those in the vicinity of MW1-46, MW1-47, and MW1-48 by an area of relatively lower concentrations. The highest COC concentrations in this area are found in the depth range of 13 to 22 ft bgs.
  - ➢ Based on the absence of detectable cVOCs in porewater samples located due west of the Central Landfill, and the pattern of highest cVOC concentrations observed in grab groundwater samples, cVOCs from the Central Landfill do not appear to be discharging to surface water in this area. Rather than the cVOC plume implied by the groundwater

monitoring well data, contaminant transport beneath the Central Landfill appears to be toward the northwest along a more regional groundwater flow direction.

- Based on the continuous soil cores logged in 2017 and the 2016 MIP results, a laterally continuous aquitard does not exist in the central portion of the landfill, between what was defined in the ROD as the shallow and intermediate aquifers, upgradient of well MW1-17, or anywhere investigated in 2016 and 2017. This finding does not support the geologic interpretation presented in the ROD, but is consistent with that presented in the RI/FS.
- The 2017 PCB data are similar to concentrations measured pre-ROD. The 2017 result at MA-09 could indicate a temporal increase in PCBs at location MA-09, or a spatial variation in sediment concentrations in this area. The measured concentrations could be residual pre-ROD concentrations, given the selective nature of the sediment removal to protect root systems. Because of the uncertainty regarding concentration trends based on the 2017 results, a recommendation was provided for three additional annual sampling events performed at the five stations sampled in 2017, using the same sampling techniques and analytical procedures.
  - ➢ The elevated concentrations of PCBs in groundwater at well MW1-14, combined with the groundwater flow direction to the northwest and the location of the highest PCB concentrations in sediment and porewater at location MA-09 (downgradient of MW1-14), imply that recontamination may be occurring from a source within the landfill. In accordance with the recontamination requirements of the SMS (WAC 173-204-500[5][b][iii]), the potential for an uncontrolled source in the landfill should be assessed.
  - ➢ Because the highest current PCB concentrations are not higher than those found at the time of the ROD and are limited to the immediate vicinity of station MA-09, a recommendation was provided of not reopening the risk assessment regarding PCBs in sediment until additional PCB concentration trend data are available.

Figure 4-12 presents and summarizes the current contaminant transport pathways understood at OU 1 based on the Phase I and Phase II investigations. The 2017 Phase II Site Recharacterization Report concluded that a revised physical/chemical CSM is warranted and specific additional data collection are needed to refine the CSM. Once these additional data are collected, then a list of remedial technologies to decrease the restoration timeframe can be developed.

2019 Source Area Investigation. In 2019, an additional source area investigation was conducted at OU 1. The investigation was designed to collect quantitative data to:

1) Verify the migration path of VOCs and 1,4-dioxane from the Central Landfill hotspots toward wells on the causeway between the tide flats and Dogfish Bay;
2) Identify the source of PCB contamination in site sediments; and
3) Better define the extent of contamination:
   a) At the east side of the South Plantation;
   b) In the marsh area southeast of the South Plantation; and
   c) In Marsh Creek.

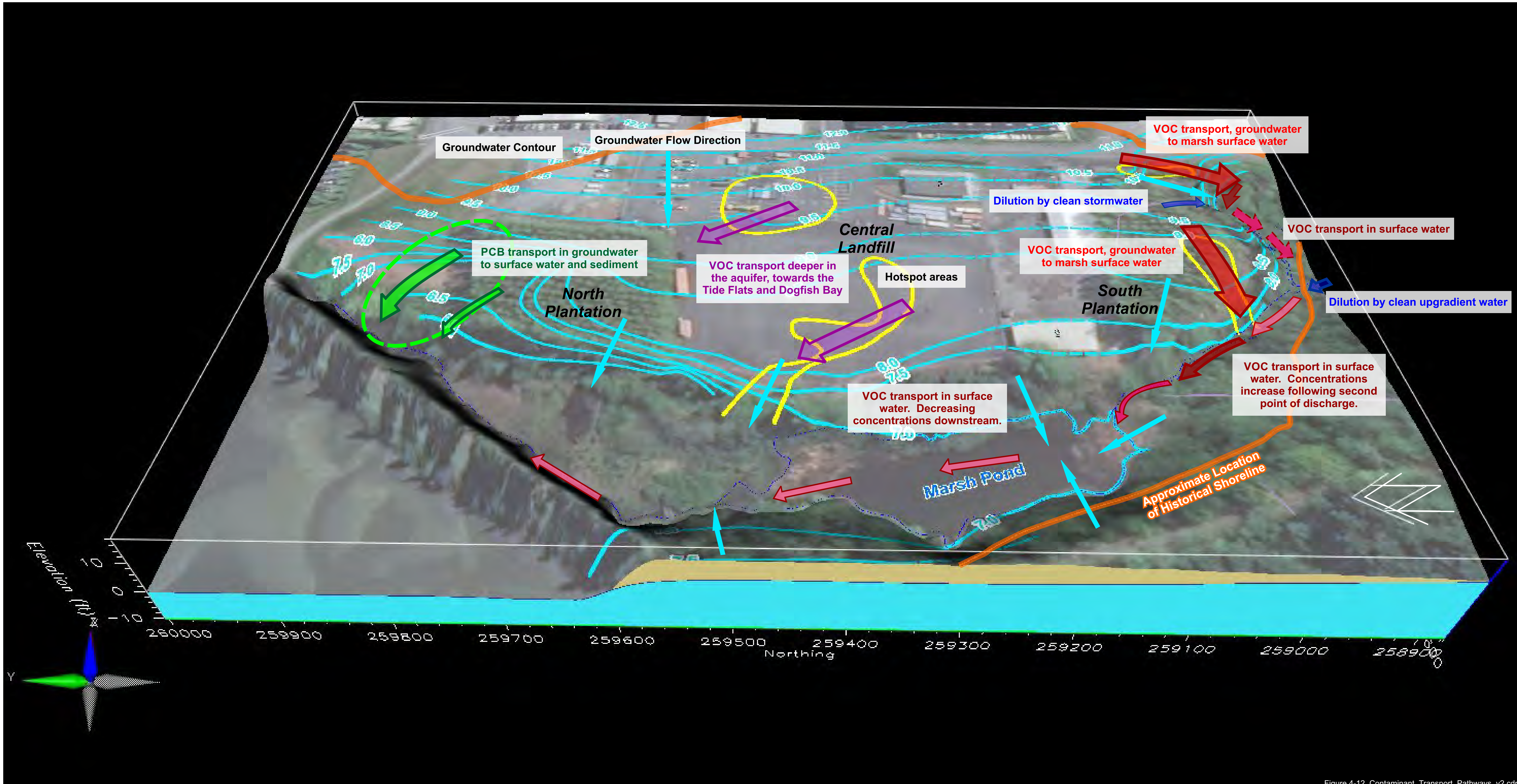


Figure 4-12_Contaminant_Transport_Pathways_v2.cdr

U.S. NAVY	Figure 4-12 OU 1 Area 1 2017 Phase II Site Characterization – Contaminant Transport Pathways	NBK KEYPORT FIFTH FIVE-YEAR REVIEW

Lithologic data were also collected to improve mapping of the regional aquitard contact within the site boundary and to conduct fate and transport modeling.

The 2019 source investigation report was not published by June 2019 (i.e., the end of this FYR period), so only a preliminary summary of the field procedures, activities and data are presented below. Data from these investigations will be used to update the existing CSM, allow better evaluation of remedy effectiveness, and support a focused feasibility study designed to evaluate alternatives for the treatment of identified hotspots to reduce the restoration timeframe at the site. The 2019 source investigation consisted of two mobilizations:

First Mobilization – June 2019

- A total of 33 direct push borings were installed across the North Plantation, Central Landfill, and South Plantation; a total of 102 soil samples were collected; and a total of 67 grab groundwater samples were collected. All samples were analyzed for the target VOCs listed in the Sampling and Analysis Plan (SAP) (Battelle, 2019), consisting of the nine cVOC COCs identified in the ROD and chloroethane. Additional subsets of samples were analyzed for 1,4-dioxane, PCB Aroclors, TPH-Diesel, and/or TOC (soil only).
- A total of 16 porewater samples were collected from areas south of the South Plantation, downstream of Marsh Pond, and along Marsh Creek. The samples collected from south of the South Plantation and downstream of Marsh Pond were analyzed for the target VOCs, and the samples collected along Marsh Creek were analyzed for PCB congeners.
- A total of eight (8) surface water samples were collected. Five (5) surface water samples were collected from Marsh Pond and from surface water downstream of Marsh Pond, and analyzed for target VOCs. Three (3) surface water samples were collected from areas near Seep SP1-1 and analyzed for PCB congeners.
- A total of seven (7) sediment samples were collected at, or in the vicinity of, historical sediment sample locations. These samples were collected for PCB congeners.

Second Mobilization – September/October 2019

- A total of 17 sonic borings were installed. A total of nine (9) monitoring wells were installed: three (3) in the South Plantation, one (1) in the Central Landfill, and five (5) in the North Plantation.
- A total of 27 soil samples were collected from the sonic boreholes. These samples were analyzed for the target VOCs, with additional subsets of samples analyzed for PCB congeners, TPH-Diesel, and/or TOC.
- A total of 10 grab groundwater samples were collected from the sonic boreholes. These samples were analyzed for the target VOCs, with an additional subset of samples analyzed for 1,4-dioxane.
- A total of 34 groundwater samples were collected from the nine (9) newly installed monitoring wells and twenty (20) pre-existing monitoring wells. All of these groundwater samples were analyzed for the target VOCs. Wells located in apparent hotspots that were

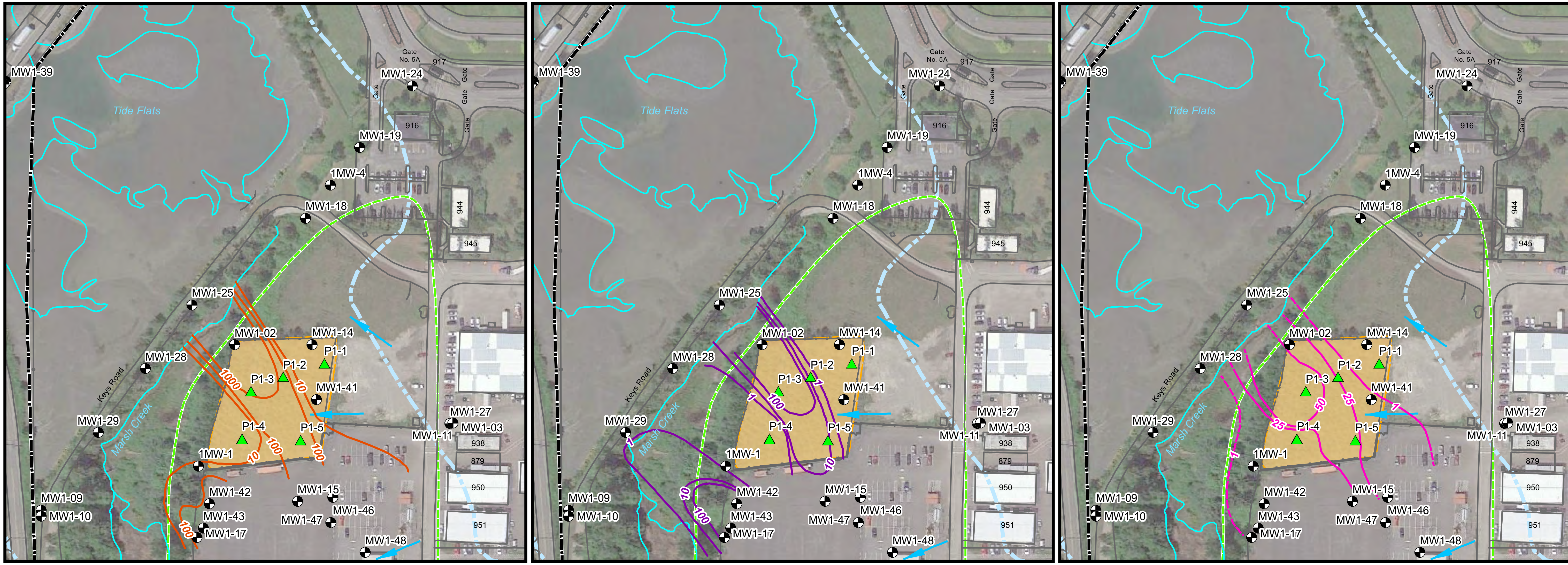
expected to be the focus of potential future remedial action were additionally analyzed for microbial population, PFAS, PCBs, TPH-Diesel, 1,4-dioxane, and biodegradation parameters (i.e., methane, ethane, nitrate, nitrite, sulfate, chloride, dissolved organic carbon, and sulfide). PFAS results are presented on Table D-28 in Appendix D, shown on Figures 4-4 and 4-8 and discussed in Section 5.0 (U.S. Navy, 2018b).

- A total of three (3) porewater samples were collected in October 2019. These samples were collected from west/southwest of the South Plantation and were analyzed for the target VOCs.
- To update the CSM, the majority of the sonic borings were advanced to greater depths than in previous investigations. The soil cores were continuously logged from these locations to identify the upper contact of the regional aquitard within the site boundary.

The data collected from the 2019 source investigation have not yet been comprehensively analyzed or published; however, there preliminary findings to date indicate that contaminant mass in groundwater is migrating towards the northwest to surface water. Figure 4-13 presents the contoured maximum grab groundwater concentrations of cis-1,2-DCE, vinyl chloride, and 1,4-dioxane from Geoprobe borings in the North Plantation. Vinyl chloride was detected in sediment pore water samples adjacent to the creek, which indicates contaminant mass discharge to the creek along a much longer reach of creek than previously understood (i.e., previously, discharge to the creek was only known to occur at the South Plantation).

The off-site transport of contaminant mass in groundwater towards the northwest has been known since before the time of the ROD; however, the source investigation has found contaminant mass substantially deeper and at greater concentrations. For example, monitoring well MW1-64, located in the northwest corner of the North Plantation, was installed to a completion depth of 55 ft bgs with the screened interval set from 45 to 55 ft bgs. The bottom of the well screen was set to the top of a silty clay layer encountered at 55 ft bgs, assumed to be the upper contact of the regional aquitard. Concentrations of cis-1,2-DCE, vinyl chloride, and 1,4-dioxane were detected in MW1-64, indicating groundwater contamination deeper than previously understood. Additionally, at sonic boring SP-B144 (MW1-68, located in the eastern portion of the South Plantation), a soil sample was collected at 50 ft bgs, below a 16-ft thick clay layer encountered from 30 to 46 ft bgs. TCE (at 53 µg/Kg) was detected in the soil sample, indicating cVOC soil contamination below the clay layer. Monitoring well MW1-68 was installed to a completion depth of 47 ft bgs, with the screened interval set from 37 to 47 ft bgs. The bottom of the well screen was set to just below the bottom contact of the 16-ft clay layer. Cis-1,2-DCE, TCE, and vinyl chloride were detected in the groundwater sample, indicating cVOC groundwater contamination within and below the clay layer.

Additionally, high concentrations of PCBs and TPH-Diesel were observed in shallow soil samples collected from the northern edge of the North Plantation (i.e., borings NP-B119, NP-B120, NP-B121, NP-B122, NP-B123, NP-B124, and NP-B125 installed during the first mobilization, and borings NP-B137 and NP-B138 installed during the second mobilization). The co-located presence of relatively high TPH concentrations and high PCB concentrations in soil generally did not result in detectable PCB concentrations as Aroclors in groundwater; PCBs as Aroclors were not detected in groundwater in 2019. However, PCBs as congeners were detected in shallow and deeper groundwater in 2019.



cis-1,2-DCE

Vinyl Chloride

1,4-Dioxane

Explanation

- Piezometer
- Monitoring Well
- Base Boundary
- OU1 Boundary
- Plantation Area
- Approximate Groundwater Flow Direction
- cis-1,2-DCE Concentration Contours
- Vinyl Chloride Concentration Contours
- 1,4-Dioxane Concentration Contours
- Approximate Location of Historical Shoreline

N

Scale in Feet

0 150 300

Figure 04-13_OU1_A1_comparison.mxd

U.S. NAVY	**Figure 4-13** **Initial Results from 2019 Source Investigation at OU 1 – Contoured Maximum Concentrations of cis-1,2-DCE, Vinyl Chloride, and 1,4-Dioxane**	NBK KEYPORT FIFTH FIVE-YEAR REVIEW

Preliminary data analysis suggests that PCBs and TPH-Diesel are migrating together in groundwater; however, conflicting evidence was observed regarding flow characteristics (i.e., shallow dissolution of PCBs followed by vertical migration to deeper groundwater vs. deeper dissolution of PCBs followed by lateral migration of groundwater). It should be noted that concentrations of PCBs detected in deeper groundwater samples were below the PAL and below the Aroclor detection limit. To evaluate the impact to the environment of PCB–contaminated groundwater discharging to surface water, further statistical analyses of sediment samples from the area of the creek downgradient of seep SP1-1 is scheduled to be conducted in the winter of 2020-2021.

As part of the source investigation, an Environmental Sequence Stratigraphy (ESS) interpretation of the geology at the site was also conducted and suggests tidal channel deposits overlying a package of fluvial channels, with a primary paleo tidal channel oriented roughly southeast to northwest potentially acting as a preferential pathway for deep contaminant mass migration to the northwest.

Vapor Intrusion Study. In 2018, VI study activities were conducted at 10 buildings (i.e., Buildings 916, 944, 945, 893, 951, 824, 1051, 108, 820, and 950) east and northeast of Bradley Road, adjacent to the OU 1 former landfill during both later winter and summer timeframes. The overall objectives of the VI study were to: 1) evaluate whether the VI pathway is complete between the site and nearby buildings; 2) assess whether cVOCs in groundwater have contributed to indoor air concentrations via the VI pathway; and 3) collect information to support the selection of appropriate mitigation measures, if required.

Preliminary screening with a portable gas chromatograph/mass spectrometer (GC/MS), landfill gas meter, and differential pressure monitors was performed from March 12 to 16, 2018, immediately prior to the first sampling event, in each of the 10 buildings selected for further investigation. The portable GC/MS and landfill gas meter were used to identify potential background indoor air sources, soil vapor entry points, and preliminary breathing zone concentrations. The preliminary screening results were used to inform final placement of Summa canisters to collect time-integrated samples. Cross-building differential pressure monitoring was performed during preliminary screening to provide an indication of whether the inside of each building tends to be more or less pressurized as compared to outdoor conditions.

For sub-slab and exterior soil vapor sampling, Vapor Pin® FLX-VP stainless steel probes with compression fittings and stainless steel secure flush mounted covers were installed using a rotary hammer drill. Sub-slab and exterior soil vapor probes were installed from March 19 to 22, 2018. Indoor air, outdoor air, sub-slab, and exterior soil vapor samples were collected, and differential pressure was monitored in both late winter (March 2018) and summer (July 2018). The VI sampling results for each building are provided on Tables D-18 through D-27 in Appendix D. The preliminary screening and air sampling results for each building are summarized below:

<u>Buildings 916, 944, 945, 893, 951, 824, 1051, 108:</u>

- During preliminary screening, no background indoor air sources were identified, with the exception of Building 893. In Building 893, an air freshener in the second-floor men’s restroom was identified as a background indoor air source. Since Summa canister samples were not collected on the second floor and concentrations of compounds off-gassing from the air freshener were low relative to industrial screening levels, the air freshener was not removed from the building prior to sampling.

- Corrected indoor air concentrations were greater than zero for various cVOCs, 1,4-dioxane, and/or methane in both late winter and summer. However, the corrected indoor air concentrations were less than MTCA Method C (industrial) and Method B indoor air screening values, which indicates that the VI contributions, if any, to indoor air quality in these buildings was not significant.
- Indoor air, sub-slab, and/or exterior soil vapor concentrations in both late winter and summer were less than the MTCA Method C (industrial) and Method B screening levels for all target compounds. **Therefore, no further action for the VI pathway is warranted in these buildings.**

<u>Building 820:</u>

- During preliminary screening, no background indoor sources were identified.
- In March, corrected indoor air concentrations were greater than zero in Building 820 for PCE, TCE, cis-1,2-DCE, 1,4-dioxane, and methane. In July, corrected air concentrations were greater than zero in Building 820 for PCE, TCE, trans-1,2-DCE, 1,4-dioxane, and methane. However, the corrected indoor air concentrations were less than MTCA Method C (industrial) and Method B indoor air screening values, which indicates that the VI contribution, if any, to indoor air quality in Building 820 is not significant.
- Indoor air concentrations in both late winter and summer were less than the MTCA Method C (industrial) screening levels for all target compounds detected in Building 820. Sub-slab soil gas concentrations for all target compounds except TCE were less than the MTCA Method C (industrial) and Method B screening levels. The only TCE exceedance was for the field duplicate sub-slab soil gas sample from the warehouse, with the primary sample and all subsequent samples at least three times less than the industrial screening level.
- Ongoing monitoring was not warranted for Building 820 because there were no exceedances of indoor air industrial screening levels and only one exceedance of the TCE sub-slab soil gas industrial screening level out of 16 sample locations. The one TCE exceedance was for a field duplicate sample with an estimated result that had more than 25% relative percent difference as compared to the result for the primary sample. **It was determined that no further action for the VI pathway is warranted in Building 820.**

<u>Building 950:</u>

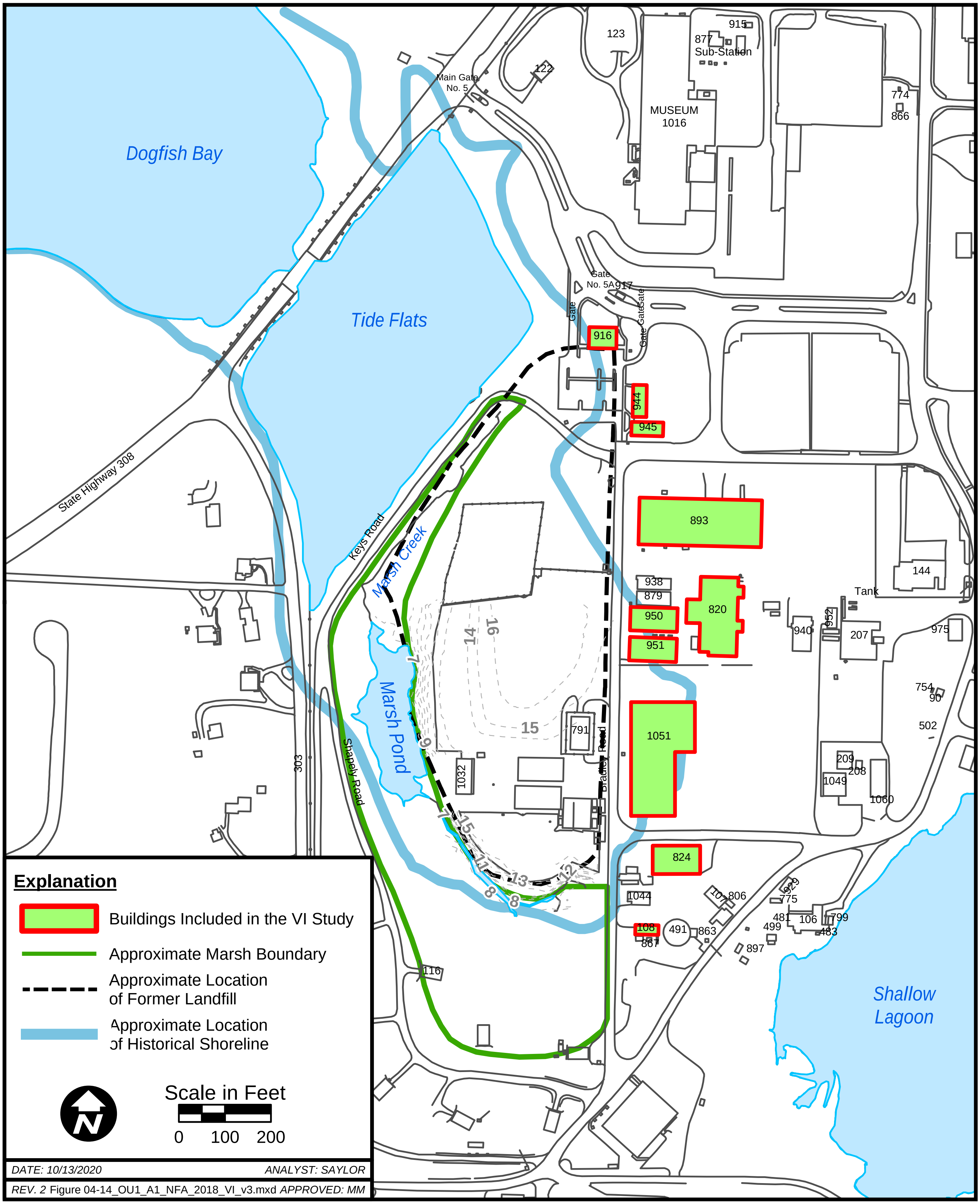
- During preliminary screening, no background indoor air sources were identified.
- In March, corrected indoor air concentrations were greater than zero in Building 950 for PCE, TCE, cis-1,2-DCE, vinyl chloride, 1,4-dioxane, and methane. In July, corrected air concentrations were greater than zero in Building 950 for PCE, TCE, cis-1,2-DCE, trans-1,2-DCE, and methane. The corrected indoor air concentrations for all contaminants were less than MTCA Method C (industrial) and Method B indoor air screening values, which indicates that the VI contribution, if any, to indoor air quality in Building 950 is not significant.

- Indoor air concentrations in both late winter and summer were less than the MTCA Method C (industrial) screening levels for all target compounds detected in Building 950. Sub-slab soil gas concentrations for all target compounds except methane were less than the MTCA Method C (industrial) and Method B screening levels. Methane levels were slightly greater than the screening levels in July, but less than the screening levels in March.
- Ongoing monitoring was not warranted for Building 950 because methane concentrations in sub-slab soil gas were only slightly greater than the screening level at 10.4% and 10.7% of the LEL in July and an order of magnitude less than the screening level in March. Concentrations of methane in indoor air were only slightly greater than those for the nearest upwind outdoor air location. **It was determined that no further action for the VI pathway is warranted at Building 950.**

Figure 4-14 presents a site map of the 10 buildings included in the VI study performed in March and July 2018. It was noted, however, that the former landfill will be vented in 2020, which will reduce the concentrations of cVOCs and methane in soil gas over time.

USGS Tidal Lag Study. In 2018, the USGS attempted to conducted a tidal lag study to: 1) better understand nearshore groundwater-seawater interactions; 2) determine the optimal schedule/timing for groundwater sampling at different wells; and 3) inform a concurrent groundwater modeling effort at OU 1. To meet these objectives, water levels were continuously monitored in 19 existing groundwater monitoring wells (see Figure 4-15) and five surface-water features of interest from July 12, 2018 to August 8, 2018, a period that included neap and higher amplitude spring tides. The pressure transducer in one well failed to log data; therefore, the results are only presented for 18 groundwater monitoring wells. The time-series data also included specific conductance at the surface-water features. However, although time-series data for specific conductance was also scoped to be collected in the monitoring wells used, the data loggers did not function correctly, so did not record specific conductance over time. A vertical profile of specific conductance was measured once in the screened interval of selected monitored wells to determine if the freshwater/ saltwater interface was present at the time and was used to make conclusions with regard to the project objectives.

Based on this data, the USGS reported that the optimal times for sampling groundwater for freshwater contaminants originating from OU 1 is when fresh groundwater flowing seaward is least impeded by elevated tides. Those times are related to predicted tide levels by tidal lags (i.e., the duration between low tides and corresponding low groundwater levels). For the USGS study, tidal lag times were determined relative to tidal levels in Liberty Bay (rather than in the more nearby Tide Flats) because the predicted tides for the Poulsbo, WA Station that are used to schedule groundwater sampling represent open-water conditions in the area and the sill that separates Dogfish Bay from the Tide Flats clearly affects the timing and magnitude of low-low tides in the Tide Flats (see Figures 1-2 and 1-3).

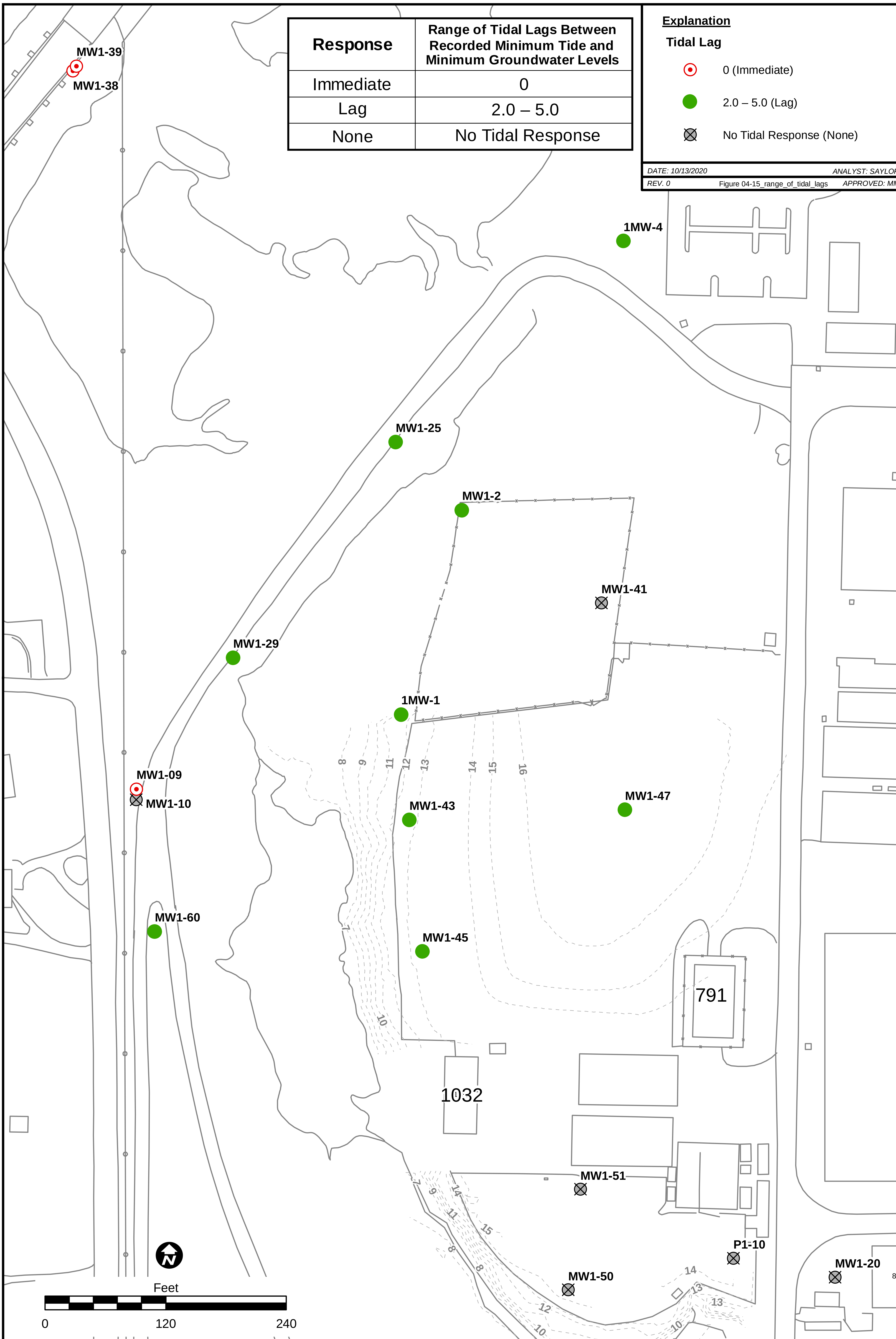


U.S. NAVY

Figure 4-14
OU 1 No Further Action Summmary of 2018 Vapor Intrusion Investigation

NBK KEYPORT
FIFTH
FIVE-YEAR REVIEW

Response	Range of Tidal Lags Between Recorded Minimum Tide and Minimum Groundwater Levels
Immediate	0
Lag	2.0 – 5.0
None	No Tidal Response



U.S. NAVY

Figure 4-15
OU 1 Tidal Lag Study Monitoring Locations

Naval Base Kitsap Keyport

Using the tidal levels and time-series water level data, the calculated tidal lag times at each monitoring wells fell into three general categories:

Monitoring Well	Range of tidal lags between recorded minimum tide and minimum groundwater levels (hours)	Response
MW1-9*, MW1-38*, MW1-39*	0	Immediate
MW1-60, MW1-2*, MW1-29*, MW1-25*, 1MW-1*, MW1-43, MW1-47, MW1-45, 1MW-4*	2.0 – 5.0	Lag
MW1-10*, MW1-41, MW1-50, MW1-51, MW1-20, P1-10	No Tidal Response	None

*Specific conductance also measured at the top, middle, and bottom of each saturated screen interval.

Groundwater levels in the middle group of wells appeared to respond primarily together with tidal level changes in the Tide Flats rather than tidal level changes in Liberty Bay. The study found that when sampling during spring (rather than neap) tides, as has generally been the standard practice at OU 1, the optimal time to sample the 12 monitoring wells influenced by tides would be to add the tidal lags of the predicted low-low tide for Liberty Bay as measured at the Poulsbo, WA Station. Sampling schedules for the six monitoring wells where groundwater levels were only minimally influenced by tides need not be constrained by tidal conditions.

The discrete groundwater specific conductance data collected were used to determine if a seawater/freshwater interface was present at any of the monitoring wells, and to inform decisions on what depth groundwater should be sampled in existing wells. Vertical water quality profiles were measured once in the screened interval of nine monitoring wells. The profiles included measurements at the top, middle, and bottom of each saturated screen interval. As has been the standard practice, the study found that groundwater samples can still be collected from the middle of the saturated screened interval since no tidal-induced changes in the seawater/freshwater interface were identified in the screened interval of the wells. However, it was noted that collection of time-series specific conductance data would more thoroughly confirm this practice. Therefore, the USGS is currently repeating this study and sample timing will be based on the results of the existing study until revised results are obtained.

4.2.2 OU 2 Area 2

The following section provides: 1) a review of the selected remedy, particularly the LTM program; 2) a discussion of LTM results during this FYR period and trends over time; 3) a data gap evaluation based on current LTM results and results from the RI (U.S. Navy, 1993a and 1993b); and 4) a discussion of 1,4-dioxane groundwater monitoring results. Figure 2-2 depicts the LTM sampling locations at OU 2 Area 2. Appendix E presents all historical groundwater monitoring results from OU 2 Area 2, including cVOCs (i.e., vinyl chloride, TCE, and cis-1,2-DCE) in Table E-1 and 1,4-dioxane in Table E-2.

Review of LTM Program. As described in Section 2.0 and the ROD (U.S. Navy, EPA, and Ecology, 1994), the selected remedy for OU 2 Area 2 includes:

- Monitored natural attenuation.
- LTM to establish trends in COC concentrations and determine when LUCs can be discontinued.
- LUCs to prevent residential land use and construction of domestic wells.

Per the ROD, the COCs for OU 2 Area 2 are vinyl chloride and TCE with RGs of 0.023 and 5 μg/L, respectively, both the MTCA B cleanup level. At the time of the ROD, the RG for vinyl chloride was below the practical quantitation limit (PQL) of standard EPA methods for drinking water. In such cases, the MTCA B cleanup level was based on the PQL (per WAC 173-340-700[6]) and the expected PQL for vinyl chloride was 0.1 μg/L. In 2012, the RG for vinyl chloride was updated to 0.029 μg/L based on the calculated MTCA B cleanup level using the current oral slope factor. Using improved analytical techniques, the PQL has been below this updated RG of 0.029 μg/L since June 2012.

At OU 2 Area 2, groundwater samples were collected and analyzed for TCE with concentrations compared to the RG of 5 μg/L. Although not identified as a COC in the ROD, groundwater samples were similarly collected and analyzed for cis-1,2-DCE with concentrations compared to the MTCA B cleanup level of 16 μg/L. Groundwater samples for both TCE and cis-1,2-DCE analyses were collected from November 1995 through June 2014 until both analytes were discontinued from the monitoring program based on recommendations in the fourth FYR (U.S. Navy, 2015b), noting that concentrations were below their respective cleanup levels during the entire previous FYR period.

Groundwater samples were collected and analyzed for 1,4-dioxane from the three monitoring wells (i.e., 2MW-1, 2MW-6, and MW2-8) as a one-time sampling event in June 2007 to evaluate if this chemical of emerging concern was present at the site. There is no RG established for 1,4-dioxane, as it is not a COC in the ROD; however, the current MTCA B cleanup level is 0.44 μg/L, which is a decrease from the previous cleanup level of 4 μg/L in 2007. Due to this decrease in the MTCA B cleanup levels (i.e., 4 to 0.44 μg/L), the fourth FYR (U.S. Navy, 2015b) recommended two additional annual monitoring events using a laboratory analytical method that can achieve a reporting limit of 0.4 μg/L. Monitoring would be discontinued if the two additional annual monitoring events demonstrate that 1,4-dioxane is not detected above 0.44 μg/L.

LTM Results and Trends Over Time – Vinyl Chloride. During this FYR period, groundwater samples were collected and analyzed for vinyl chloride from three monitoring wells (i.e., 2MW-1, 2MW-6, and MW2-8) in June 2016, September 2018, and June 2019. Figure 4-16 presents a site map of OU 2 Area 2 with the vinyl chloride results from this FYR period. As shown in Figure 4-16, vinyl chloride concentrations were consistently below the RG of 0.029 μg/L in well 2MW-1. Vinyl chloride was detected above the RG in well MW2-8: non-detect in June 2016, 0.049 J μg/L in September 2018, and then non-detect in June 2019. In well 2MW-6, vinyl chloride concentrations were above the RG during all three LTM events, ranging from 0.073 to 1.4 μg/L.

Vinyl chloride concentrations have consistently been above the RG of 0.029 μg/L in well 2MW-6. Figure 4-17 presents a time-series plot of vinyl chloride concentrations in well 2MW-6 from November 1995 through June 2019, the entire dataset. As shown in Figure 4-17, concentrations had been demonstrating a decreasing trend with concentrations decreasing from 5 μg/L in September 1996 to as low as 0.073 μg/L in June 2016. In September 2018, concentrations increased to 1.4 μg/L and then decreased to 0.16 M μg/L in June 2019.

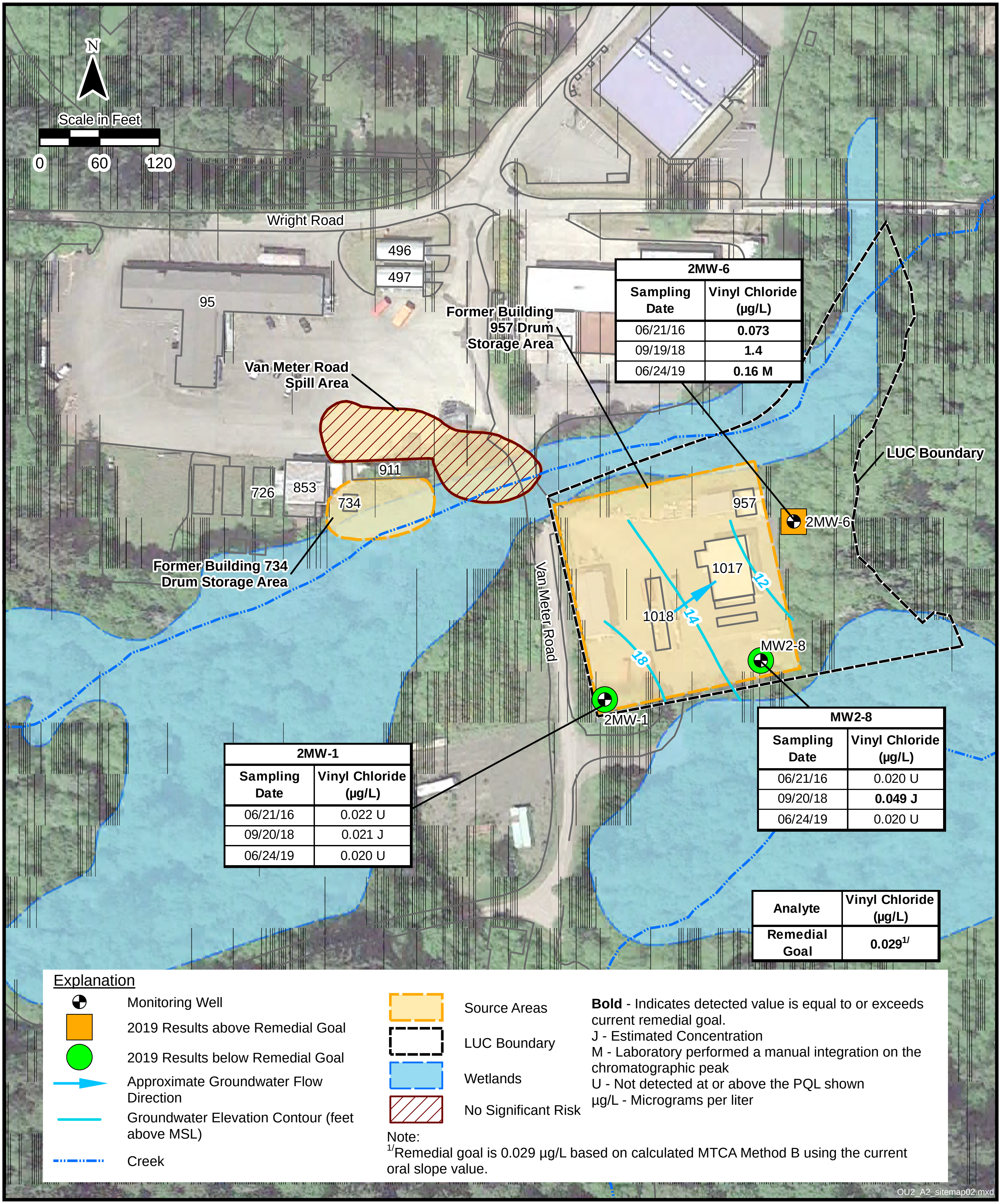
To ensure concentrations were still demonstrating a decreasing trend despite this increased concentration observed in September 2018, a nonparametric statistical analysis, specifically GSI's Mann-Kendall Toolkit, was used to evaluate the dataset as part of this FYR. Appendix F presents the output results from GSI's Mann-Kendall Toolkit. Over the entire dataset (i.e., November 1995 through June 2019), vinyl chloride concentrations are demonstrating a statistically significant decreasing trend in well 2MW-6. To evaluate more recent data, results from the four most recent LTM events were entered into the Toolkit, the minimum number of data points required for the program. Over these four most recent LTM events (i.e., June 2014 through June 2019), vinyl chloride concentrations are demonstrating neither an increasing nor decreasing trend (i.e., no trend) at well 2MW-6 (see Appendix F).

Data Gap Evaluation – Vinyl Chloride. Although vinyl chloride concentrations in well 2MW-6 are demonstrating a statistically significant decreasing trend over the entire dataset, there was an increased concentration observed in September 2018 (at 1.4 μg/L). Because of this observation in well 2MW-6, current LTM results and results from the RI (U.S. Navy, 1993a) were re-evaluated as part of this FYR to determine if there are any data gaps, which if filled, would provide an updated/further understanding of the CSM for OU 2 Area 2.

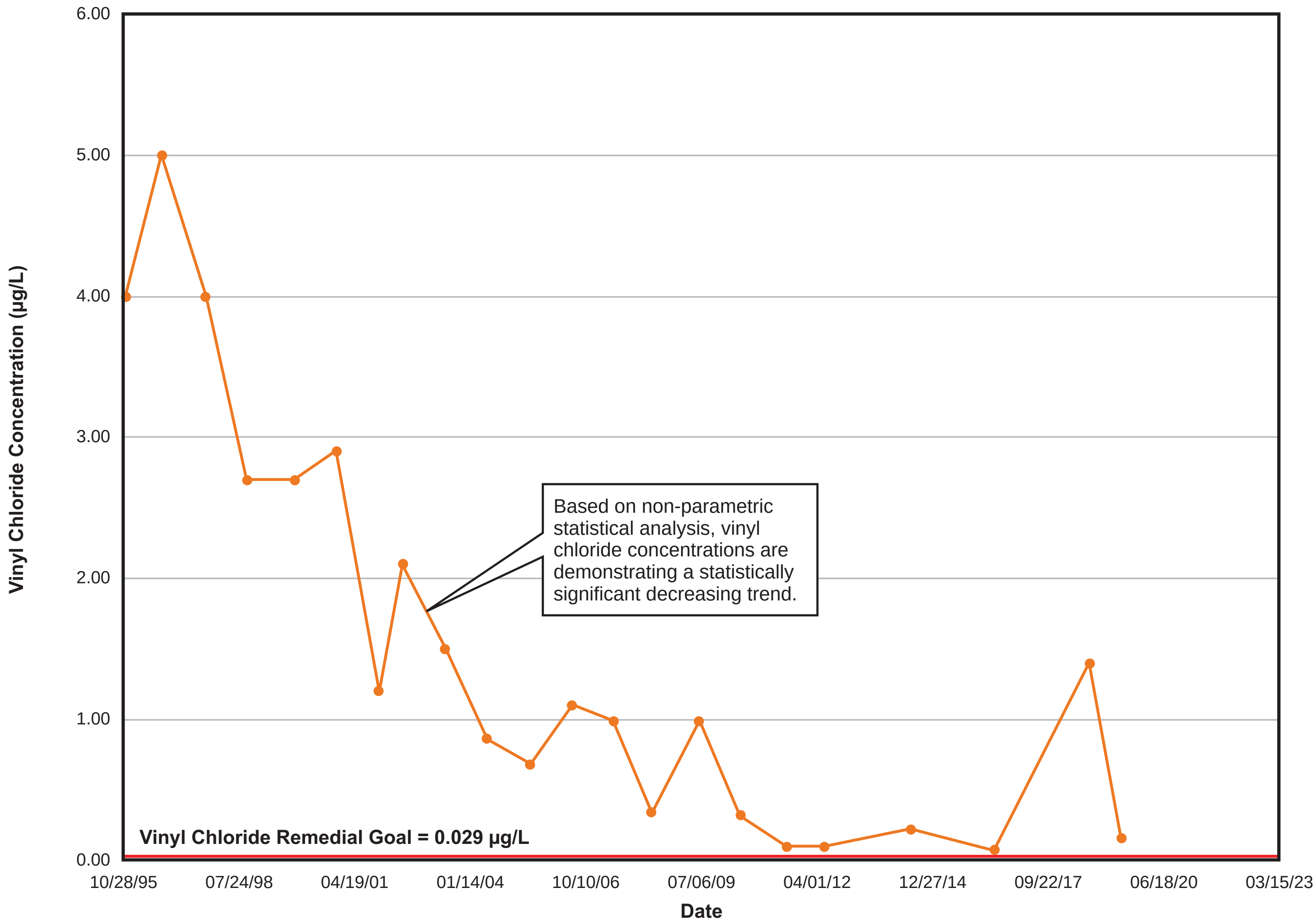
Figure 4-18 presents a geological cross-section through OU 2 Area 2 parallel with the approximate groundwater flow direction. This geological cross-section was developed from the RI and also includes the projected location of well 2MW-6. As depicted in Figure 4-18, cVOCs were detected in shallow wells 2MW-1, 2MW-3, and MW2-10 during the RI and 2MW-6 during current LTM events, while shallow well 2MW-2 and deeper wells MW2-7 and MW2-6 were non-detect during the RI (U.S. Navy, 1993a).

At OU 2 Area 2, the Clover Park Aquitard serves as the confining layer at approximately 30 to 35 ft bgs. There are five geological units above the Clover Park Aquitard (i.e., 2A, 2B, 2F, 2G, and 2H). The shallow aquifer is present in all five geologic units above the Clover Park Aquitard, with a water table at approximately 4 to 8 ft bgs. The more permeable layers are near the top (i.e., 2A, 2B, and 2F) and base (i.e., 2H) of the aquifer and a less permeable unit (i.e., 2G) separates the two more permeable zones (see Figure 4-18). Regardless, it appears that the two more permeable zones at the top and base of the aquifer are hydraulically connected (U.S. Navy, 1993a).

As shown in Figure 4-18, well 2MW-6 is screened within the shallow zone at approximately 6.5 to 16.5 ft bgs and located furthest downgradient with vinyl chloride concentrations consistently detected above the RG of 0.029 μg/L. The consistent detections above the RG in well 2MW-6 (and recent increased concentration) may be an indication that cVOC mass detected in the shallow zone (i.e., wells 2MW-1, 2MW-3, and MW2-10) during the RI may have since migrated to deeper depths and further downgradient than the current monitoring network. As such, these observations in well 2MW-6 may not be providing a full understanding of the nature and extent of the cVOC plume. Given this information, a data gap investigation may be warranted to delineate the lateral and vertical leading edges of the cVOC plume at OU 2 Area 2.

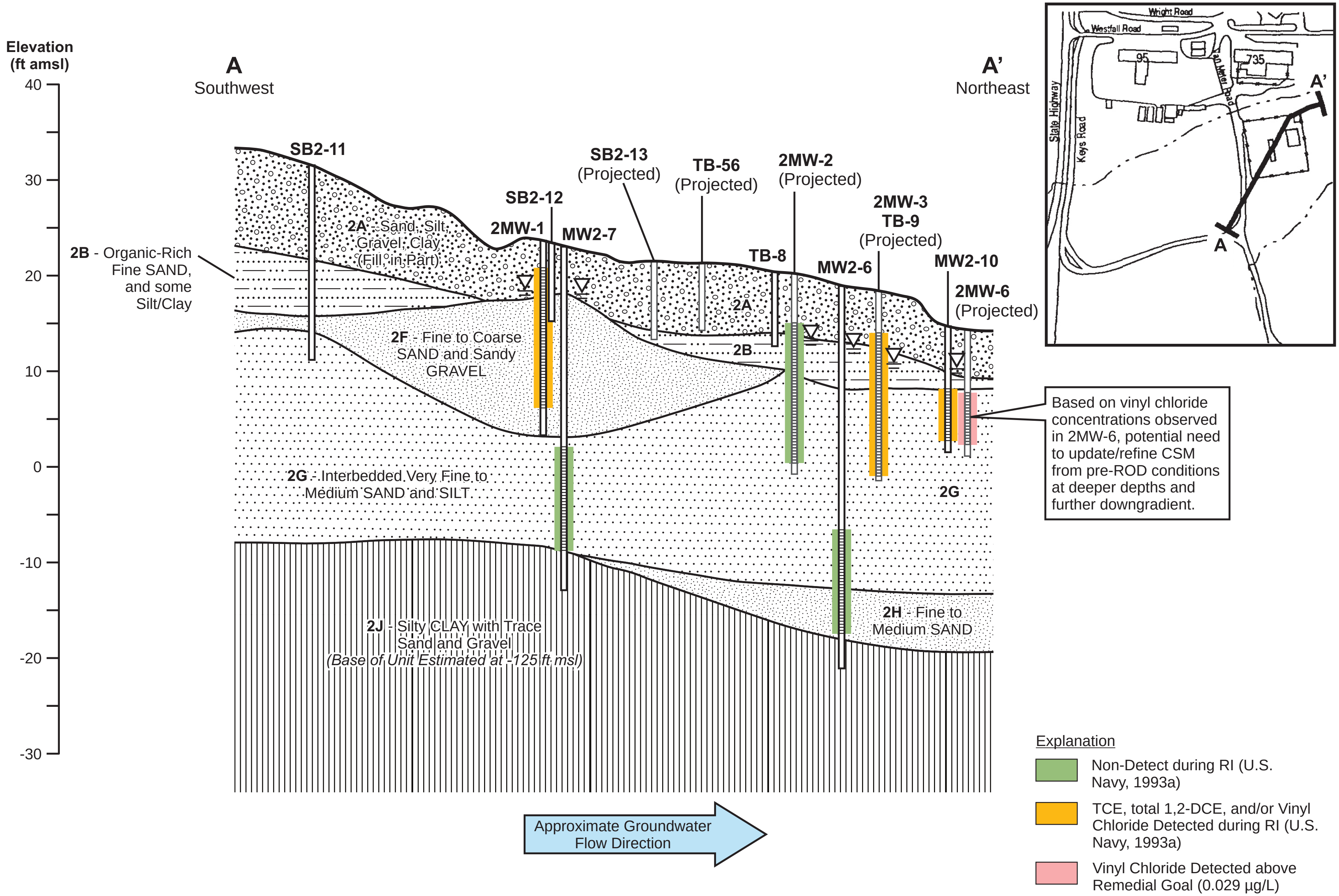


U.S. NAVY	**Figure 4-16** **OU 2 Area 2 Potentiometric Map and Vinyl Chloride Concentrations in Groundwater (2016-2019)**	NBK KEYPORT FIFTH FIVE-YEAR REVIEW



OU2A2_VC_2MW-6.CDR

U.S. NAVY	**Figure 4-17** **OU 2 Area 2 Vinyl Chloride Concentrations in Groundwater at 2MW-6 Over Time**	NBK KEYPORT FIFTH FIVE-YEAR REVIEW



U.S. NAVY

Figure 4-18
OU2 Area 2 Geologic Cross Section with Data Gap Evaluation

NBK KEYPORT
FIFTH
FIVE-YEAR REVIEW

1,4-Dioxane Monitoring Results. During this FYR period, groundwater samples were collected and analyzed for 1,4-dioxane from three monitoring wells (i.e., 2MW-1, 2MW-6, and MW2-8) in June 2017, September 2018, and June 2019. All results were non-detect with the exception of one detection (i.e., at 0.17 J μg/L) in September 2018 in well 2MW-6. Regardless, this detected concentration is well below the MTCA B cleanup level of 0.44 μg/L, indicating that 1,4-dioxane is not present in groundwater at levels that pose an unacceptable risk. Table E-2 in Appendix E presents all 1,4-dioxane groundwater results from OU 2 Area 2, including results from this FYR period and June 2007.

4.2.3 OU 2 Area 8

The following section provides a review of the data generated during this FYR period, including from the 1) LTM program, including groundwater monitoring for PFAS compounds; 2) marine investigation and subsequent HHRA and ERA; 3) 2017 and 2019 VI investigations; and 4) USGS tidal lag study. Figure 1-5 presents a site map of OU 2 Area 8.

Long-Term Monitoring Program. The LTM program for OU 2 Area 8 includes groundwater, seep water, surface water, and sediment sampling, which have been conducted in accordance with the regulator-approved LTM Work Plans (U.S. Navy, 2012h and 2017c) and presented and discussed in LTM Reports. Figure 2-3 depicts the LTM sampling locations at OU 2 Area 8. Tables G-1 through G-8 in Appendix G present recent and historical monitoring data in all media for OU 2 Area 8.

Groundwater. Groundwater was sampled on an annual basis from monitoring wells MW8-8, MW8-9, MW8-11, MW8-12, MW8-14, and MW8-16 from June 2015 through June 2019, and from monitoring well MW8-15 in June 2019. Results of VOCs, 1,4-dioxane, dissolved metals, and PFAS analyses are discussed in the following subsections.

At OU 2 Area 8, groundwater is sampled and analyzed for five target VOCs (i.e., TCE, PCE, 1,1-DCE, cis-1,2-DCE, and 1,1,1-TCA). Figure 4-19 presents the groundwater monitoring results for these five target VOCs during this FYR period and Table 4-3 presents summary statistics for all VOC results during this FYR period to support this discussion. The following subsections discuss data trends for VOCs during this FYR period with respect to their RGs and the RAOs. The OU 2 ROD tabulates both groundwater RGs and surface water RGs. Because groundwater at the site discharges to surface water, monitoring results are compared to the RGs for both media.

Trichloroethene

TCE was detected above the drinking water RG of 5 μg/L at MW8-8, MW8-11, and MW8-12 from 2015 through 2019. TCE was detected above the drinking water RG at MW8-9 in 2015 and at MW8-16 (intermediate screen) from 2015 through 2017, but concentrations have since decreased to below the RG of 5 μg/L. During this FYR period, TCE was either non-detect or detected at concentrations below the RG at MW8-14 (shallow screen) and was non-detect at MW8-15 (deep screen).

Tetrachloroethene

PCE was detected above the drinking water RG of 5 μg/L solely at MW8-8 from 2015 through 2019. During this FYR period, PCE was either non-detect or detected at concentrations below the RG in all

Table 4-3. Summary Statistics for VOC Results at OU 2 Area 8 During this FYR Period

Analyte	RG[a]	**No. of groundwater samples**	**No. of detections**	**No. of exceedances above an RG**	**Minimum detected concentration (μg/L)**	**Maximum detected concentration (μg/L)**	**MWs with at least one exceedance**	**Notes/Comments**
TCE	DW: 5 SW: 81	31	25	19	0.031	63	MW8-8, MW8-9, MW8-11, MW8-12, MW8-16	All exceedances above DW RG, but below SW RG
PCE	DW: 5 SW: 8.9	31	24	5	0.014	8.4	MW8-8	All exceedances above DW RG, but below SW RG (all concentrations < 10 μg/L)
cis-1,2-DCE	DW: 70 SW: NE	31	23	0	0.027	28	--	No exceedances since 2006 (MW8-16)
1,1-DCE	DW: 7 SW: 3.2	31	17	0	0.02	0.5	--	No exceedances since 2006 (MW8-11)
1,1,1-TCA	DW: 200 SW: 42,000	25	17	0	0.074	6.3	--	No exceedances since 1998 (MW8-11)
Chloroform	DW: 7.2 SW: 470	31	21	0	0.009	3.0	--	None

Table 4-3 (continued). Summary Statistics for VOC Results at OU 2 Area 8 During this FYR Period

Analyte	RG[a]	No. of groundwater samples	No. of detections	No. of exceedances above an RG	Minimum detected concentration (µg/L)	Maximum detected concentration (µg/L)	MWs with at least one exceedance	Notes/Comments
CT	DW: 0.34 SW: 4.4	13	5	2	0.029	0.86	MW8-11, MW8-12	Both exceedances in 2018: above DW RG, but below SW RG (both concentrations < 1 µg/L)
1,1-DCA	DW: 800 SW: NE	26	7	0	0.063	0.9	--	None
1,2-DCA	DW: 5 SW: 5.9	13	4	0	0.006	0.02	--	ND in all MWs sampled during 2019 event
trans-1,2-DCE	DW: 100 SW: 33,000	31	19	0	0.11	3.0	--	None
1,1,2-TCA	DW: 5 SW: 81	14	4	0	0.019	0.23	--	ND in all MWs sampled during 2019 event
Toluene	DW: 1,000 SW: 49,000	18	7	0	0.1	1.1	--	Not sampled in 2018 or 2019
Total Xylenes	DW: 10,000 SW: NE	18	3	0	0.11	0.13	--	Not analyzed in 2018 or 2019
1,4-dioxane [b]	DW: NE SW: NE	31	18	12	0.16	16	MW8-8, MW8-11, MW8-12	ND in MW8-9, MW8-14, MW8-16 from 2017 - 2019

[a] RGs are based on the MTCA Method B cleanup levels.
b No RG established for 1,4-dioxane – concentration compared to MTCA Method B cleanup level of 0.44 mg/L.
DW – drinking water
NE – not established
SW – surface water

other monitoring wells (i.e., MW8-9, MW8-11, MW8-12, MW8-14 [shallow screen], MW8-15 [deep screen], and MW8-16 [intermediate screen]).

1,1-Dichloroethene, cis-1,2-Dichloroethene, and 1,1,1-Trichloroethane

During this FYR period, 1,1-DCE, cis-1,2-DCE, and 1,1,1-TCA concentrations have been either non-detect or detected at concentrations below their drinking water RGs of 7, 70, and 200 µg/L, respectively, at all monitoring wells. Of note, analysis of 1,1,1-TCA was not completed in 2018 due to laboratory accreditation issues.

Other Detected VOCs

VOCs other than the five target VOCs listed above have been detected in one or more monitoring wells during this FYR period. These VOCs include chloroform, 1,1-DCA, toluene, trans-1,2-DCE, total xylenes, carbon tetrachloride, 1,2-DCA, and 1,1,2-TCA. With the exception of CT in 2018, none of these VOCs has been detected above their respective drinking water or surface water RGs. In 2018, CT was detected above the drinking water RG of 0.34 µg/L in monitoring wells MW8-11 and MW8-12, but dropped below RGs in 2019.

During this FYR period, all VOCs in groundwater were either non-detect or detected at concentrations below their respective surface water RGs, demonstrating that VOC concentrations in groundwater would not cause future adverse impacts or human health risks via surface water exposures.

1,4-Dioxane

1,4-Dioxane was first sampled in spring 2007, but based on a recommendation in the third FYR, 1,4-dioxane was added to the OU 2 Area 8 LTM program beginning in 2011. The 1,4-dioxane sampling results from 2007 through 2019 are tabulated on Table G-3 in Appendix G. Figure 4-19 presents the groundwater monitoring results for 1,4-dioxane during this FYR period.

There is no RG established for 1,4-dioxane, so concentrations are compared to the MTCA Method B cleanup level (carcinogenic) of 0.44 µg/L for data evaluation. During this FYR period, 1,4-dioxane was detected in three of the seven OU 2 Area 8 wells (i.e., MW8-8, MW8-11, and MW8-12 – the same wells in which TCE was detected) at concentrations above the MTCA Method B cleanup level. In the past three years of sampling (2017 through 2019), 1,4-dioxane was non-detect in wells MW8-9, MW8-14, MW8-15 (2019), and MW8-16.

At OU 2 Area 8, groundwater is also sampled and analyzed for 10 dissolved metals (i.e., cadmium, total chromium, arsenic, copper, lead, mercury, nickel, silver, thallium, and zinc). During the baseline risk assessment, cadmium and chromium were identified as groundwater COCs for the hypothetical future residential scenario (based on residential use of groundwater as drinking water and inhalation during household use). As such, Figure 4-20 presents the groundwater monitoring results for cadmium and chromium during this FYR period. Table 4-4 presents summary statistics for all metals results during this FYR period to support this discussion. The following subsections discuss data trends for dissolved metals during this FYR period with respect to their RGs and the RAOs.

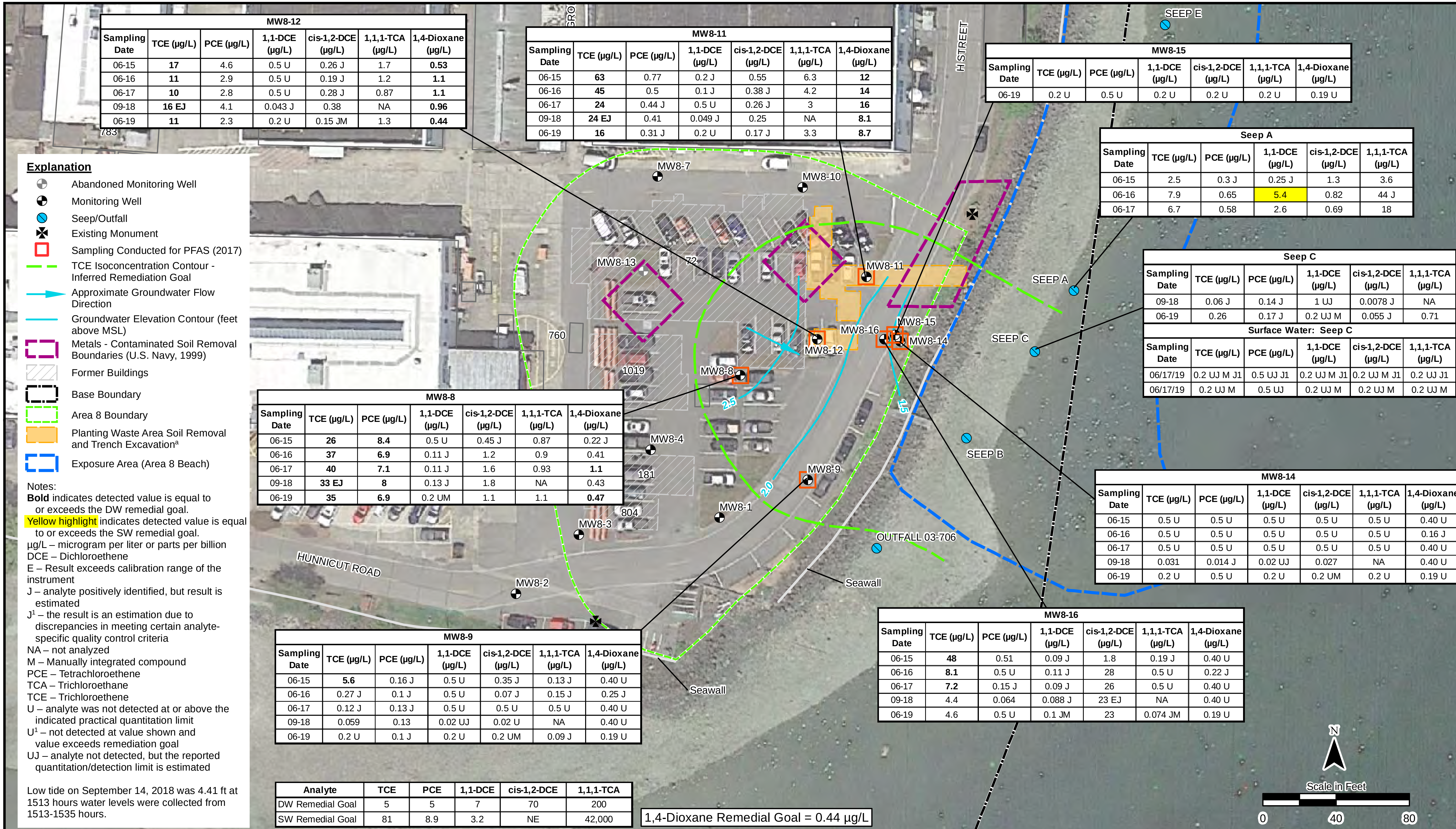
Dissolved Cadmium

For cadmium, the drinking water RG is 5 µg/L and the surface water RG is 8 µg/L. During this FYR period, dissolved cadmium was detected at concentrations exceeding both RGs in wells MW8-11 (2015

Table 4-4. Summary Statistics for Metals Results at OU 2 Area 8 during this FYR Period

Analyte	RG[a]	No. of groundwater samples collected from MWs	No. of detections in MWs	No. of exceedances above an RG	Minimum detected concentration (µg/L)	Maximum detected concentration (µg/L)	MWs with at least one exceedance	Notes/Comments
arsenic	DW: 0.05 SW: 0.14	31	31	31	0.23	2.6	MW8-8, MW8-9, MW8-11, MW8-12, MW8-14, MW8-15, MW8-16	All exceedances below site background value of 12 µg/L
cadmium	DW: 5 SW: 8	31	27	10	0.006	161	MW8-11, MW8-14	None
total chromium	DW: 50 SW: NE	31	30	15	0.28	182	MW8-8, MW8-11, MW8-12	None
copper	DW: 590 SW: 2.5	31	27	5	0.06	5.75	MW8-11	All exceedances above SW RG, but below DW RG
lead	DW: 15 SW: 5.8	31	18	2	0.008	12	MW8-9, MW8-11	Both exceedances in 2016: above SW RG but below DW RG
mercury [b]	DW: 2 SW: 0.025	12	12	0	0.00034	0.0114	--	Not analyzed since 2016
nickel	DW: 100 SW: 7.9	31	31	4	0.26	19.1	MW8-11	All exceedances above SW RG, but below DW RG
silver	DW: 48 SW: 1.2	31	25	5	0.008	4.21	MW8-11	All exceedances above SW RG, but below DW RG
thallium [b]	DW: 1,1 SW: 1.6	12	5	0	0.007	0.029	--	Not analyzed since 2016
zinc	DW: 4,800 SW: 77	31	29	1	0.22	85	MW8-11	Only exceedance in 2016 - above SW RG, but below DW RG

a RGs are MTCA Method B cleanup levels
b analyzed in 2015 and 2016 only
Concentrations of metals is dissolved metals
Hexavalent chromium was not analyzed during FYR period
DW – drinking water; SW – surface water



MW8-12

Sampling Date	TCE (µg/L)	PCE (µg/L)	1,1-DCE (µg/L)	cis-1,2-DCE (µg/L)	1,1,1-TCA (µg/L)	1,4-Dioxane (µg/L)
06-15	**17**	4.6	0.5 U	0.26 J	1.7	**0.53**
06-16	**11**	2.9	0.5 U	0.19 J	1.2	**1.1**
06-17	**10**	2.8	0.5 U	0.28 J	0.87	**1.1**
09-18	**16 EJ**	4.1	0.043 J	0.38	NA	**0.96**
06-19	**11**	2.3	0.2 U	0.15 JM	1.3	**0.44**

MW8-11

Sampling Date	TCE (µg/L)	PCE (µg/L)	1,1-DCE (µg/L)	cis-1,2-DCE (µg/L)	1,1,1-TCA (µg/L)	1,4-Dioxane (µg/L)
06-15	**63**	0.77	0.2 J	0.55	6.3	**12**
06-16	**45**	0.5	0.1 J	0.38 J	4.2	**14**
06-17	**24**	0.44 J	0.5 U	0.26 J	3	**16**
09-18	**24 EJ**	0.41	0.049 J	0.25	NA	**8.1**
06-19	**16**	0.31 J	0.2 U	0.17 J	3.3	**8.7**

MW8-15

Sampling Date	TCE (µg/L)	PCE (µg/L)	1,1-DCE (µg/L)	cis-1,2-DCE (µg/L)	1,1,1-TCA (µg/L)	1,4-Dioxane (µg/L)
06-19	0.2 U	0.5 U	0.2 U	0.2 U	0.2 U	0.19 U

Seep A

Sampling Date	TCE (µg/L)	PCE (µg/L)	1,1-DCE (µg/L)	cis-1,2-DCE (µg/L)	1,1,1-TCA (µg/L)
06-15	2.5	0.3 J	0.25 J	1.3	3.6
06-16	7.9	0.65	5.4	0.82	44 J
06-17	6.7	0.58	2.6	0.69	18

Seep C

Sampling Date	TCE (µg/L)	PCE (µg/L)	1,1-DCE (µg/L)	cis-1,2-DCE (µg/L)	1,1,1-TCA (µg/L)
09-18	0.06 J	0.14 J	1 UJ	0.0078 J	NA
06-19	0.26	0.17 J	0.2 UJ M	0.055 J	0.71

Surface Water: Seep C

Sampling Date	TCE (µg/L)	PCE (µg/L)	1,1-DCE (µg/L)	cis-1,2-DCE (µg/L)	1,1,1-TCA (µg/L)
06/17/19	0.2 UJ M J1	0.5 UJ J1	0.2 UJ M J1	0.2 UJ M J1	0.2 UJ J1
06/17/19	0.2 UJ M	0.5 UJ	0.2 UJ M	0.2 UJ M	0.2 UJ M

MW8-8

Sampling Date	TCE (µg/L)	PCE (µg/L)	1,1-DCE (µg/L)	cis-1,2-DCE (µg/L)	1,1,1-TCA (µg/L)	1,4-Dioxane (µg/L)
06-15	**26**	**8.4**	0.5 U	0.45 J	0.87	0.22 J
06-16	**37**	**6.9**	0.11 J	1.2	0.9	0.41
06-17	**40**	**7.1**	0.11 J	1.6	0.93	**1.1**
09-18	**33 EJ**	**8**	0.13 J	1.8	NA	0.43
06-19	**35**	**6.9**	0.2 UM	1.1	1.1	**0.47**

MW8-14

Sampling Date	TCE (µg/L)	PCE (µg/L)	1,1-DCE (µg/L)	cis-1,2-DCE (µg/L)	1,1,1-TCA (µg/L)	1,4-Dioxane (µg/L)
06-15	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.40 U
06-16	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.16 J
06-17	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.40 U
09-18	0.031	0.014 J	0.02 UJ	0.027	NA	0.40 U
06-19	0.2 U	0.5 U	0.2 U	0.2 UM	0.2 U	0.19 U

MW8-16

Sampling Date	TCE (µg/L)	PCE (µg/L)	1,1-DCE (µg/L)	cis-1,2-DCE (µg/L)	1,1,1-TCA (µg/L)	1,4-Dioxane (µg/L)
06-15	**48**	0.51	0.09 J	1.8	0.19 J	0.40 U
06-16	**8.1**	0.5 U	0.11 J	28	0.5 U	0.22 J
06-17	**7.2**	0.15 J	0.09 J	26	0.5 U	0.40 U
09-18	4.4	0.064	0.088 J	23 EJ	NA	0.40 U
06-19	4.6	0.5 U	0.1 JM	23	0.074 JM	0.19 U

MW8-9

Sampling Date	TCE (µg/L)	PCE (µg/L)	1,1-DCE (µg/L)	cis-1,2-DCE (µg/L)	1,1,1-TCA (µg/L)	1,4-Dioxane (µg/L)
06-15	**5.6**	0.16 J	0.5 U	0.35 J	0.13 J	0.40 U
06-16	0.27 J	0.1 J	0.5 U	0.07 J	0.15 J	0.25 J
06-17	0.12 J	0.13 J	0.5 U	0.5 U	0.5 U	0.40 U
09-18	0.059	0.13	0.02 UJ	0.02 U	NA	0.40 U
06-19	0.2 U	0.1 J	0.2 U	0.2 UM	0.09 J	0.19 U

Analyte	TCE	PCE	1,1-DCE	cis-1,2-DCE	1,1,1-TCA
DW Remedial Goal	5	5	7	70	200
SW Remedial Goal	81	8.9	3.2	NE	42,000

1,4-Dioxane Remedial Goal = 0.44 µg/L

Explanation

- Abandoned Monitoring Well
- Monitoring Well
- Seep/Outfall
- Existing Monument
- Sampling Conducted for PFAS (2017)
- TCE Isoconcentration Contour - Inferred Remediation Goal
- Approximate Groundwater Flow Direction
- Groundwater Elevation Contour (feet above MSL)
- Metals - Contaminated Soil Removal Boundaries (U.S. Navy, 1999)
- Former Buildings
- Base Boundary
- Area 8 Boundary
- Planting Waste Area Soil Removal and Trench Excavation[a]
- Exposure Area (Area 8 Beach)

Notes:
Bold indicates detected value is equal to or exceeds the DW remedial goal.
Yellow highlight indicates detected value is equal to or exceeds the SW remedial goal.
µg/L – microgram per liter or parts per billion
DCE – Dichloroethene
E – Result exceeds calibration range of the instrument
J – analyte positively identified, but result is estimated
J[1] – the result is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria
NA – not analyzed
M – Manually integrated compound
PCE – Tetrachloroethene
TCA – Trichloroethane
TCE – Trichloroethene
U – analyte was not detected at or above the indicated practical quantitation limit
U[1] – not detected at value shown and value exceeds remediation goal
UJ – analyte not detected, but the reported quantitation/detection limit is estimated

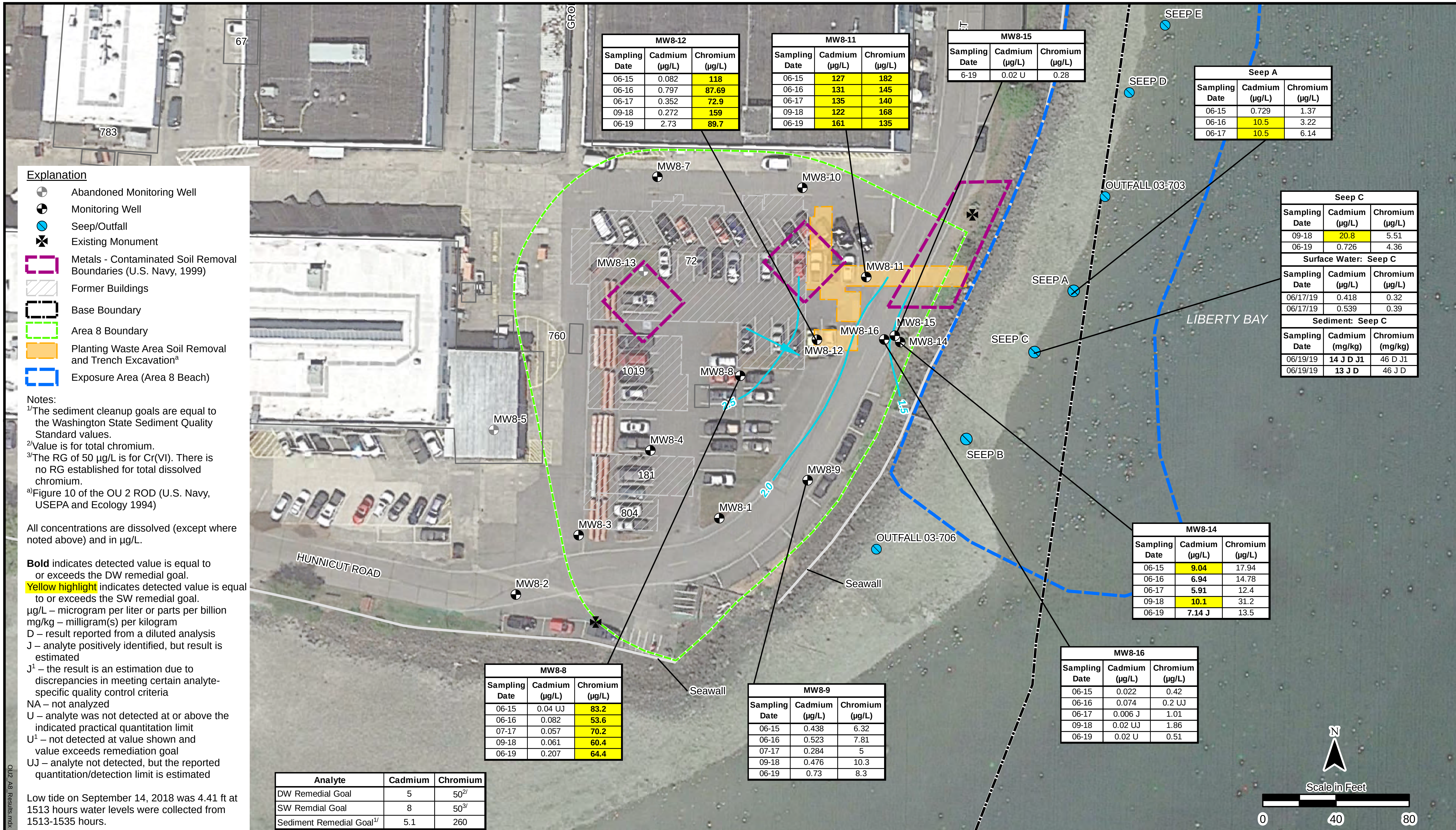
Low tide on September 14, 2018 was 4.41 ft at 1513 hours water levels were collected from 1513-1535 hours.

Figure 04-19_OU2_A8_DioxResults_v2.mdx

U.S. NAVY

Figure 4-19
OU 2 Area 8 VOC and 1,4-Dioxane LTM Sampling Results (2015-2019)

NBK KEYPORT
FIFTH
FIVE-YEAR REVIEW



Explanation

- Abandoned Monitoring Well
- Monitoring Well
- Seep/Outfall
- Existing Monument
- Metals - Contaminated Soil Removal Boundaries (U.S. Navy, 1999)
- Former Buildings
- Base Boundary
- Area 8 Boundary
- Planting Waste Area Soil Removal and Trench Excavation[a]
- Exposure Area (Area 8 Beach)

Notes:
[1/] The sediment cleanup goals are equal to the Washington State Sediment Quality Standard values.
[2/] Value is for total chromium.
[3/] The RG of 50 µg/L is for Cr(VI). There is no RG established for total dissolved chromium.
[a)] Figure 10 of the OU 2 ROD (U.S. Navy, USEPA and Ecology 1994)

All concentrations are dissolved (except where noted above) and in µg/L.

Bold indicates detected value is equal to or exceeds the DW remedial goal.
Yellow highlight indicates detected value is equal to or exceeds the SW remedial goal.
µg/L – microgram per liter or parts per billion
mg/kg – milligram(s) per kilogram
D – result reported from a diluted analysis
J – analyte positively identified, but result is estimated
J[1] – the result is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria
NA – not analyzed
U – analyte was not detected at or above the indicated practical quantitation limit
U[1] – not detected at value shown and value exceeds remediation goal
UJ – analyte not detected, but the reported quantitation/detection limit is estimated

Low tide on September 14, 2018 was 4.41 ft at 1513 hours water levels were collected from 1513-1535 hours.

MW8-12

Sampling Date	Cadmium (µg/L)	Chromium (µg/L)
06-15	0.082	**118**
06-16	0.797	**87.69**
06-17	0.352	**72.9**
09-18	0.272	**159**
06-19	2.73	**89.7**

MW8-11

Sampling Date	Cadmium (µg/L)	Chromium (µg/L)
06-15	**127**	**182**
06-16	**131**	**145**
06-17	**135**	**140**
09-18	**122**	**168**
06-19	**161**	**135**

MW8-15

Sampling Date	Cadmium (µg/L)	Chromium (µg/L)
6-19	0.02 U	0.28

Seep A

Sampling Date	Cadmium (µg/L)	Chromium (µg/L)
06-15	0.729	1.37
06-16	10.5	3.22
06-17	10.5	6.14

Seep C

Sampling Date	Cadmium (µg/L)	Chromium (µg/L)
09-18	20.8	5.51
06-19	0.726	4.36
Surface Water: Seep C		
Sampling Date	**Cadmium (µg/L)**	**Chromium (µg/L)**
06/17/19	0.418	0.32
06/17/19	0.539	0.39
Sediment: Seep C		
Sampling Date	**Cadmium (mg/kg)**	**Chromium (mg/kg)**
06/19/19	**14 J D J1**	46 D J1
06/19/19	**13 J D**	46 J D

MW8-14

Sampling Date	Cadmium (µg/L)	Chromium (µg/L)
06-15	**9.04**	17.94
06-16	**6.94**	14.78
06-17	**5.91**	12.4
09-18	**10.1**	31.2
06-19	**7.14 J**	13.5

MW8-16

Sampling Date	Cadmium (µg/L)	Chromium (µg/L)
06-15	0.022	0.42
06-16	0.074	0.2 UJ
06-17	0.006 J	1.01
09-18	0.02 UJ	1.86
06-19	0.02 U	0.51

MW8-8

Sampling Date	Cadmium (µg/L)	Chromium (µg/L)
06-15	0.04 UJ	**83.2**
06-16	0.082	**53.6**
07-17	0.057	**70.2**
09-18	0.061	**60.4**
06-19	0.207	**64.4**

MW8-9

Sampling Date	Cadmium (µg/L)	Chromium (µg/L)
06-15	0.438	6.32
06-16	0.523	7.81
07-17	0.284	5
09-18	0.476	10.3
06-19	0.73	8.3

Analyte	Cadmium	Chromium
DW Remedial Goal	5	50[2/]
SW Remdial Goal	8	50[3/]
Sediment Remedial Goal[1/]	5.1	260

U.S. NAVY

Figure 4-20
OU 2 Area 8 Metals LTM Sampling Results (2015-2019)

NBK KEYPORT
FIFTH
FIVE-YEAR REVIEW

through 2019) and MW8-14 (2015 and 2018), located within the plating waste area soil removal and trench excavation area and downgradient, respectively. Dissolved cadmium was either non-detect or detected at concentrations below both RGs in all other monitoring wells (i.e., MW8-8, MW8-9, MW8-12, MW8-15 and MW8-16).

Dissolved Chromium

For total chromium, both the drinking water and surface water RG is 50 µg/L. During this FYR period, dissolved chromium was consistently detected at concentrations above both RGs in wells MW8-8, MW8-11, and MW8-12, a similar lateral extent as TCE contamination. Dissolved chromium was either non-detect or detected at concentrations below both RGs in all other monitoring wells (i.e., MW8-9, MW8-14, MW8-15, and MW8-16).

Dissolved Arsenic

For arsenic, the drinking water RG is 0.05 µg/L and the surface water RG is 0.14 µg/L. Dissolved arsenic exceeded both the drinking water and surface water RG in all seven monitoring wells during each sampling event from 2015 through 2019 (i.e., MW8-15 sampled in 2019 only). However, the concentrations detected were well below the background value of 12 µg/L for arsenic in groundwater at OU 2 Area 8, as determined during the RI (U.S. Navy, 1993a and 1993b).

Dissolved Copper, Lead, Mercury, Nickel, Silver, Thallium, and Zinc

During this FYR period, dissolved copper, lead, mercury, nickel, silver, thallium, and zinc have more often than not been non-detect or detected at concentrations below their respective drinking water and surface water RGs. The following summary details exceptions to this finding during this FYR period:

Dissolved Metal	Drinking Water RG (µg/L)	Surface Water RG (µg/L)	Exceptions during FYR Period
Copper	590	2.5	Detected above the surface water RG in MW8-11 from 2015 through 2019.
Lead	15	5.8	Detected above the surface water RG in MW8-9 and MW8-11 in 2016.
Mercury	2	0.025	No longer analyzed for after 2016, detected below drinking water protection and surface water RGs.
Nickel	100	7.9	Detected above the surface water RG in MW8-11 in 2015, 2016, 2017, and 2019.
Silver	48	1.2	Detected above the surface water RG in MW8-11 from 2015 through 2019.
Thallium	1.1	1.6	No longer analyzed for after 2016, detected below drinking water and surface water RGs.
Zinc	4,800	77	Detected above the surface water RG in MW8-11 in 2016.

During this FYR period and previous FYR periods, dissolved metals concentrations in groundwater more often than not exceed their respective surface water RGs rather than their drinking water RGs, as detailed above. These findings indicate that dissolved metals concentrations in groundwater, particularly cadmium and chromium, require further investigation to assess risk from surface water exposures. Therefore, in accordance with the OU 2 ROD, an HHRA and ERA for OU 2 Area 8 was completed during this FYR period and are discussed below. The HHRA concluded that no unacceptable risk to human health or higher trophic level ecological receptors is present in the intertidal zone, but that an unacceptable risk to benthic invertebrates is present in the intertidal zone of the Area 8 beach, based on bioaccumulation of metals concentrations.

PFAS

At OU 2 Area 8, groundwater samples were collected and analyzed for PFAS compounds in 2018 and 2019 (see Figure 4-17) (U.S. Navy, 2019c, 2020). There is no promulgated cleanup level for PFAS compounds; however, EPA's health advisory level is 70 ng/L for perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS) concentrations, separately or combined. In 2018, combined concentrations of PFOA and PFOS in groundwater were detected above 70 ng/L at MW8-11 (i.e., 74 ng/L) and MW8-12 (i.e., 77 M ng/L). In 2019, separate and combined concentrations of PFOA and PFOS in groundwater were not detected above 70 ng/L in any monitoring wells. In addition to PFOS and PFOA, perfluorobutanesulfonic acid (PFBS) has an EPA Regional Screening Level (RSL) of 400,000 ng/L. PFBS was detected in five of the seven groundwater samples at concentrations between 0.77 and 4.7 ng/L, which are well below the EPA RSL. PFAS results are further discussed and evaluated in Section 5.0 with regards to human health risk assessment assumptions. Groundwater monitoring data for PFAS are provided on Table G-5 in Appendix G.

Seep Discharge. At OU 2 Area 8, seep water samples have been historically collected from Seep A, Seep B, and Seep C, located along the shore of Port Orchard Bay (see Figure 2-3). This sampling has been conducted to determine if OU 2 Area 8 groundwater is adversely impacting the adjacent marine environment, as required by the ROD. As a result of consistently low and stable VOC and dissolved metals concentrations, sampling at Seep B was discontinued in 2012, as recommended in the third FYR. Starting in September 2018, Seep C was sampled instead of Seep A under the LTM program. Seep C has historically shown higher VOC concentrations than Seep A. Therefore, the U.S. Navy determined that Seep C was more representative of worst-case conditions related to seepage of groundwater to surface water at OU 2 Area 8.

During the 2015 to 2017 sampling efforts conducted at Seep A, 1,1-DCE (in 2016) was the only target VOC detected above the surface water RG of 3.2 μg/L (at 5.4 μg/L). This exceedance is most likely an indication of biodegradation along the flow path from monitoring well MW8-11 (which demonstrates the greatest TCE concentrations in groundwater) to Seep A (with 1,1-DCE, a daughter product of TCE). Several VOCs (including cis-1,2-DCE, PCE, 1,1,1-TCA, TCE, chloroform, trans-1,2-DCE, and 1,1-DCA) were detected, but at concentrations below their respective surface water RGs (or drinking water RG if a surface water RG has not been established). Arsenic was detected above the surface water RG of 0.14 μg/L in 2015, 2016, and 2017, and cadmium was detected above the surface water RG of 8 μg/L in 2016 and 2017. Concentrations of all other dissolved metals at Seep A from 2015 through 2017 were either non-detect or detected at concentrations below their respective surface water RGs (see Figures 4-19 and 4-20; see Appendix G).

During the 2018 and 2019 sampling conducted at Seep C, no VOCs were detected at concentrations exceeding their respective surface water RGs. Concentrations of cis-1,2-DCE, PCE, 1,1,1-TCA (2019 only), and TCE were detected in 2018 and 2019 at concentrations below the surface water RGs at Seep C. Arsenic was detected above the surface water RG of 0.14 μg/L in both years, and cadmium was detected above the surface water RG of 8 μg/L in 2018. Concentrations of all other dissolved metals at Seep C in 2018 and 2019 were either non-detect or detected at concentrations below their respective surface water RGs (see Figures 4-19 and 4-20; see Appendix G).

Similar to groundwater detections, the concentrations of arsenic detected at Seep A (2015 through 2017) and Seep C (2018 and 2019) were less than the OU 2 Area 8 background concentration for arsenic in groundwater of 12 µg/L established during the RI (U.S. Navy, 1993b).

Surface Water. In 2019, a surface water sample (and duplicate) was collected from the Seep C location and analyzed for VOCs and dissolved metals. None of the target VOCs were detected above laboratory reporting limits in this sample. Arsenic was detected above the surface water RG, but significantly below the OU 2 Area 8 background concentration of 12 µg/L. Concentrations of all other metals at Seep C surface water were either non-detect or detected at concentrations below their respective surface water RGs. The surface water VOC and dissolved metals results are presented in Figures 4-19 and 4-20 and summarized on Tables G-6 and G-7 in Appendix G, respectively.

Sediment. In 2019, a sediment sample (and duplicate) was collected from the Seep C location and analyzed for metals. The data were compared to the sediment cleanup goals, which were set to equal the Washington State SQS. An estimated concentration of cadmium was detected above the sediment cleanup goal of 5.1 mg/kg. All other metals at the Seep C location were detected at concentrations below the sediment cleanup goal. The Seep C sediment metals results are presented in Figure 4-20 and summarized on Table G-8 in Appendix G.

The historical and current cadmium exceedances in groundwater (MW8-11, MW8-14), seep water (Seep A, Seep C), and sediment (Seep C) appear in the same general vicinity. The 2019 surface water sampling results indicate low cadmium concentrations in surface water at the Seep C location. Despite historical chromium exceedances in groundwater (MW8-8, MW8-11, and MW8-12), chromium concentrations have remained below RGs in seep water, surface water, and sediment at the Seep C location.

Marine Investigation. A marine investigation report was completed in 2016 (U.S. Navy, 2016d), which describes and presents the results of the tissue, sediment, seep water, outfall, and surface water sampling conducted in 2015 and 2016 at OU 2 Area 8. The report documents the results of the sampling of clam tissue and sediment (at ROD-established sampling locations [Stations SS01 to SS09]) and one-time sampling of clam tissue, sediment, seep water, marine water, and outfalls from new locations across the Area 8 beach. The purpose of the investigation was to collect additional data to support a determination of the nature and extent of metals contamination and to support future HHRA/ERAs. In addition, because of some uncertainty associated with the northern extent of impacted seeps and sediments, additional data collection efforts were conducted to fully characterize the extent of contamination (U.S. Navy, 2016d).

The following sampling activities were conducted, as identified in the QAPP:

- <u>Reference Area Tissue and Surface Water Collection</u> – Twenty-two (22) tissue sampling stations and eight (8) marine water stations were sampled on June 2 and 3, 2015, at the reference area, Penrose Point State Park on Carr Inlet. The surface water was submitted for laboratory analysis of metals, and the clams were weighed, measured, and submitted for laboratory analysis of metals and percent moisture content.
- <u>OU 2 Area 8 Tissue Collection</u> – Clam tissue samples were collected at 41 sampling stations on the beach adjacent to OU 2 Area 8 (Area 8 beach) during June 2015 and June 2016. The clams were weighed, measured, and submitted for laboratory analysis of metals and percent moisture content.

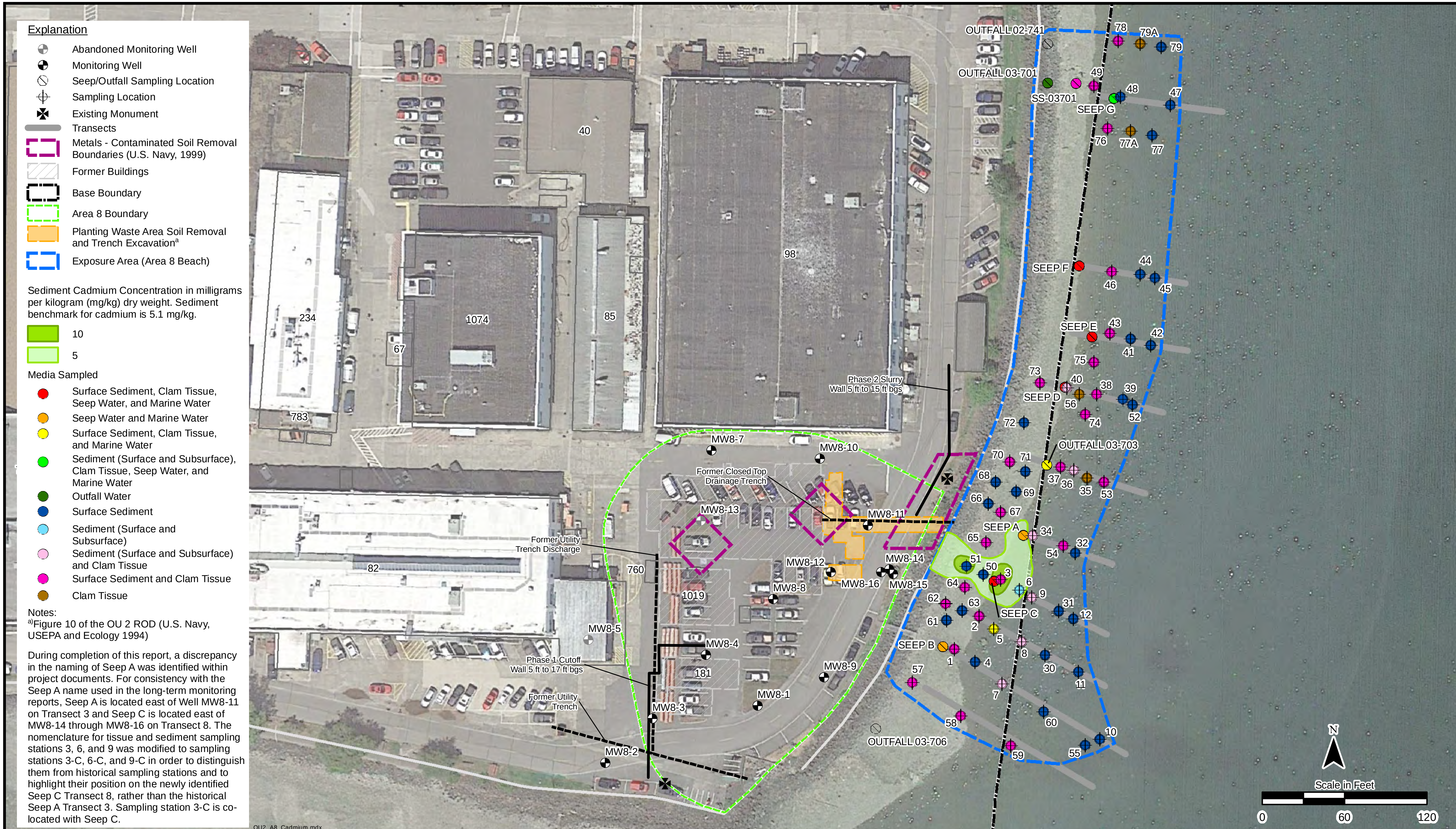
- OU 2 Area 8 Sediment Collection – Sediment samples were collected from 66 Area 8 beach sampling stations in June 2015 and June 2016. Sediment samples were collected from the biologically active zone of 0 to 10 centimeters (cm) at all 66 stations, and from a depth of 10 to 24 cm at 10 of the 66 stations. The physical characteristics of the sediment samples were recorded, and the June 2015 samples were submitted for laboratory analysis of metals, acid volatile sulfide/simultaneously extracted metals [AVS/SEM], TOC, total solids, and grain size. The June 2016 samples were only analyzed for metals, and a subset of samples were analyzed for AVS/SEM (i.e., the 2016 samples were not analyzed for TOC, total solids, or grain size).
- OU 2 Area 8 Surface Water Collection – Marine surface water samples were collected near the surface water/sediment interface at nine (9) Area 8 beach sampling locations in June 2015. The marine surface water samples, collected as tide was rising and seeps were inundated with water, were submitted for laboratory analysis of dissolved metals.

Figure 4-21 presents the tissue, sediment, seep water, outfall, and surface water sampling locations from the marine investigation. A drain in Building 98 under a hydraulic pressure tank used to test torpedo systems in potable water was the source of intermittent flow from outfall 03-701. Therefore, one sample of potable water and two samples of process water were collected from this location and submitted for laboratory analysis of dissolved metals. All analytical results from the marine investigation are tabulated in Appendix H including: Tables H-1 and H-2 (tissues), Tables H-3 through H-5 (sediment), Table H-6 (seeps and outfalls), Table H-7 through H-9 (marine water), and Table H-10 (B98 water). Based on these results, it was determined that the potable water at Keyport exceeds ecological surface water criteria for copper. The predominance of the test water used is recycled; however, any water remaining in the bottom of the tank is discharged to the outfall and was determined to be the source of copper concentrations in the sample from outfall 03-701. Therefore, although potable water discharge is permitted under the NBK Keyport stormwater permit, the discharge line from Building 98 hydraulic tank was rerouted to the sanitary sewer to stop the continual discharge to the beach north of the Area 8 beach.

The marine investigation report included sampling methodology and data reporting only, without any data interpretation, as the project team decided that data interpretation should be informed by the results of the associated risk assessments. Therefore, the data interpretation was included in the HHRA/ERA.

Human Health and Ecological Risk Assessments. Subsequently, the HHRA/ERA (U.S. Navy, 2018a) was conducted to estimate human health and ecological risks associated with exposure to potentially contaminated media at the Area 8 beach (i.e., clam tissue, sediment, seep water, and marine water), per the recommendations of the third and fourth FYRs. The specific objectives were to: 1) characterize human health and ecological site risks relative to background; 2) confirm the extent of contamination; 3) update the CSM; and 4) assess the need to implement contingent groundwater control actions based on the results of the risk assessments.

Human Health Risk Assessments
For the HHRA, data collected during the marine investigation in 2015 and 2016 were compared to background and reference area data. Additionally, the HHRA evaluated the potential human health risks associated with subsistence-level and recreational-level exposures to COCs in clam tissue and sediment.



U.S. NAVY

Figure 4-21
Area 8 Beach Cadmium Sediment and Seep Concentrations Greater than Ecological Benchmarks

NBK KEYPORT
FIFTH
FIVE-YEAR REVIEW

Background and Reference Area Evaluation - Results
The results of the single-point comparison of the site and reference area concentrations are summarized below:

- Arsenic concentrations were consistent with background and reference area concentrations.
- Cadmium concentrations exceeded reference area data in sediment near Seep A, Seep C, Seep D, and Outfall 03-703.
- Cadmium concentrations exceeded the background threshold value (BTV) in clam tissue near Seep A, Seep C, and Outfall 03-703. However, the cadmium concentrations in clam tissue are generally consistent with reference area concentrations, as the magnitude of exceedance over BTV is low.
- Several sporadic exceedances of the chromium, copper, lead, nickel, zinc, and mercury BTVs in sediment and clam tissue were noted, indicating that seeps and outfalls may be contributing these metal concentrations to Port Orchard Bay.
- For silver, nearly 50% of the sediment samples and nearly all of the clam tissue samples exceed their relative BTVs. These results indicate that the seeps may be contributing to silver concentrations in sediment and clam tissue above reference area concentrations, but do not demonstrate a pattern with respect to specific potential point sources to Port Orchard Bay.

The population to population (site versus background) comparison concluded that concentrations of cadmium and silver in sediment are statistically higher than the background concentrations, and that concentrations of lead, nickel, silver, and methylmercury in clam tissue are statistically higher than those measured in the reference clam tissue samples.

Suquamish Subsistence Receptors - Results
For Suquamish subsistence receptors at the Area 8 beach, the non-cancer hazard index (HI) from ingestion of clam tissue is 4 and 5 for child and combined child/adult receptors, respectively, and the cancer risk is 3×10^{-4}. At the reference area, the non-cancer HIs and cancer risks are the same as those for the Area 8 beach when rounded to one significant figure. These results indicate that exposure to COCs in clams collected from the Area 8 beach is not substantially different than the exposure to reference area clams, and the incremental site non-cancer HIs are 0.6 and 0.7 for child and combined child/adult receptors, respectively. For exposure to sediment at the Area 8 beach, non-cancer HIs are less than the target health goal of 1 for both the child and combined child/adult receptors and the cancer risk is 6×10^{-6}, slightly above EPA's de minimis cancer risk level of 1×10^{-6}. As stated in the risk assessment report (U.S. Navy, 2018a), non-cancer HIs and cancer risks calculated based on the natural background sediment concentrations actually resulted in slightly higher hazard and risk estimates than those estimated for Area 8 beach sediments. Thus, there is no unacceptable incremental non-cancer hazard or cancer risk to human health from sediment. The contribution of sediment exposures to the cumulative hazard and risk estimates based on combined exposure to clam tissue and sediment is insignificant.

These results indicate that while the hazard and risk estimates calculated for the Area 8 beach slightly exceed target health goals, non-site related sources from background or other ubiquitous sources contribute significantly to the concentrations of COCs measured at the site. Because the incremental non-cancer hazard and cancer risk estimates are below target health goals, there is no unacceptable site-related risks to human health for Suquamish subsistence receptors.

Recreational Receptors – Results
At the Area 8 beach, the non-cancer HI from ingestion of clam tissue by recreational receptors is 0.2 and 0.1 for child and combined child/adult receptors, respectively, below the non-cancer target health goal of 1. The cancer risk is 2 x 10^{-6}, slightly above the EPA's de minimis cancer risk level of 1 x 10^{-6}. At the reference area, the non-cancer HIs and cancer risks are the same as those for the Area 8 beach when rounded to one significant figure. Again, these results indicate that exposure to COCs in clams collected from the Area 8 beach is not substantially different than the exposure from the reference area. In addition, the incremental site non-cancer HIs are 0.03 and 0.02 for child and combined child/adult receptors, respectively, well below the target health goal.

Because the non-cancer hazard estimates calculated for the 2 Area 8 beach are below target health goals, there is no unacceptable health risk for recreational receptors at the site, even without considering the contribution from background sources. Though the cancer risk estimates calculated for the Area 8 beach slightly exceed the de minimis target cancer risk level, non-site related sources from natural background or other ubiquitous sources contribute significantly to the concentrations of COCs measured at the site. Because the incremental non-cancer hazard and cancer risk estimates are well below target health goals, there is no unacceptable site-related risks to human health for recreational receptors.

HHRA Conclusions
Despite the presence of several COCs in Area 8 beach sediment and clam tissue at concentrations exceeding background and reference area concentrations, the incremental site risk over background for Suquamish subsistence and recreational receptors meets target health goals. Therefore, no risks to human health were identified and contingency/additional actions, such as groundwater controls, are not necessary to protect human health from Area 8 contaminants.

The ERA for the Area 8 beach evaluated the potential environmental hazards to ecological receptors potentially exposed to residual metal COCs. The ecological receptors of concern were subdivided into primary categories: sediment benthos (e.g., shellfish); aquatic life (e.g., aquatic plants, aquatic invertebrates, and fish during high tide); semi-aquatic avians (e.g., northwestern crow) and mammalian predators (e.g., river otter). The media evaluated included seep water, surface water, sediments, and clam tissue. Table 4-5 presents a summary of the findings from the ERA.

Cadmium concentrations in sediment and seep water exceeding ecological benchmarks are delineated in Figure 4-21. As shown in Figure 4-21, these exceedances are along Transect 8, including Seep C, and into Transect 3 at Seep A.

Based on the finding of no significant risk to free-swimming aquatic life, semi-aquatic birds or mammals, contingency/additional actions, such as groundwater controls, are not necessary to protect these receptor groups from contaminants migrating at OU 2 Area 8. Lines of evidence were proposed in the ERA which suggest that the risks to benthic organisms are low despite the localized, elevated concentrations of cadmium in sediment and seep water. These lines of evidence included:

- Surface water and sediment benchmark comparisons that indicate localized impacts.

- Cadmium clam tissue concentrations that are not elevated relative to reference area tissue levels.
- The presence of sufficient AVS where the data are available to indicate sediment impacts are minimal.
- The findings of the 2008 bioassay tests at the highest cadmium seep and sediment concentrations to indicate cadmium is not toxic based on the SMS Rule.

Ecology's SMS regulation (i.e., an ARAR under the OU 2 ROD) allows the use of bioassay analysis in cases where chemical concentrations in sediment samples exceed the published numeric standards. Samples that pass the bioassay analysis are considered to not pose an unacceptable risk to benthic organisms. Therefore, to ensure OU 2 Area 8 COCs do not pose unacceptable risk to benthic organisms, an ERA addendum was conducted. The primary objective of the ERA addendum was to collect additional data needed to fully evaluate the potential risks to the benthic community from COCs originating from OU 2 Area 8 and finalize the ERA. To meet this objective, eight (8) sediment samples (including a duplicate) and one (1) seep water sample were collected from the Area 8 beach; and three (3) sediment samples and one (1) seep water sample were collected from the reference area in June 2019 and tested under a bioassay program in July and August 2019.

Figure 4-22 presents these sediment and seep water sampling locations at the Area 8 beach. The sediment samples were collected in the intertidal zone of the Area 8 beach, in the biologically active zone of 0 to 10 centimeters, and the seep water sample was collected from Seep C, which has the highest contaminant concentrations. The reference area samples were collected from Penrose Point State Park, consistent with characterizations during previous sampling events and similar to the Area 8 beach sediment. The results of the Area 8 beach and reference area sediment and seep water samples are tabulated on Tables H-11 through H-25 in Appendix H.

Figure 4-22 also presents the sediment and seep bioassay results. As shown in Figure 4-22, the cadmium concentration in water from Seep C was 28 μg/L, exceeding the seep benchmark of 7.9 μg/L in the 100%, as well as at the 75% (21 μg/L) and 50% (14 μg/L) dilution series concentrations used in the bioassay test. However, there is no statistically significant difference in mussel development between Seep C and reference area seep water; therefore, contaminants present in seep water, do not pose an unacceptable risk to benthic organisms.

Acute exposure to contaminants in sediment did not indicate a hazard to benthic organisms relative to reference area results based on the amphipod bioassay results. However, acute exposure to accumulated contaminants in sediment pose a potential hazard to benthic organisms based on the bioassay results for larval mussels at two locations (and possibly at SS64; see Figure 4-22):

- Location SS03-C reduced normal development in survivors relative to reference.
- Location Seep A reduced normal development in survivors relative to reference.

Additionally, chronic exposure to accumulated contaminants in sediment pose a potential hazard to benthic organisms based on the bioassay endpoints of both reduced survival and growth for juvenile polychaetes at two locations (see Figure 4-22):

- Location SS64, reduced growth relative to reference.
- Location Seep A, reduced growth relative to reference.

Table 4-5. Summary of Area 8 Beach Ecological Risk Assessment Findings

Exposure Medium	Measures of Effect	Assessment Findings
Benthic Invertebrates		
Sediment	Comparison of measured concentrations in sediment to conservative sediment risk- based screening benchmarks.	**Cadmium.** Cadmium exceedances of sediment benchmarks occurred at five locations, four of which are located along Transect 8 near Seep C[a] (SS50, SS51, SS03-C[a], and SS06-C[a]) and one at the discharge point of Seep A[a]. Based on statistical comparison and in conjunction with bioassay results below, cadmium concentrations in sediment present No Significant Risk.
		Silver. Silver concentrations in sediment exceeded the sediment benchmark at two locations. Both locations are near Outfall 03-703, where seep concentrations also exceed the surface water benchmark. The sediment 95UCL does not exceed sediment benchmark; significant number of clams at Outfall 03-703, indicating the silver does not appear to be adversely affecting clam populations, so silver concentrations in sediment present No Significant Risk.
	Comparison of the sum of simultaneously extracted divalent metals to concentrations of acid volatile sulfides to assess bioavailable fraction of divalent metals.	AVS/SEM ratios less than one indicating divalent metals are not bioavailable for uptake by biota and sufficient AVS available or other lines of evidence exist indicating cadmium in sediment is not likely a contributing source to tissue cadmium levels, so presents No Significant Risk.
	Evaluation of existing bioassay tests	No significant toxicity was noted in the sediment sample with the highest cadmium concentration, so cadmium presents No Significant Risk.
Seep Water	Used as a line of evidence to assess seep data in conjunction with AVS/SEM as a potential source for metals accumulation in shellfish tissue.	Seep water is most likely the source of cadmium in clam tissue. However, based on shellfish abundance studies and risk findings for mammals and birds (hazard quotients less than one based on cadmium clam tissue concentrations), bioaccumulation of seep water is not significant, so presents No Significant Risk.
Clam Tissue	Comparison of measured concentrations of metals in littleneck clam tissue to critical tissue levels (CTLs) and statistical comparison to Penrose Point Reference Area Concentrations.	Although arsenic and cadmium CTL exceedances were detected at all sample locations, arsenic and cadmium tissue concentrations were considered statistically similar to Penrose Point reference tissue concentrations, so present No Significant Risk.

Table 4-5 (continued). Summary of Area 8 Beach Ecological Risk Assessment Findings

Exposure Medium	Measures of Effect	Assessment Findings
Aquatic Plants, Invertebrates and Fish		
Marine Surface Water Seep Water	Comparison of measured concentrations in seep water and surface water to conservative risk-based water quality benchmarks.	Cadmium concentrations in seep water samples exceeded water quality benchmarks, but there were no cadmium exceedances in marine surface water, the more relevant exposure medium. So cadmium in surface water presents No Significant Risk.
Semiaquatic Birds and Mammals		
Sediment and Clam Tissue	Calculation of hazard quotients based on average daily doses for indicator bird and mammal species and comparison to chemical- and receptor-specific toxicity reference values (TRVs)	Calculated hazard quotients of less than one, so No Significant Risk.

Notes:

[a] During completion of the ERA, a discrepancy in the naming of Seep A was identified within project documents. For consistency with the Seep A location used in long-term monitoring reports, Seep A is located east of Well MW8-11 on Transect 3 and Seep C is located east of MW8-14 through MW8-16 on Transect 8. The nomenclature for SS03 and SS06 was modified to sampling stations SS03-C and SS06-C in order to distinguish them from historical sampling stations and to highlight their downgradient position from the newly identified Seep C Transect 8, rather than the historical Seep A Transect 3 locations.

Sample location SS03-C is collocated with Seep C.

AVS/SEM = acid-volatile sulfide/simultaneous extracted metal

The ecological risk assessment identified no risk to higher trophic level biota, but concluded that acute and chronic exposure to accumulated contaminants in sediment pose a current potential hazard to benthic organisms based on the bioassay results/endpoints. The area of exposure with unacceptable risk is well delineated and of limited extent within the Area 8 beach intertidal zone. Based on the identification of risk at the Area 8 beach, the OU 2 ROD requires a contingent remedial action be implemented as part of the selected remedy, to protect the benthic community. Therefore, the Navy will begin a supplemental remedial investigation at OU 2 Area 8 in 2021 to better understand site hydrogeology, current contaminant magnitude and extent and allow evaluation of remedial alternatives to control the release of contaminant to the Area 8 beach.

2017 and 2019 Vapor Intrusion Investigations. A VI Study (U.S. Navy, 2018c) was conducted in fall 2017 at OU 2 Area 8 in response to a recommendation in the fourth FYR (U.S. Navy, 2015b), to conduct a VI evaluation, including soil gas sampling adjacent to occupied buildings within 100 feet of monitoring wells exhibiting TCE concentrations exceeding 5 µg/L (i.e., VI default screening level).

The overall objectives of the VI study were to: 1) evaluate whether the VI pathway is complete between the site and nearby buildings; 2) assess whether the cVOCs in groundwater at OU 2 Area 8 have contributed to indoor air concentrations via the VI pathway; and 3) collect information to support the selection of appropriate mitigation measures, if required. To address these questions, the scope of work consisted of collection and analysis of soil vapor samples from six (6) locations adjacent to buildings near known cVOC concentrations in groundwater.

Soil vapor locations SV-1 through SV-5 were installed as dual nested multi-depth probes, with each nested probe completed with a sample point at a shallow depth (4.5 to 5 feet bgs) and a deeper depth (8 feet). Soil vapor location SV-6 was installed as a single depth point at 5 feet bgs due to saturation in soils observed at approximately 7 feet bgs. Ultimately, samples were not collected from the deeper sampling depths, with the exception of well SV-3, due to the presence of water or insufficient soil vapor volume encountered during purging and/or sampling efforts; therefore, a total of seven soil vapor samples were collected. Figure 4-23 presents the soil vapor locations and results for cVOCs exceeding PALs at OU 2 Area 8.

As shown in Figure 4-23, trans-1,2-DCE, TCE, 1,1,2-TCA, and PCE in soil vapor exceeded their respective PALs of 2,000, 66.7, 6.67, and 1,333 $\mu g/m^3$ at one or more locations. All other VOCs were non-detect or detected at concentrations below their respective PAL. In addition, the deeper sample at SV-3 (at 8 ft bgs) demonstrated greater VOC concentrations. This deeper sample is closer to groundwater containing VOCs, suggesting that the source of VOCs in soil vapor may be contaminated groundwater. Also, the greatest VOC concentrations were detected in samples from two of the locations farthest from known VOC concentrations in groundwater (i.e., SV-1 and SV-2). These two locations are near an underground electrical corridor, which appears to have a spur aligned to the east and terminating within the area of known VOCs in groundwater (see Figure 4-23). One interpretation of these results could be that VOC vapors are migrating along the backfill of this electrical corridor.

Based on these finding, an additional investigation of the VI pathway and VOC migration along preferential pathways was warranted and ultimately conducted in April and July 2019 at Buildings 82, 85, 98, and 1074 adjacent to OU 2 Area 8. The overall objectives of the investigation were to: 1) evaluate potential health risk from worker inhalation exposures through the VI pathway and 2) collect information to support the selection of appropriate mitigation measures, if needed.

Explanation

- Abandoned Monitoring Well
- Monitoring Well
- June 2015 Seep/Outall Sampling Location
- 2019 Seep Bioassay Sample Location
- June 2015 Sediment Sampling Location
- June 2016 Sediment Sampling Location
- 2019 Sediment Bioassay Sample Location
- Existing Monument
- Transects
- Metals - Contaminated Soil Removal Boundaries (U.S. Navy, 1999)
- Former Buildings
- Base Boundary
- Area 8 Boundary
- Planting Waste Area Soil Removal and Trench Excavation[a]
- Exposure Area (Area 8 Beach)

Sediment Cadmium Concentration in milligrams per kilogram (mg/kg) dry weight. Sediment benchmark for cadmium is 5.1 mg/kg.

- 10
- 5

Notes:

[a]Figure 10 of the OU 2 ROD (U.S. Navy, USEPA and Ecology 1994)

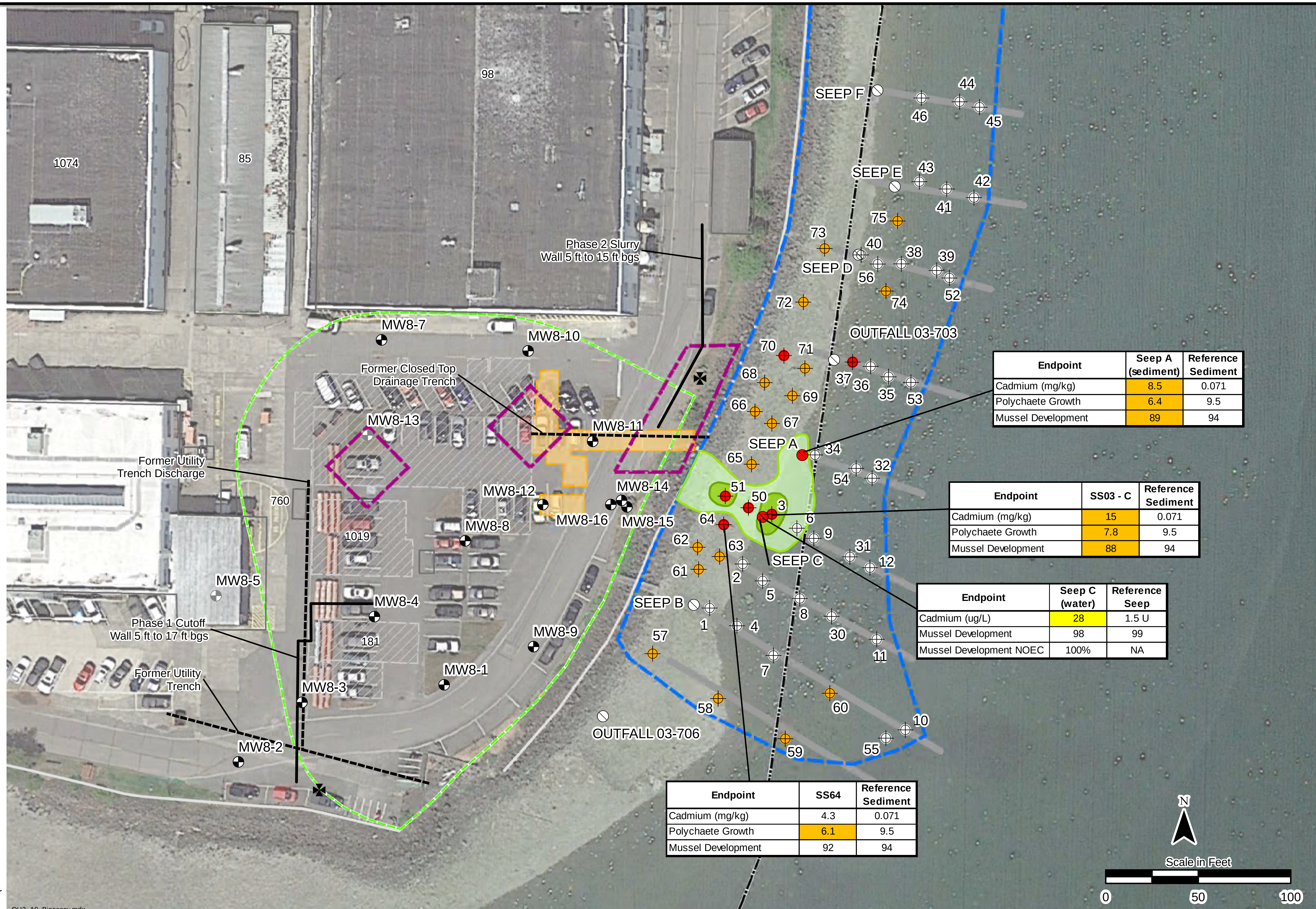
Reference sediment was collected from station PPSP-2 and reference seep water was collected from station PPSP-1.

2. Sediment values shown in highlited in orange indicate the following:

a. Cadmium - The value is greater than the Sediment Cleanup Objective (SCO) of 5.1 milligrams per kilogram.
b. Polychaete Growth - There is a statistically significant difference between the value and the associated laboratory control and/or reference sediment.
c. Mussel Development - There is a statistically significant difference between the value and the associated laboratory control and reference sediment.

3. Cadmium value for Seep C (water) shown highlighted in yellow indicates the concentration is greater than the applicable water quality benchmark of 7.9 micrograms per liter. The cadmium concentrations at the 75% (21 µg/L) and 50% (14 µg/L) also exceed the benchmark, while the 25% (7 µg/L) and 12.5% (3.5 µg/L) were lower than the benchmark.

4. There was no statistically significant difference in mussel development between the Seep C water and the reference seep.



Endpoint	Seep A (sediment)	Reference Sediment
Cadmium (mg/kg)	8.5	0.071
Polychaete Growth	6.4	9.5
Mussel Development	89	94

Endpoint	SS03 - C	Reference Sediment
Cadmium (mg/kg)	15	0.071
Polychaete Growth	7.8	9.5
Mussel Development	88	94

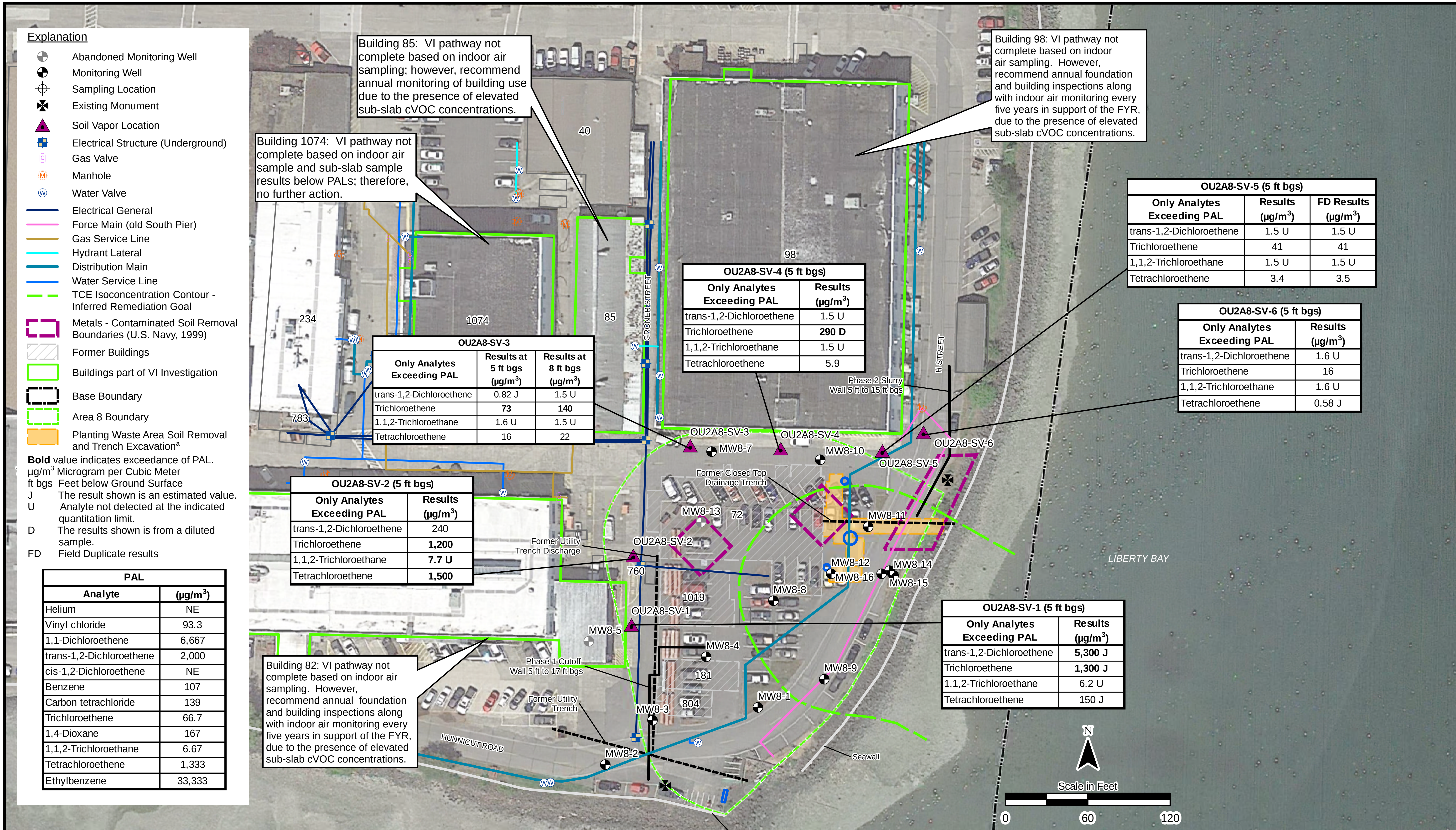
Endpoint	Seep C (water)	Reference Seep
Cadmium (ug/L)	28	1.5 U
Mussel Development	98	99
Mussel Development NOEC	100%	NA

Endpoint	SS64	Reference Sediment
Cadmium (mg/kg)	4.3	0.071
Polychaete Growth	6.1	9.5
Mussel Development	92	94

U.S. NAVY

Figure 4-22
Area 8 Beach Locations of Predicted Bioassay Impacts and Beach Cadmium Sediment and Seep Concentrations Greater Than Ecological Benchmarks

NBK KEYPORT
FIFTH
FIVE-YEAR REVIEW



PAL	
Analyte	(µg/m³)
Helium	NE
Vinyl chloride	93.3
1,1-Dichloroethene	6,667
trans-1,2-Dichloroethene	2,000
cis-1,2-Dichloroethene	NE
Benzene	107
Carbon tetrachloride	139
Trichloroethene	66.7
1,4-Dioxane	167
1,1,2-Trichloroethane	6.67
Tetrachloroethene	1,333
Ethylbenzene	33,333

OU2A8-SV-3		
Only Analytes Exceeding PAL	Results at 5 ft bgs (µg/m³)	Results at 8 ft bgs (µg/m³)
trans-1,2-Dichloroethene	0.82 J	1.5 U
Trichloroethene	**73**	**140**
1,1,2-Trichloroethane	1.6 U	1.5 U
Tetrachloroethene	16	22

OU2A8-SV-4 (5 ft bgs)	
Only Analytes Exceeding PAL	Results (µg/m³)
trans-1,2-Dichloroethene	1.5 U
Trichloroethene	**290 D**
1,1,2-Trichloroethane	1.5 U
Tetrachloroethene	5.9

OU2A8-SV-5 (5 ft bgs)		
Only Analytes Exceeding PAL	Results (µg/m³)	FD Results (µg/m³)
trans-1,2-Dichloroethene	1.5 U	1.5 U
Trichloroethene	41	41
1,1,2-Trichloroethane	1.5 U	1.5 U
Tetrachloroethene	3.4	3.5

OU2A8-SV-6 (5 ft bgs)	
Only Analytes Exceeding PAL	Results (µg/m³)
trans-1,2-Dichloroethene	1.6 U
Trichloroethene	16
1,1,2-Trichloroethane	1.6 U
Tetrachloroethene	0.58 J

OU2A8-SV-2 (5 ft bgs)	
Only Analytes Exceeding PAL	Results (µg/m³)
trans-1,2-Dichloroethene	240
Trichloroethene	**1,200**
1,1,2-Trichloroethane	**7.7 U**
Tetrachloroethene	**1,500**

OU2A8-SV-1 (5 ft bgs)	
Only Analytes Exceeding PAL	Results (µg/m³)
trans-1,2-Dichloroethene	**5,300 J**
Trichloroethene	**1,300 J**
1,1,2-Trichloroethane	6.2 U
Tetrachloroethene	150 J

U.S. NAVY

Figure 4-23
OU 2 Area 8 Summary of 2017 and 2018
Vapor Intrusion Investigations

NBK KEYPORT
FIFTH
FIVE-YEAR REVIEW

Preliminary screening was performed immediately prior to the first sampling event in each of the four buildings to inform final placement of Summa canisters to collect time-integrated samples, as shown below:

Screening Method	Purpose	Target Analytes
portable GC/MS (INFICON HAPSITE®)	To identify potential background indoor air sources, soil vapor entry points, and preliminary breathing zone concentrations.	PCE, TCE, 1,1-DCE, cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride
ppbRAE (PID)		Total VOC screening
differential pressure monitors	To provide an indication of whether the inside of each building tends to be more or less pressurized as compared to outdoors (i.e., more or less susceptible to VI).	NA

Indoor air, outdoor air, and sub-slab vapor samples were collected, and differential pressure was monitored in both early spring (April 2019) and summer (July 2019) to account for the seasonal variability of VI potential. All indoor air and outdoor air samples were collected using 6-L Summa canisters, whereas sub-slab vapor samples were collected using 1-L Summa canisters. All samples were analyzed for the six (6) target cVOCs: PCE, TCE, 1,1-DCE, cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride via EPA Method TO-15 SIM. In April 2019, six outdoor air samples, 30 indoor air samples, and 28 soil vapor samples were collected. In July 2019, four outdoor air samples, 29 indoor air samples, and 28 soil vapor samples were collected.

The results of the VI investigation indicate that the VI pathway is incomplete. Contaminants that were detected in indoor air above PALs were shown to be the result of indoor background sources and although elevated contaminant concentrations were detected in sub-slab vapor from underneath three of the four buildings, elevated concentrations were not detected in the paired indoor air samples, indicating the VI pathway is incomplete. In addition, the PAL algorithm is extremely conservative and often does not produce concentrations that represent a VI concern, especially considering the attenuation factors for industrial buildings present at the site. Annual foundation inspections were recommended for Buildings 82, 85, and 98 and VI monitoring, including collection and analysis of indoor and outdoor air samples and subslab vapor samples conducted every 5 years was recommended for Buildings 82 and 98. No further action was recommended for Building 1074, since indoor air and sub-slab vapor concentrations were below PALs (see Figure 4-23). The results and recommendations of the VI investigation are currently in Draft form. Final recommendations for VI inspections and monitoring at OU 2 Area 8 will be documented in the Final OU 2 Area 8 VI Report.

USGS Tidal Lag Study. A tidal lag study was conducted by USGS from October to November 2017 to determine the optimal time during the semi-diurnal and neap-spring tidal cycles to sample groundwater for freshwater contaminants at OU 2 Area 8 monitoring wells (USGS, 2018). For the study, groundwater levels and specific conductance in five monitoring wells (i.e., MW8-8, MW8-9, MW8-11, MW8-12, and MW8-14) , along with marine water levels (tidal levels) were measured every 15 minutes during a 3-week duration to determine how nearshore groundwater responds to tidal forces. Time series data were collected during a period that included neap and spring tides. Vertical profiles of specific conductance were also measured in the screened interval of each monitoring well prior to instrument deployment to determine if the freshwater/saltwater interface was present in the monitoring well at that time.

Based on the data collected, the following observations were made regarding groundwater response to tidal influences:

<u>Specific-Conductance Time-Series Data:</u>

- Evidence of substantial saltwater intrusion into the screened intervals of most shallow monitoring wells.
- Data consistently indicated that groundwater had the lowest specific conductance (was least mixed with seawater) during the same period when groundwater levels were lowest.
- Data suggest that it is the heights of the actual high-high and low-low tides (regardless of whether or not they occur during the neap or spring part of the cycle) that allows seawater intrusion into the nearshore aquifer of OU 2 Area 8.

<u>Vertical Profiles of Specific Conductance Data:</u>

- The landward-most well (MW8-8) was completely freshwater, while one of the most seaward wells (MW8-9) was completely saline/seawater.
- A distinct saltwater interface was measured in the three other shallow wells (MW8-11, MW8-12, and MW8-14), with the topmost groundwater occurring as freshwater underlain by higher conductivity water/seawater.

<u>Lag Time Data:</u>

- Lag times were surprisingly long considering the monitoring wells are all located within 200-ft of the shoreline and the local geology is largely coarse-grained glacial outwash deposits.
- Various manmade subsurface features (i.e., cutoff walls and backfilled excavations) most likely influence and complicate the hydraulic connectivity between seawater and groundwater.

Based on the USGS study findings, the optimal time for sampling the shallow monitoring wells at OU 2 Area 8 is centered on a 2 to 5-hour period following the predicted low-low tide during neap tide, with due consideration of local atmospheric pressure and wind conditions that have the potential to generate tides that can be substantially higher than those predicted from lunar-solar tidal forces. The optimal time for sampling the deeper monitoring wells at OU 2 Area 8 would be during the 6 to 8-hour period following a predicted low-low tide, also during the neap tide part of the tidal cycle. These periods are when groundwater in the monitoring wells is mostly freshwater and least diluted by saltwater intrusion (USGS, 2018).

The USGS study recommended collecting undisturbed samples from the top of the screened interval (or top of the water table if below the top of the interval) to best characterize contaminant concentrations in freshwater (USGS, 2018). However, additional consideration should be given to this recommendation, given that cVOCs detected in groundwater at OU 2 Area 8 vertically migrate to deeper depths within the aquifer; thus, worst-case scenario concentrations may be found in the lower portions of the screened interval. In addition, climate change effects and particularly weather pattern changes (i.e., local atmospheric pressure and wind conditions) may significantly impact the magnitude and duration of saltwater intrusion and ultimately, the timeframe when best to sample groundwater for freshwater contaminants.

4.3 Results of Site Inspections

The following subsections summarize the results of the annual LUC inspections and FYR site inspections at NBK Keyport.

4.3.1 Land Use Control Inspections

LUCs have been implemented at the various OUs at NBK Keyport to prevent exposures to contaminants and to limit or prohibit activities that may interfere with the integrity of a remedial action (U.S. Navy, 2017b). To ensure effectiveness of the LUCs, physical and records inspections within the LUC boundary are conducted on an annual basis. These inspections are guided by the inspection checklists provided in the IC Plans (U.S. Navy, 2016a and 2017b). Table 4-6 presents a summary of the LUC inspection results from 2015 through 2019.

As shown in Table 4-6, there were no instances/findings of LUC deficiencies during this FYR period, demonstrating that LUCs have been adequately implemented. The LUCs are preventing exposure to residual contamination and have controlled, limited, or prohibited activities that may interfere with the integrity of the completed remedial actions. That noted, in 2019, there was an observation of several newer, deeper cracks, approximately 1-inch wide, in the western portion of the motorcycle training area at OU 1. Several other smaller cracks were also observed, similar to previous years, but there appears to have been some settling (see Table 4-6).

4.3.2 Five-Year Review Site Inspection

An inspection of OU 1, OU 2 Area 2, and OU 2 Area 8 was conducted in accordance with EPA guidance for FYRs (EPA, 2001). The site inspection provided a means to verify that the remedies are protective of human health and the environment and to assist in identifying recommendations for additional/corrective actions to ensure that the remedies continue to be protective.

The site inspections for this fifth FYR were conducted on September 19, 2019 by the following personnel:

Name	Organization	Role
Carlotta Cellucci	NAVFAC Northwest	Remedial Project Manager
Michael Meyer	Battelle	Project Manager
Angela Paolucci	Battelle	FYR Task Manager

A FYR site inspection checklist along with photographs were used to guide the visual inspections at each site and ultimately, assess the protectiveness of the remedies. The completed FYR site inspection checklists and photographic log are provided in Appendices I and J, respectively.

There were no significant observations made at OU 2 Area 2 or OU 2 Area 8 during the FYR site inspections; however, specific observations regarding OU 1 are provided below:

- ***Tide Gate:*** The tide gate was observed/noted and based on regular inspections and maintenance documented in the 2018/2019 Annual O&M Report (U.S. Navy, 2019h), the tide gate is working as intended and designed to limit tidal flooding of the marsh, which could cause erosion of the landfill and/or adversely affect plantation tree health (see Section 4.2.1 and Appendix J).
- ***Phytoremediation:*** Consistent with the 2018/2019 Annual O&M Report (U.S. Navy, 2019h), tree health stress was observed in both plantations; however, stress was notably more apparent in the North Plantation (compared to the South Plantation), including leaf curl and burn and low leaf density (see Section 4.2.1 and Appendix J).
- ***Landfill Cover:*** Similar to the fourth FYR (U.S. Navy, 2015e), there are several ~1-inch wide cracks traversing the Central Landfill from east to west and north to south; there is significant bulging and cracking caused by tree roots outside the southeast corner of the North Plantation; and water ponding in the southern portion of the Central Landfill (see Appendix J).
- ***Landfill Infringements:*** Similar to the fourth FYR (U.S. Navy, 2015e), alder trees and other brush are growing up through penetrations in the asphalt near old foundations in the southern portion of the Central Landfill (see Appendix J).

Site conditions observed at OU 1, OU 2 Area 2, and OU 2 Area 8 indicated that LUCs requirements are currently being met, as confirmed in Section 4.3.1.

Table 4-6. Summary of Annual LUC Inspections at NBK Keyport

Inspector's Checklist	Response (Yes/No)					Findings/Comments
	2015	2016	2017	2018	2019	
OU 1 – Former Landfill[(a)]						
Has access to OU 1 been maintained (have security procedures for base entry served to maintain a restricted access)?	Yes	Yes	Yes	Yes	Yes	–
Have drinking water wells been installed on Navy property within 1,000 feet of the landfill?	No	No	No	No	No	–
For Area A, the land between the tide flats and the marsh, have water wells been installed, except those for monitoring or remedial action purposes?	No	No	No	No	No	–
For Area B, the land between the tide flats and the Pass and ID Building parking lot, have water wells been installed, expect those for monitoring or remedial action purposes?	No	No	No	No	No	–
For Area C, the tide flats and adjacent shoreline owned by the Navy, have any activities occurred that could interfere with or compromise monitoring or remedial actions?	No	No	No	No	No	–
For Area D, the former landfill, have water wells been installed, expect those for monitoring or remedial action purposes?	No	No	No	No	No	–
For Area D, the former landfill, are any employees permanently assigned to work in buildings within this area?	No	No	No	No	No	–
For Area D, the former landfill, have there been any land use activities other than remedial activities, storage, parking, and facilities that involve only occasional occupancy by workers?	No	No	No	No	No	–
For Area D, the former landfill, have activities that involve digging and construction within this area been controlled by the base excavation/dig permit procedure and other pertinent base instruction?	Yes	Yes	Yes	Yes	Yes	–
For Area D, the former landfill, is there significant damage (e.g., cracking, seam separation, root damage, etc.) to asphalt surfaces that permits direct-contact exposure of people to underlying soils or that may significantly increase infiltration of surface water/stormwater?	–	No	No	No	No	Cracks and seams are minimal and do not permit direct contact in 2016, 2017, and 2018. In 2019, several deeper cracks in western portion of motorcycle training area.
For Area D, the former landfill, if activities requiring an excavation/dig permit were conducted, were there any instances in which the permit requirements were not effective in maintaining the requirements of the Institutional Controls Plan?	No	No	No	No	No	–
For Area E, the marsh pond and marsh system, have there been any new construction or maintenance activities that disturbed the wetlands adjacent to the landfill and resulted in an exposure hazard?	No	No	No	No	No	–
For Area E, the marsh pond and marsh system, have there been any new construction or maintenance activities that interfere with or compromise the monitoring or remedial actions for the landfill?	No	No	No	No	No	–
OU 2 Area 2 – Van Meter Road Spill/Drum Storage Area						
Has access to OU 2 Area 2 been maintained (have security procedures for base entry served to maintain a restricted access)?	Yes	Yes	Yes	Yes	Yes	–
Have activities that involved digging and construction within OU 2 Area 2 been controlled by the base excavation/dig permit procedure and other pertinent base instructions?	Yes	NA/Yes	NA	Yes	Yes	–
If activities requiring an excavation/dig permit were conducted within OU 2 Area 2, were there any instances in which the permit requirements were not effective in maintaining the requirements of the Institutional Controls Plan?	No	NA/No	NA	No	No	–
Have water wells been installed at OU 2 Area 2, except those for monitoring or remedial actions?	No	No	No	No	No	–
Has residential development occurred in OU 2 Area 2?	No	No	No	No	No	–
OU 2 Area 8 – Plating Shop Waste/Oil Spill Area						
Has access to OU 2 Area 8 been maintained (have security procedures for base entry served to maintain a restricted access)?	Yes	Yes	Yes	Yes	Yes	–
Have activities that involved digging and construction within OU 2 Area 8 been controlled by the base excavation/dig permit procedure and other pertinent base instructions?	Yes	NA/Yes	Yes	Yes	Yes	–

Table 4-6 (continued). Summary of Annual IC Inspections at NBK Keyport

Inspector's Checklist	Response (Yes/No)					Findings/Comments
	2015	2016	2017	2018	2019	
If activities requiring an excavation/dig permit were conducted within OU 2 Area 8, were there any instances in which the permit requirements were not effective in maintaining the requirements of the Institutional Controls Plan?	No	NA/No	No	No	No	–
Have water wells been installed at OU 2 Area 8, except those for monitoring or remedial actions?	No	No	No	No	No	–
Has residential development occurred in OU 2 Area 8?	No	No	No	No	No	–

(a) LUC areas within OU 1 are depicted in Figure 2-1.
– Indicates that question was not asked that year or site was not inspected that year.
NA Not applicable.

5.0 TECHNICAL ASSESSMENT

In accordance with the *Comprehensive Five-Year Review Guidance* (EPA, 2001), the technical assessment for NBK Keyport answers three questions:

- Question A: Is the remedy functioning as intended by the decision documents?
- Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?
- Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Table 5-1 summarizes the responses to Questions A, B, and C based on the technical assessment discussion provided in the following subsections for OU 1 and OU 2 at NBK Keyport.

Table 5-1. Summary of the Technical Assessment for NBK Keyport

OU	**Area/Site**	**Question A:** Is the remedy functioning as intended by the decision documents?	**Question B:** Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	**Question C:** Has any other information come to light that could call into question the protectiveness of the remedy?
OU 1	Area 1	No	No	No
OU 2	Area 2	Yes	No	No
	Area 8	No	No	No

5.1 Answers to Questions A, B, and C for OU 1

The following section provides a summary response to Questions A, B, and C for OU 1.

Question A: For OU 1, the remedy is not functioning as intended by the OU 1 ROD (U.S. Navy, EPA, and Ecology, 1998); therefore, the answer to Question A is "no." During this FYR period, the understanding of the CSM, as depicted in the ROD has changed completely. cVOCs have been found at deeper depths in both soil and groundwater than understood at the time of the ROD; cVOC concentrations discharging to surface water are more widespread and at substantially higher concentrations than known at the time of the ROD; and a PCB source area has been identified within the northern area of the landfill that may be re-contaminating an area of the wetland that was previously remediated. Based on this information, investigations in support of focused feasibility study for hotspot treatment and human health and ecological risk assessments to ensure risk assumptions have not changed based on the changed CSM have been initiated.

Phase I and Phase II Site Characterizations recommended in the fourth FYR (U.S. Navy, 2015e), along with source area investigations, have been conducted during this FYR period, providing new data to refine the CSM for the South Plantation, Central Landfill, and North Planation at OU 1 (see Section 4.2.1). These investigations are on-going and include verifying exposure assumptions, conducting supplemental human health and ecological risk assessments, and re-evaluating points of compliance, ARARs, RAOs, and cleanup levels to ensure protectiveness in the future. To date, these investigations have documented subsurface geology and contaminant distribution that differs significantly from the CSM understanding at the time of the ROD (U.S. Navy, EPA, and Ecology, 1998). For example, cVOCs have been found at deeper depths in both soil and groundwater; cVOC concentrations discharging to surface water are more widespread and at substantially higher concentrations than known at the time of the ROD; and a PCB source area has been identified within the area north of the north plantation that may be re-contaminating an area of the wetland that was previously remediated. LUCs are implemented and maintained to prevent all currently known exposures.

Question B: For OU 1, the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy are currently being re-evaluated based on data obtained during this FYR period, therefore, the answer to Question B is "no" for the following reasons:

1. Exposure point cVOC concentrations for ecological receptors in surface water in the wetland south of the south plantation are orders of magnitude higher than known at the time of the ROD, so this exposure assumption is no longer valid
2. Ecological cVOC exposures in sediment porewater occur over a much larger portion of the marsh than understood at the time of the ROD, so again this exposure assumption is no longer valid
3. PCB sediment data indicate the potential for adverse risk/effects to human health and the benthic community, and PCBs did not pose a risk at the time of the ROD.

ARARs used to establish cleanup levels in the OU 1 ROD (U.S. Navy, EPA, and Ecology, 1998) are evaluated in Section 5.5.1 and summarized in Table 5-2. The changes to the toxicity risk assumptions are discussed in Section 5.5.2. At the time of this FYR, there are no verified changes to the risk assessment exposure assumptions and LUCs are implemented and maintained to prevent all currently known exposures.

However, additional human health and ecological risk assessments are underway and the recent results of PCB samples in the wetland, as well as the exposure area and exposure point concentrations of cVOCs, will be used to assess whether risk conclusions in the ROD should be revised. For human health risk, the 2017 PCB sediment data were compared to natural background for marine sediment and indicated the potential for adverse risk at all sediment sampling locations. In the interim, the tide flats are currently closed by the Washington State Department of Health (WDOH) to harvesting and consuming shellfish by recreational or subsistence fishers; therefore, the remedy is protective in the short term. Note that the Suquamish Tribe has treaty reserved rights to harvest and maintain the authority to determine harvest practices for tribal members. For ecological risk, because the highest current PCB concentrations are not higher than those found at the time of the ROD and are limited to the immediate vicinity of station MA-09, the remedy is protective in the short term. Although initial risk evaluation of sample results near sediment station MA09 indicate minor adverse effects to the benthic community, and the ROD anticipated that post remedy concentrations would be lower and any adverse effects would have been eliminated by remedial action, these effects will be more thoroughly evaluated during the ongoing HHRA/ERA. Regarding ecological exposure to cVOCs, the area of these exposures is substantially larger than known at the time of the ROD, and the concentrations are orders of magnitude higher than understood at the time of the ROD.

Groundwater samples were collected and analyzed for PFAS compounds in 2017 and 2019 to determine if these chemicals of emerging concern were present at the site. PFAS compounds were detected in groundwater during these monitoring events; however, neither PFOS, PFOA, nor total PFOS plus PFOA concentrations were detected above the Lifetime Health Advisory (LHA) of 70 ng/L (see Appendix D). PFBS was also analyzed in 10 groundwater samples collected in 2017 and was not detected in any of the samples with the highest reporting limit achieved of 0.37 ng/L. Additionally, there have been no new pathways identified for exposure to occur as long as LUCs restricting groundwater use for drinking water are maintained.

Question C: For OU 1, no other information has come to light (i.e., other than information discussed in previous sections of this FYR report regarding preliminary data) that could call into question the protectiveness of the remedy; therefore, the answer to Question C is "no."

The U.S. Navy recognizes PFAS compounds as chemicals of emerging concern and is in the process of completing a Preliminary Assessment (PA) (and will begin a Site Inspection [SI]) at NBK Keyport. The results of the PFAS PA/SI will be addressed in the next FYR for NBK Keyport. During this FYR period, PFAS and 1,4-dioxane were analyzed in select groundwater samples to assess whether the planned remedial alternative evaluation for hotspot treatment should account for additional contaminants. As stated previously, neither PFOS, PFOA, nor total PFOS plus PFOA concentrations were detected above the LHA of 70 ng/L in 2017 or 2019. Therefore, PFAS does not currently affect protectiveness.

Sea level rise caused by climate change effects and weather pattern changes caused by climate change may significantly impact the magnitude and duration of both tidal forces and storms, thereby increasing erosive forces along shorelines. At OU 1, the sill/causeway that separates Dogfish Bay from the tidal flats and the presence of the tide gate significantly lessen any effects of climate change that would cause tidal flooding of the marsh and erosion of the landfill in the short term. Therefore, climate change issues do not affect protectiveness.

5.2 Answers to Questions A, B, and C for OU 2 Area 2

The following section provides a summary response to Questions A, B, and C for OU 2 Area 2.

Question A: For OU 2 Area 2, the remedy (i.e., LTM and LUCs) is functioning as intended by the OU 2 ROD (U.S. Navy, EPA, and Ecology, 1994); therefore, the answer to Question A is "yes." Contaminant concentrations have trended down or been steady and LUCs are implemented and maintained to prevent all currently known exposures.

However, As discussed in Section 4.2.2, the consistent vinyl chloride detections above the RG in well 2MW-6 (and a recent increased concentration) may indicate that cVOC mass detected in the shallow zone (i.e., wells 2MW-1, 2MW-3, and MW2-10) during the RI has migrated to deeper and further downgradient than can be evaluated by the current monitoring well network. As such, the monitoring network may not be providing a current understanding of the nature and extent of groundwater contamination at OU 2 Area 2. Notwithstanding, annual LUC inspections and the FYR site inspection demonstrate that LUCs have been adequately implemented and maintained during this FYR period, preventing all currently known exposures. However, to reduce restoration timeframe and ensure the protection of downgradient receptors, additional investigation is recommended at OU 2 Area 2.

Question B: For OU 2 Area 2, the cleanup level for vinyl chloride used at the time of the remedy is no longer valid; therefore, the answer to Question B is "no."

ARARs used to establish cleanup levels in the OU 2 ROD (U.S. Navy, EPA, and Ecology, 1994) are evaluated in Section 5.5.1 and summarized in Table 5-3. The changes to the toxicity risk assumptions are

discussed in Section 5.5.2. Although the ARAR value supporting the ROD RG for vinyl chloride is no longer valid, LUCs are implemented and maintained to prevent all currently known exposures.
Question C: For OU 2 Area 2, no other information has come to light (i.e., other than information discussed in previous sections of this FYR report regarding preliminary data) that could call into question the protectiveness of the remedy (i.e., LTM and LUCs); therefore, the answer to Question C is “no.”

The Navy recognizes PFAS compounds as chemicals of emerging concern and is in the process of completing a PA (and will begin a SI) at NBK Keyport. The results of the PFAS PA/SI will be addressed in the next FYR for NBK Keyport. At this time, there are no recommendations or analytical data from OU 2 Area 2 to assess; therefore, the presence/effects of PFAS have not been evaluated. Also, there are no shoreline remedies in place at OU 2 Area 2; therefore, climate change effects do not call into question the protectiveness of the remedy.

5.3 Answers to Questions A, B, and C for OU 2 Area 8

The following section provides a summary response to Questions A, B, and C for OU 2 Area 8.

Question A: For OU 2 Area 8, the remedy is not functioning as intended by the OU 2 ROD (U.S. Navy, EPA, and Ecology, 1994); therefore, the answer to Question A is “no.”

The LTM program for OU 2 Area 8 includes groundwater, seep water, surface water, and sediment sampling for VOCs and metals and has been conducted in accordance with the regulator-approved LTM Work Plans (U.S. Navy, 2012h and 2017c) during this FYR period. The results of the annual LUC inspections demonstrate that LUCs have been adequately implemented and maintained; thus, preventing human exposure to groundwater as drinking water. In addition to LTM and LUCs, other components of the selected remedy for OU 2 Area 8 (U.S. Navy, EPA, and Ecology, 1994) include:

- Assess risks to human health and the environment using sediment and tissue monitoring data from the Area 8 beach.
- Implement contingent groundwater controls if OU 2 Area 8 groundwater is demonstrated to present a risk to human health or the environment based on a completed risk assessment.

As part of the selected remedy and recommendations in previous FYRs, human health and ecological risk assessments were completed during this FYR period. The human health risk assessment concluded that despite the presence of several COCs in Area 8 beach sediment and clam tissue samples at concentrations exceeding background and reference area concentrations, the incremental site risk over reference area risk for Suquamish subsistence and recreational receptors met target health goals, so no risk to human health was identified. The ecological risk assessment concluded that acute and chronic exposure to accumulated contaminants in sediment pose a current potential hazard to benthic organisms based on the bioassay results/endpoints, but did not identify risk to higher trophic level biota. Therefore, the risk assessments found that contingent groundwater control actions are not needed to protect human health or higher trophic level biota, but contingent groundwater control actions (to be conducted as part of the selected remedy) are needed to protect the benthic community.

Results of the VI soil gas study performed at OU 2 Area 8 in 2016 indicated the presence of contaminants in an area not previously identified. The highest soil gas concentrations were detected west of the Area 8 plume, adjacent to Building 82. Results of the VI study indicate that the presence of this contamination does not present a risk to human health via the VI pathway. In addition, there is no direct contact pathway, since the entire area is paved, and LUCs are maintained restricting groundwater use for drinking

water. Therefore, the presence of this additional contamination does not affect protectiveness. However, these results will be investigated during the upcoming 2021 supplemental remedial investigation.
Question B: For OU 2 Area 8, the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy are still valid for the terrestrial environment. The human health and ecological risk assessments for the marine environment (required by the OU 2 ROD and recommended in previous FYRs) were completed during this FYR period, constituting a revision to the risk assessment assumption in the OU 2 ROD; therefore, the answer to Question B is "no."

ARARs used to establish cleanup levels in the ROD are evaluated in Section 5.5.1 and summarized in Table 5-3. The changes to the toxicity risk assumptions are discussed in Section 5.5.2.

As stated previously, the human health risk assessment conducted in the Area 8 beach intertidal zone during this FYR period concluded that despite the presence of several COCs in beach sediment and clam tissue samples at concentrations exceeding background and reference area concentrations, the incremental site risk over reference area risk for Suquamish subsistence and recreational receptors met target health goals. Therefore, the project team agreed that no additional investigation or contingent actions, such as groundwater controls, were necessary to protect human health.

The ecological risk assessment identified no risk to higher trophic level biota, but concluded that acute and chronic exposure to accumulated contaminants in sediment pose a current potential hazard to benthic organisms based on the bioassay results/endpoints. The area of exposure with unacceptable risk is well delineated and of limited extent within the Area 8 beach intertidal zone. However, based on the OU 2 ROD, contingent groundwater control actions, to be conducted as part of the selected remedy, are required to protect the benthic community.

Groundwater samples were collected and analyzed for PFAS compounds in 2018 and 2019 to assess these chemicals of concern in all existing monitoring wells at the site. PFAS compounds were detected in groundwater during these monitoring events. The total concentration of PFOA plus PFOS was detected above the LHA of 70 ng/L in two monitoring wells (i.e., MW8-11 at 74 ng/L and MW8-12 at 77 M ng/L) in 2018. PFBS was detected in five of seven samples at concentrations (0.77 to 4.7 ng/L) well below the EPA RSL of 400,000 ng/L. PFAS concentrations were below the LHA in all monitoring wells in 2019. Using the EPA RSL Calculator and maximum detected concentration (of 77 M ng/L), the estimated screening level non-cancer hazard quotient (HQ) is 0.2, less than EPA's acceptable target HQ of 1 for non-carcinogens, indicating no non-cancer effects associated with daily consumption of groundwater. Additionally, there have been no new pathways identified for exposure to occur as long as LUCs restricting groundwater use for drinking water are maintained.

Question C: For OU 2 Area 8, no other information has come to light (i.e., other than information discussed in previous sections of this FYR report related to preliminary data) that could call into question the protectiveness of the remedy; therefore, the answer to Question C is "no."

The U.S. Navy recognizes PFAS as chemicals of emerging concern and is in the process of completing a PA (and will begin a SI) at NBK Keyport. The results of the PFAS PA/SI will be addressed in the next FYR for NBK Keyport. PFAS were added to the analyte list for OU 2 Area 8 in 2018 to determine the presence or absence of these contaminants in groundwater at the site. PFAS concentrations in 2018 and 2019 indicate no non-cancer effects associated with daily consumption of groundwater; therefore, the detection of PFAS does not currently impact protectiveness.

Climate change effects may significantly impact the magnitude and duration of saltwater intrusion at OU 2 Area 8, thus causing changes to groundwater geochemistry and the attenuation capacity of the aquifer. Based on the HHRA, groundwater COCs have not impacted sediments and surface water quality offshore to cause unacceptable human health risks, indicating that groundwater geochemistry and attenuation capacity have not yet been adversely impacted by saltwater intrusion. Therefore, climate change issues do not currently affect protectiveness.

5.4 Continued Validity of ROD Assumptions (Question B)

This section reviews the validity of the ROD cleanup levels by assessing: 1) any changes to standards identified as ARARs; 2) any changes in underlying assumptions used to calculate risk-based concentrations identified as cleanup levels in the RODs; and 3) newly promulgated standards for COCs since the RODs were signed to evaluate the protectiveness of the remedy.

5.4.1 Changes in Standards and TBCs

For this FYR, all sources of ARARs identified in the RODs (U.S. Navy, EPA, and Ecology, 1998 and 1994) were reviewed for changes that could affect the assessment of remedy protectiveness. Based on this review, it was concluded that the following regulations listed as ARARs have changed:

- EPA's National Recommended Water Quality Criteria (304[a]) – aquatic life and human health criteria.
- EPA’s 2016 “Revision of Certain Federal Water Quality Criteria Applicable to Washington” (40 Code of Federal Regulations [CFR] 131.45; formerly the Washington criteria were in 40 CFR 131.36, referred to as the National Toxics Rule [NTR]).
- Water Quality Standards for Surface Waters of the State of Washington (as provided in 173-201A WAC, Table 240 Toxics Substances Criteria, last updated 1/23/2019) – aquatic life and human health criteria.
- Washington State Sediment Management Standards (Chapter 173-204 WAC)
- Washington State MTCA Cleanup Regulations (Chapter 173-340 WAC), in particular, the use of background levels or the laboratory PQL as a cleanup level when the MTCA cleanup level is lower than these values. As such, this FYR includes an assessment of current PQLs used for LTM and a comparison of the current ARARs with the RGs based on background levels or the PQLs.
- Although the Washington State MTCA regulations have not changed since 2013, the risk-based criteria in the associated Cleanup Levels and Risk Calculation (CLARC) tables were updated in May 2019 to align with EPA’s RSL toxicity. The CLARC tables were consulted for this FYR to compare ROD MTCA Method B RGs to current MTCA Method B values, where applicable.

OU 1

OU 1 RGs were established for groundwater, surface water, sediment, and clam tissue. The basis for the RGs was the protection of human health, if groundwater was used for drinking, if surface water contained a food source, or if clams were harvested by a subsistence population (U.S. Navy, EPA, and Ecology, 1998). No specific numeric RG was established for sediment. Instead, the ROD indicated that bioassays would be conducted if sediment concentrations exceeded SQS. No numeric RG was established for the landfill soil. Instead, the ROD indicated that LUCs would be maintained to prevent contact with landfill soil and vapor. The following subsections discuss the RGs for groundwater, surface water, sediment, and clam tissue established in the ROD compared to current ARARs (as of February 2020) and those ARARs with lower values that may impact the protectiveness of the remedy.

Groundwater. Table 5-2 compares modified standards (as of February 2020) with the RGs presented in the OU 1 ROD (U.S. Navy, EPA, and Ecology, 1998; Table 11-4). The RGs were based on the use of groundwater as drinking water. There have been no changes to the groundwater ARARs during this FYR period. As discussed in the fourth FYR (U.S. Navy, 2015b), although lower drinking water ARARs were noted for 1,1-DCA, 1,2-DCA, cis-1,2-DCE, TCE, and vinyl chloride, the RGs remain protective because the calculated risks associated with the RGs are either within EPA's acceptable excess cancer risk range of 10^{-4} to 10^{-6} (or MTCA's acceptable excess cancer risk range of 10^{-5} to 10^{-6}), or if the calculated risk is above that risk range, LUCs are in place, and the remedy remains protective for the groundwater COCs. As noted in the fourth FYR (U.S. Navy, 2015b), 1,1-DCE is no longer considered a carcinogen. The current MCL is approximately an order of magnitude greater than the RG and the MTCA Method B value is approximately three orders of magnitude greater than the RG (i.e., 0.5 μg/L).

The RG for vinyl chloride was based on the PQL of 0.5 μg/L, which was achievable in 1998. As noted in the fourth FYR (U.S. Navy, 2015b), most laboratories can now achieve PQLs of 0.02 μg/L for vinyl chloride and a recommendation was made in the fourth FYR to adopt the lower PQLs. However, based on the LTM reports, the achievable lower PQL was not used during this FYR period. The PQL used over the last 5 years for vinyl chloride is equal to the ROD RG of 0.5 μg/L which is associated with a risk of 2×10^{-5} (i.e., exceeding the ROD target risk goals, but within EPA's target range). LUCs are in place to prevent groundwater use as drinking water; therefore, the remedy remains protective with ROD RGs for the groundwater COCs.

The second FYR recommended the addition of 1,4-dioxane to the groundwater analyte list because of its potential to be present in chlorinated solvent plumes. There is no RG established in the ROD for 1,4-dioxane. The 2012 CRA Plan (U.S. Navy, 2012i) reported the MTCA Method B value of 0.44 μg/L as a screening level and provided a trigger action matrix for detections of 1,4-dioxane. The current MTCA Method B value, as shown in Table 5-2, remains unchanged.

Surface Water. Table 5-2 also compares modified standards for surface water (as of February 2020) with those in the OU 1 ROD (U.S. Navy, EPA, and Ecology, 1998; Table 11-5). Based on the current MTCA Method B values, the RG for TCE would decrease from 56 to 13 μg/L. MTCA Method B values for the other COCs have either remained the same or increased.

Since the fourth FYR (U.S. Navy, 2015b), Washington State published water quality criteria protective of human health in WAC 173-201A. EPA approved of some of these Washington criteria and promulgated them in the Federal water quality criteria applicable to Washington State in 40 CFR 131.45. The Washington State criteria for the COCs listed in Table 5-2 were not approved by EPA and therefore, the modified standard would be the Federal water quality criteria listed under 40 CFR 131.45 in Table 5-2. EPA is currently in the process of proposing to amend the federal regulations to withdraw certain human health criteria applicable to waters in Washington State. If these Federal water quality criteria are withdrawn, then the State criteria take precedence. The outcome of this pending action will be reviewed during the next FYR period.

Table 5-2. Groundwater and Surface Water ARARs for OU 1

	Drinking Water (µg/L)						Surface Water Protection (Marine) (µg/L)						
			Current Values					Current Values[e]					
Chemical	ROD RG[a]	Basis of ROD RG	MTCA Method B[b]	Federal and State MCL	PQL	Change in RG if Established Today?	ROD RG Based on MTCA Method B Surface Water[a]	MTCA Method B[b]	National WQC CWA §304	State WQC 173-201A WAC[c]	Federal WQC 40 CFR 131.45[d]	PQL	Change in RG if Established Today?
1,1-DCA	800	MTCA B	7.7	None	NA	Yes, lower (MTCA)	NA	NA	NA	NA	NA	NA	NA
1,2-DCA	5	MCL	0.48	5	NA	No (MCL); Yes, lower (MTCA)	59	59	650	120	73	NA	No (MTCA)
1,1-DCE	0.5	PQL	400	7	0.02	Yes, higher (MCL)	1.9	23,000	20,000	4,100	4,000	NA	Yes, higher
cis-1,2-DCE[f]	70	MCL	16	70	NA	No (MCL); Yes, lower (MTCA)	NA	NA	NA	NA	NA	NA	NA
trans-1,2-DCE	100	MCL	160	100	NA	No (MCL)	33,000	33,000	4,000	5,800	1,000	NA	Yes, lower (federal WQC)
PCE[g]	5	MCL	5	5	NA	No (MCL)	4.2	100	29	7.1	2.9	NA	Yes, lower (federal WQC)
1,1,1-TCA	200	MCL	16,000	200	NA	No (MCL)	41,700	930,000	200,000	160,000	50,000	NA	Yes, higher
TCE[h]	5	MCL	4	5	NA	No (MCL); Yes, lower (MTCA)	56	13	7	0.86	0.70	NA	Yes, lower (federal WQC)
Vinyl chloride	0.5	PQL	0.029	2	0.02	Yes, lower (MTCA/PQL)	2.9	3.7	1.6	0.26	0.18	NA	Yes, lower (federal WQC)
PCBs	0.04	PQL	0.044	0.5	0.01-0.005	Yes (MTCA/PQL)	PQL: 0.04	0.0001	0.000064	0.00017	0.000007	0.01-0.005	Yes (PQL)
1,4-Dioxane[i]	None	NA	0.44	None	NA	NA	NA	NA	NA	NA	NA	NA	NA

a. Source: ROD Table 11-4 for groundwater and Table 11-5 for surface water (U.S. Navy, EPA, and Ecology, 1998).

b. MTCA Method A levels as reported in the Cleanup Levels and Risk Calculation (CLARC) Master Table dated June 26, 2019. CLARC cleanup levels for hazardous waste sites comply with the Model Toxics Control Act (MTCA) Cleanup Regulation, chapter 173-340 WAC as provided in Ecology, 2013.

c. 173-201A WAC, Table 240. Permanent ruling in August 2016 and last updated January 2019. Based on a much higher consumption rate of 175 g/day compared to a MTCA Method B consumption rate of 54 g/day: https://apps.leg.wa.gov/WAC/default.aspx?cite=173-201A-240.

d. Because EPA approved the corresponding water quality criteria adopted by Washington that meet the requirements of the CWA and EPA's implementing regulations at 40 CFR part 131, the EPA is now proposing a rulemaking to withdraw these corresponding federal criteria applicable to Washington. The withdrawal, once finalized, will enable Washington to implement its EPA-approved human health criteria, submitted on August 1, 2016, and approved on May 10, 2019, as applicable criteria for CWA purposes.

e. Derived for human health for the consumption of organism only.

f. In accordance with WAC 173-340-720(3)(a) and 173-340-720(7)(b), the MCL for cis-1,2-DCE is not sufficiently protective when compared to the current MTCA B drinking water values. Therefore, the MCL would no longer be acceptable if cleanup levels were to be established today, i.e., the non-cancer hazard level of the MCL would exceed hazard index of 1.

g. Because the MCL does not exceed a hazard quotient of 1 or a cancer risk of 1 x 10^{-5}, the MCL can be selected as the Method B ground water cleanup level [WAC 173-340-720 (7) (b)]. Thus, the MTCA groundwater cleanup levels are based on the MCL for PCE of 5 µg/L.

h. Normally, under MTCA, Ecology would use the MCL of 5 µg/L for TCE as the Method B cleanup level. However, in this case, the new toxicity information indicates the MCL exceeds a hazard quotient of 1. Therefore, under WAC 173-340-720 (7)(b), the MCL must be adjusted downward to 4 ug/L, so that the Method B cleanup level will not exceed a hazard quotient of 1. Thus, 4 ug/L is selected as the Method B groundwater cleanup level instead of the standard risk-based MTCA Method B value of 0.54 µg/L (Ecology, 2019b).

i. The chemical was identified as a potential chemical of concern in the second FYR; therefore, no ROD RG was established.

Notes:
WQC – water quality criteria
DCA – dichloroethane
DCE – dichloroethene
MCL – maximum contaminant level
µg/L – microgram per liter
MTCA – Model Toxics Control Act
PCBs – polychlorinated biphenyls
PCE – tetrachloroethene
PQL –- practical quantitation limit
RG – remedial goal
ROD – Record of Decision
TCA – trichloroethane
TCE – trichloroethene

The RGs for trans-1,2-DCE, PCE, TCE, and vinyl chloride are based on MTCA Method B values for consumption of organisms from surface water. The other surface water ARARs shown in Table 5-2, also are based on consumption of organisms from water. Values differ across regulatory programs based on the values of the exposure input parameters, in particular, the consumption rate. Differences in consumption rates are discussed in Section 5.4.2.2.

As shown in Table 5-2, trans-1,2-DCE, PCE, TCE, and vinyl chloride would have lower or more stringent surface water ARARs if selected today. Based on the most recent surface water sampling results from 2017 (U.S. Navy, 2018b):

- The maximum concentration of trans-1,2-DCE detected (at 47.2 JD μg/L) is significantly less than the RG of 33,000 μg/L and federal water quality criteria of 1,000 μg/L; therefore, the lower ARAR does not impact the protectiveness of the remedy with regard to trans-1,2-DCE.
- PCE concentrations were not detected above the LOD; thus, the lower ARAR does not impact the protectiveness of the remedy with regard to PCE.
- Concentrations of TCE detected in five of the 12 surface water samples exceeded the RG of 56 μg/L, and concentrations of TCE in all surface water samples were greater than the federal water quality criterion of 0.70 μg/L.
- Concentrations of vinyl chloride detected in nine of the 12 surface water samples exceeded the RG of 2.9 μg/L, and concentrations of vinyl chloride in all surface water samples were greater than the federal water quality criterion of 0.18 μg/L.

For PCBs, the surface water RG is based on the PQL (i.e., 0.04 μg/L), not a MTCA or water quality criterion, which are both orders of magnitude lower. The maximum detected value remains above the RG (see Appendices C and D). Therefore, using a method to achieve a lower PQL is premature at this time. However, once concentrations reduce below the PQL, a revised method should be evaluated for future sampling to meet a human health risk-based value.

The remedy remains protective in the short term for human receptors while the source area investigations of the elevated VOCs, 1,4-dioxane, and PCBs concentrations continue, because the tide flats are currently closed by WDOH to harvesting and consuming shellfish by recreational and subsistence fishers. Note that the Suquamish Tribe has treaty reserved rights to harvest and maintain the authority to determine harvest practices for tribal members. For ecological receptors, exposures to PCBs in surface water are limited to the immediate vicinity of station MA-09, and as discussed below for sediment, the remedy is protective in the short term while source area investigations continue. For ecological exposures to VOCs in surface water, adverse impacts to organisms are expected to be minimal because VOCs are more likely to volatilize to the atmosphere, and because VOCs are not bioaccumulative (WAC 173-333-310), so adverse impacts through the food chain will not occur. Therefore, the remedy is protective in the short term while source area investigations continue. An update of the human health and ecological risk assessments is being conducted and will incorporate the results of the source area investigations. If ongoing investigations or the planned update of the HHRA and ERA identify a current or future unacceptable human health or ecological risk, then the existing CSM will be updated and alternative remedial actions to address contamination will be evaluated.

Sediment. The OU 1 ROD established RGs for the nine VOCs identified as COCs and for PCBs (U.S. Navy, EPA, and Ecology, 1998; Table 11-6). The RGs were based on the Washington State 1995 SMS, which include SQS criteria for the protection of the benthic community and performance of bioassays if the chemical result failed the SQS criterion. The OU 1 ROD also identified pesticides, SVOCs, and metals as sediment contaminants of interest (COIs) to be included in the LTM program to monitor ecological risks posed by potential migration of landfill contaminants. Although RGs were not established in the OU 1 ROD for COIs, COI data have been historically compared to current SMS criteria.

As addressed in the fourth FYR (U.S. Navy, 2015b), the Sediment Management Standard (SMS) was revised in September 2013, including an updated cleanup decision framework to address bioaccumulative chemicals (e.g., PCBs) that pose risks to human health and higher trophic level species. The risks to humans and higher trophic levels occur primarily through consumption of fish/shellfish. Under the revised SMS, the SQS criterion protective of the benthic community for PCBs remains 12 mg/kg. For the protection of human health and higher trophic level species, the revised SMS offers options of back calculating risk-based sediment criteria from tissue concentrations. Alternatively, for sites where it is expected that risk-based sediment concentrations would be below background, which is the case for most bioaccumulative carcinogenic chemicals, cleanup levels can be established at background (natural or regional, respectively) or the PQL, whichever value is higher.

To assess whether exposure to PCBs in sediment samples may be associated with adverse health effects, the Sediment Cleanup User’s Manual II (SCUM II) guidance (Ecology, 2019a), which is the guidance document for implementing the cleanup provisions of the SMS (Chapter 173-204 WAC), provides different approaches, depending on available data. For instance, under Option 1, it is assumed that risk-based sediment concentrations based on the consumption of fish/shellfish exposure pathway by humans are below background concentrations and because it is not feasible to clean up below background concentrations, Option 1, Part 1, represents a simpler, more practical, and protective approach (Ecology, 2019a). Although there is not an established regional background data set for Liberty Bay, the measured PCB concentrations can be compared to the BOLD data set as Ecology has determined it to be appropriate to establish natural background for marine sediment (Ecology, 2019a).

To support review of ROD risk assumptions in light of the 2013 promulgation of Ecology's revised SMS and recommendations provided in the fourth FYR (U.S. Navy, 2015b), sediment samples were collected in the vicinity of seep SP1-1 during the Phase II investigation. The data are used to assess whether expanded, ongoing PCB monitoring should be initiated, and risk assumptions reviewed. For human health risk, the 2017 sediment data were compared to natural background for marine sediment and indicated the potential for adverse risk at all sediment sampling locations (i.e., sediment concentrations exceeded background). Source investigation data will be used in the ongoing HHRA/ERA to conduct a more detailed risk evaluation for exposure to sediment at these locations. In the interim, the tide flats are not currently open by WDOH for harvesting and consuming shellfish by recreational and subsistence fishers; therefore, the remedy remains protective in the short term. Note that the Suquamish Tribe has treaty reserved rights to harvest and maintain the authority to determine harvest practices for tribal members.

For ecological risk based on the PCB sediment results, the 2017 and 2019 data indicated a limited area of sediments where minor adverse effects to the benthic community could occur in the vicinity of station MA-09, but no adverse effects are predicted for the rest of the area. To assess bioaccumulative exposures, sediment concentrations observed in Marsh Creek sediment were averaged on an area-weighted basis for comparison to the natural background value following the evaluation options provided in the SCUM II. The area-weighted dioxin-like PCB congener toxicity equivalence (TEQ) exceeded the natural background upper tolerance limit of 0.2 ng/kg for marine sediment in Washington State (Ecology, 2019a). These findings are consistent with those of the ROD, which identified station MA-09 as exhibiting the highest PCB concentrations, and the only concentrations exceeding the SQS at the time. The 2017 PCB concentrations at station MA-09 are nearly equal to the pre-ROD concentrations at this station, prior to the sediment removal action. The measured concentrations could be residual pre-ROD concentrations, given the selective nature of the sediment removal to protect root systems. Because the highest current PCB concentrations are not higher than those found at the time of the ROD and are limited to the immediate vicinity of station MA-09, the remedy remains protective in the short term. Source investigation data will be used to conduct a more detailed ERA.

Clam Tissue. Clam tissue RGs were established for the nine VOCs identified as COCs and for PCBs. Because VOCs were never detected in clam tissue, VOCs were removed from the analyte list and their RGs are no longer included for review. The RG for PCBs of 0.015 mg/kg was a site-specific risk-based level protective of subsistence consumption of clams. PCBs were not detected in clam tissue above the RG of 0.015 mg/kg in the 2004 and 2009 monitoring events; therefore, tissue analysis was discontinued after 2009 based on regulator-approved recommendations in the third FYR.

During this FYR period, clam samples were collected from a single monitoring station (i.e., TF21) within the tide flats as reported in the 2017 LTM Report (U.S. Navy, 2018d). No PCB Aroclors were detected in TF21 marine (clam) tissue above the respective PQLs for each Aroclor. The PQLs ranged from 10 µg/kg to 15 µg/kg, all below or equal to the RG of 0.015 mg/kg (i.e., for the seafood ingestion pathway).

The PCB RG for clam tissue was established as a risk-based level protective of subsistence harvesters using a consumption rate of 92 grams per day (g/day). This consumption rate is much lower than what is expected today for the Suquamish Tribe consumption rate. In consultation with the Suquamish Tribe and stakeholders, it was decided that a shellfish consumption rate of 498.4 g/day better represents tribal members consumption of shellfish. If this higher consumption rate better reflects the Suquamish population potentially at risk, a revised site-specific RG if calculated today using the original exposure assumptions included in Appendix B, Table B-1 of the OU 1 ROD (along with the higher Suquamish-specific consumption rate) would be much lower at 0.0028 mg/kg. This revised RG cannot be compared to the historical clam data, as the PQLs are higher. Source investigation data and Suquamish-specific shellfish consumption rate will be used in the ongoing HHRA to evaluate the risk to subsistence fishers from consumption of shellfish. In the interim, the tide flats are currently not open by WDOH for harvesting or consuming shellfish; therefore, the remedy remains protective in the short term. Note that the Suquamish Tribe has treaty reserved rights to harvest and maintain the authority to determine harvest practices for tribal members.

Additional information regarding exposure assumptions (shellfish consumption rate) are reviewed in Section 5.4.2.2.

OU 2 Area 2

ARARs used to establish cleanup levels in the OU 2 ROD (U.S. Navy, EPA, and Ecology, 1994) and comparison to current ARARs are provided in Table 5-3. OU 2 Area 2 COCs are TCE and vinyl chloride in groundwater only, and RGs are based on human consumption of groundwater for potable water purposes. There have been no changes to the groundwater ARARs during this FYR period. As shown in Table 5-3, the RG for TCE was established as the MCL (i.e., 5 µg/L), and there has been no change. For vinyl chloride, the RG was established as the MTCA Method B cleanup level of 0.023 µg/L, which at the time, was below the PQL of standard EPA methods for drinking water. In such a case, the MTCA B cleanup level was based on the PQL (per WAC 173-340-700[6]) and the expected PQL was 0.1 µg/L. In 2012, the RG for vinyl chloride was updated to 0.029 µg/L based on the calculated MTCA B cleanup level using the current oral slope factor. Using improved analytical techniques (e.g., EPA Method 8260C-SIM), the PQL has been below this updated RG of 0.029 µg/L since June 2012. From 1995 through 2019, vinyl chloride concentrations in monitoring well 2MW-6 have consistently been above the RG of 0.029 μg/L. Although the RG continues to be exceeded for vinyl chloride in groundwater, LUCs are implemented and maintained, restricting groundwater use for potable water purposes. Therefore, the remedy remains protective in the short term.

OU 2 Area 8

The OU 2 ROD (U.S. Navy, EPA, and Ecology, 1994) identified three COCs in OU 2 Area 8 soil based on residential land use: arsenic, cadmium (if ingested in homegrown produce), and chromium. However, arsenic concentrations were considered at or below background for soil and groundwater. In OU 2 Area 8 groundwater, the risk assessment identified cadmium, chromium, and TCE as COCs with HQs greater than 1 and five additional COCs (i.e., carbon tetrachloride, chloroform, 1,2-DCA, 1,1-DCE, and 1,1,2-TCA) with cancer risks exceeding 1×10^{-5}, if shallow groundwater was used for drinking water. The current analyte list for ongoing LTM includes selected metals and VOCs related to TCE and its breakdown products. A comparison of the ROD RGs with current ARARs and changes to values that may impact the protectiveness of the remedy are discussed by media in the sections below.

Soil. Cadmium and chromium (total chromium concentrations were assumed to be 100 percent hexavalent chromium per the OU 2 Area 8 Explanation of Significant Differences ESD) RGs of 80 and 400 mg/kg, respectively, were based on MTCA Method B (U.S. Navy, EPA, and Ecology, 1994). The current MTCA Method B soil values are 80 mg/kg for cadmium (i.e., remains the same) and 240 mg/kg for hexavalent chromium (i.e., lower). As demonstrated in the fourth FYR (U.S. Navy, 2015b), the lower hexavalent chromium value called into question the protectiveness of the remedy. However, LUCs are in place that restrict residential land use; therefore, the remedy remains protective in the short term. Action would be required in the future if the land is converted to residential land use, and a process is in place through LUC management to trigger such action.

Groundwater. Table 5-3 compares current groundwater ARARs with those presented in the OU 2 ROD (U.S. Navy, EPA, and Ecology, 1994; Table 10-12). The modified standards have not changed during this FYR period. As discussed in the fourth FYR (U.S. Navy, 2015b), lower drinking water ARARs were noted for hexavalent chromium, cis-1,2-DCE, and TCE. Although no cleanup level was established in the ROD for 1,4-dioxane, it was added to the LTM program in 2011. At the time of initial sampling in 2007, the MTCA Method B value was 4 µg/L – it is currently 0.44 µg/L. During this FYR period, concentrations of TCE, PCE, and 1,4-dioxane were detected above the RG and MTCA Method B cleanup levels (U.S. Navy, 2019b). However, LUCs are in place that prevent groundwater use as drinking water; therefore, the remedy remains protective in the short term.

Surface Water. Because OU 2 Area 8 groundwater discharges into Port Orchard Bay, there is a potential for chemical migration from groundwater to the marine environment. Therefore, Table 5-3 also compares modified standards for surface water (as of February 2020) with those selected in the OU 2 ROD (U.S. Navy, EPA, and Ecology, 1994; Table 10-12). The RGs for trivalent chromium and 1,1,1-TCA are based on MTCA Method B values for consumption of organisms from surface water. Current MTCA B values are greater than the RGs. The RGs for cadmium and hexavalent chromium are based on the National water quality criterion (WQC) for aquatic life and these values have not changed since the ROD. For the remaining COCs (i.e., 1,1-DCE, PCE, and TCE), the surface water RGs were based on the National WQC for protection of human health. The National WQC for human health for TCE was the only criterion to decrease since the ROD. The other two values have increased since the ROD RGs were selected.

Table 5-3. Groundwater ARARs for OU 2

	Drinking Water (µg/L)						Surface Water (Marine) (µg/L)						
			Current Values						Current Values				
Chemical	**ROD Drinking Water Cleanup Level**	**Basis of Cleanup Level**	**MTCA B[a]**	**Federal MCL**	**State MCL**	**Change in Cleanup Level if Established Today?**	**ROD Surface Water Cleanup Level**	**Basis of Cleanup Level**	**MTCA B[a]**	**National WQC CWA §304**	**State WQC 173-201A WAC**	**Federal WQC 40 CFR 131.45[e]**	**Change in Cleanup Level if Established Today?**
Area 2													
TCE[b]	5	MCL	4	5	5	No (MCL); Yes, lower (MTCA)	NA	NA	NA	NA	NA	NA	NA
Vinyl chloride	1	PQL	0.029	2	2	Yes, lower (MTCA)	NA	NA	NA	NA	NA	NA	NA
Area 8													
Cadmium	5	Federal MCL	8	5	5	No	8	National WQC (Aquatic Life)	41	7.9 (Aquatic Life)	9.3 (Aquatic Life)	None	Yes, higher
Trivalent chromium	16,000	MTCA B	24,000	None	None	Yes, higher	160,000	MTCA B	240,000	None	None	None	Yes, higher
Hexavalent chromium	80	MTCA B	48	None	None	Yes, lower	50	National WQC (Aquatic Life)	490	50 (Aquatic Life)	50 (Aquatic Life)	None	No
Chromium (total)	50	State MCL	None	100	100	Yes, higher	NA	NA	NA	NA	NA	NA	NA
1,1-DCE	7	MCL	400	7	7	No	3.2	National WQC (HH)	23,000	20,000 (HH)	4100 (HH)	4,000 (HH)	Yes, higher
cis-1,2-DCE[c]	70	MCL	16	70	70	No (MCL); Yes, lower (MTCA)	NA	NA	NA	NA	NA	NA	NA
PCE[d]	5	MCL	21	5	5	No	8.9	National WQC (HH)	100	29 (HH)	7.1 (HH)	2.9 (HH)	Yes, lower
1,1,1-TCA	200	MCL	16,000	200	200	No	42,000	MTCA B	930,000	200,000 (HH)	160,000 (HH)	50,000 (HH)	Yes, higher
TCE[b]	5	MCL	4	5	5	No (MCL); Yes, lower (MTCA)	81	National WQC (HH)	13 (HH)	7 (HH)	0.86 (HH)	0.70 (HH)	Yes, lower

a. MTCA Method A levels as reported in the Cleanup Levels and Risk Calculation (CLARC) Master Table dated June 26, 2019. CLARC cleanup levels for hazardous waste sites comply with the Model Toxics Control Act (MTCA) Cleanup Regulation, chapter 173-340 WAC as provided in Ecology, 2013.
b. Normally, under MTCA, Ecology would use the MCL of 5 µg/L for TCE as the Method B cleanup level. However, in this case, the new toxicity information indicates the MCL exceeds a hazard quotient of 1. Therefore, under WAC 173-340-720 (7)(b), the MCL must be adjusted downward to 4 ug/L, so that the Method B cleanup level will not exceed a hazard quotient of 1. Thus, 4 ug/L is selected as the Method B groundwater cleanup level instead of the standard risk-based MTCA Method B value of 0.54 µg/L (Ecology, 2019b).
c. In accordance with WAC 173-340-720(3)(a) and 173-340-720(7)(b), the MCL for cis-1,2-DCE is not sufficiently protective when compared to the current MTCA B drinking water values. Therefore, the MCL would no longer be acceptable if cleanup levels were to be established today, i.e., the non-cancer hazard level of the MCL would exceed hazard index of 1.
d. Because the MCL does not exceed a hazard quotient of 1 or a cancer risk of 1 x 10^{-5}, the MCL can be selected as the Method B ground water cleanup level [WAC 173-340-720 (7) (b)]. Thus, the MTCA groundwater cleanup levels are based on the MCL for PCE of 5 µg/L.
e. Because EPA approved the corresponding water quality criteria adopted by Washington that meet the requirements of the CWA and EPA's implementing regulations at 40 CFR part 131, the EPA is now proposing a rulemaking to withdraw these corresponding federal criteria applicable to Washington. The withdrawal, once finalized, will enable Washington to implement its EPA-approved human health criteria, submitted on August 1, 2016, and approved on May 10, 2019, as applicable criteria for CWA purposes.

Notes:
WQC – water quality criteria
DCE – dichloroethene
HH – the WQC based on human ingestion of fish in the water body
MCL – maximum contaminant level
µg/L – microgram per liter
MC – marine chronic
MTCA – Model Toxics Control Act
PCE – tetrachloroethene
ROD – Record of Decision
TCA – trichloroethane
TCE – trichloroethene
NA – not applicable
WQC – water quality criteria

Since the fourth FYR, Washington State published WQC protective of human health in WAC 173-201A. EPA approved of some of these Washington State criteria and promulgated them in the Federal WQC applicable to Washington State in 40 CFR 131.45. The Washington State criteria for the COCs listed in Table 5-3 were not approved by EPA and therefore, the modified standard would be the Federal WQC listed under 40 CFR 131.45 in Table 5-3. EPA is currently in the process of proposing to amend the federal regulations to withdraw certain human health criteria applicable to waters in Washington State and, if these Federal WQC are withdrawn then the State criteria take precedence. The outcome of this pending action should be reviewed during the next FYR.

In summary, if selected today, the RGs would be higher for 1,1-DCE (4,000 µg/L) and 1,1,1-TCA (50,000 µg/L), and would be lower for PCE (2.9 µg/L) and TCE (0.70 µg/L). Surface water ARARs based on consumption of organisms from water differ across regulatory programs based on the values of the exposure input parameters, in particular, the consumption rate. Differences in consumption rates are discussed below in Section 5.5.2.2. Concentrations of PCE and TCE observed in groundwater monitoring wells and seep water samples collected during this FYR period are below their RGs (U.S. Navy, 2019b). However, concentrations of TCE in groundwater and seep water samples were above the current Federal WQC in samples collected during this FYR period. Clam tissue samples were collected in 2015 and 2016 but were not analyzed for the VOC COCs because these VOCs are not listed as bioaccumulative contaminants in WAC 173-333-310 or have log octanol-water partitioning coefficients greater than 3.5 (log $K_{ow} > 3.5$). Although TCE exceeds the current Federal WQC, this does not necessarily indicate there is a potential risk associated with consumption of clams. Nevertheless, current WDOH restrictions prohibit the harvesting of shellfish from Port Orchard Bay; therefore, the remedy remains protective. Note that the Suquamish Tribe has treaty reserved rights to harvest and maintain the authority to determine harvest practices for tribal members.

Sediment. As discussed previously, the SMS was revised in September 2013, with an expanded emphasis on assessing human health risks. No numerical sediment RGs were established in the ROD. The results of the LTM sediment and tissue sampling have been used to assess human health and ecological risks from exposure to marine sediment and tissue. Based on LTM sediment concentrations exceeding risk-based screening levels and recommendations in the third and fourth FYRs, an HHRA/ERA was conducted in 2018 utilizing sediment and clam tissue data obtained in 2015 and 2016. The HHRA/ERA (U.S. Navy, 2018a) was developed in collaboration with the EPA, Ecology and Suquamish Tribe project managers and performed in accordance with an approved HHRA/ERA Work Plan (U.S. Navy, 2016c). The HHRA concluded that despite the presence of several COCs in Area 8 beach sediment and clam tissue samples at concentrations exceeding background and reference area concentrations, the incremental site risk over reference area risk for Suquamish subsistence and recreational receptors met target health goals. As such, the project team agreed that no additional investigation or contingent actions, such as groundwater controls, were necessary to protect human health.

Likewise, the ERA found no significant hazards to free-swimming aquatic life, semi-aquatic birds, or mammals; therefore, contingent actions, such as groundwater controls, are not necessary to protect these higher trophic receptor groups. Existing lines of evidence suggested that the hazards to benthic organisms were likely low, despite localized elevated concentrations of selected metals (i.e., cadmium, mercury, and silver) in seeps and sediment. Ecology's SMS regulation and the ROD allow the use of bioassay analysis in cases where chemical concentrations in sediment samples exceed the published numeric standards, To ensure OU 2 Area 8 COCs do not pose a hazard to benthic organisms on the Area 8 beach, additional seep and sediment bioassay data were collected in 2019. As reported in the ERA Addendum (U.S. Navy, 2019d), the additional bioassay data collected at Seep C using mussels as an indicator species demonstrate that seep water COCs do not pose a hazard to benthic organisms. However, acute exposure to accumulated contaminants in sediment pose a potential hazard to benthic organisms based on the bioassay results for larval mussels at two locations. In addition, chronic exposure to accumulated contaminants in sediment pose a potential hazard to benthic organisms based on the bioassay endpoints of both reduced survival and growth for juvenile polychaetes at two locations.

Therefore, elevated cadmium concentrations occur in sediment, and because acute and chronic exposure to accumulated contaminants in sediment pose a potential hazard to benthic organisms based on the bioassay results/endpoints, additional or contingent actions (to be conducted as part of the selected remedy) are planned and will be performed to ensure protectiveness.

5.4.2 Review of Human Health Risk Assessment Assumptions

Risk assessment assumptions were also reviewed as part of the requirement to assess protectiveness of the remedy. For human health, there are potentially four areas where changes could have occurred since the signing of the RODs: 1) COC toxicity or contaminant characteristics; 2) risk assessment methodology, including exposure assumptions; 3) changes in exposure pathways; and 4) new contaminants or contaminant sources. The following subsection discuss how these changes affect the protectiveness of the remedy.

5.4.2.1 Changes in Toxicity and Other Contaminant Characteristics

There have been changes in oral cancer and non-cancer toxicity criteria since the RODs were signed; however, these changes were captured during the completion of the fourth FYR (U.S. Navy, 2015b) and highlighted as reasons for differences between ROD and current MTCA Method B values. There have been no changes to oral cancer and non-cancer toxicity criteria associated with site COCs during this FYR period.

Cancer and non-cancer inhalation toxicity criteria for COCs in OU 2 Area 8 undergoing VI evaluation have not changed based on an evaluation of the MTCA Method C air criteria selected as PALs in the 2017 and 2019 VI SAPs (U.S. Navy, 2017c, 2019e, and 2019f) to current MTCA Method C air criteria provided in the May 2019 CLARC tables (Ecology, 2019b). Note however, that the current CLARC tables are rounded to two significant figures compared to earlier versions of the CLARC tables.

5.4.2.2 Changes in Risk Assessment Methods

For OU 1, the RG for PCBs in tissue was calculated during ROD preparation as a site-specific, risk-based level protective of subsistence-level ingestion of clams, using a subsistence shellfish consumption rate of 92 g/day. More recently however, a subsistence shellfish consumption rate was determined specifically for the Suquamish Tribe and used in the recently completed risk assessment for OU 2 Area 8. A fish consumption study conducted by the Suquamish Tribe for its members presented seafood consumption rates for all the species that tribal members reported they consume, which included over 45 different species in seven broad seafood groups (Suquamish Tribe, 2000; Table T-3). In consultation with the Suquamish Tribe and stakeholders, it was decided that the 95th percentile consumption rates for adults and children from this study for shellfish Groups E and G would be used in the OU 2 Area 8 HHRA. For adults, EPA modified the 95th percentile shellfish consumption rate from the rate in the Suquamish Tribe's report (615.4 grams per day [g/day]) to include only species harvested from Puget Sound. Therefore, the EPA-modified value, 498.4 g/day (65 percent of total consumed seafood) from the EPA Framework document (EPA, 2007b, Appendix B, Table B-2), was used in the HHRA as the appropriate adult seafood consumption rate for a Puget Sound location. For children, the 95th percentile shellfish ingestion rate of 83.9 g/day was calculated using the all-shellfish tribal consumption rate of 4.994 grams per kilogram day (g/kg-day) and the tribe-specific body weight of 16.8 kilograms (kg) (Suquamish Tribe, 2000; Table C-6) was used.

If the OU 1 RGs for tissue are revised based on the planned upcoming HHRA (which would require a ROD Amendment or ESD), other exposure parameters used in the development of the OU 1 RGs will be updated to be consistent with the following exposure parameters used in the OU 2 Area 8 HHRA shellfish consumption exposure scenario:

Parameter	OU 1 ROD RG Value	OU 2 Area 8 HHRA Value
Fraction ingested from contaminated source	0.25 (unitless)	1 (unitless)
Exposure duration	70 years	64 years (adult) 6 years (child)
Body weight	70 kilogram (adult)	79 kilogram (adult) 16.8 kilogram (child)

Updates to the exposure parameters would result in a lower RG for PCBs at OU 1; however, there are currently WDOH restrictions in place that prohibit the harvesting of shellfish; therefore, the remedy remains protective in the short term. Note that the Suquamish Tribe has treaty reserved rights to harvest and maintain the authority to determine harvest practices for tribal members.

Currently, additional data are being collected for the OU 1 source area investigations that will be used in the ongoing HHRA and ERA. As the HHRA/ERA work plan was developed for OU 2 Area 8 in collaboration with the project team, this work plan should be followed for OU 1 to the extent practical, such that evaluations are performed consistently across OUs at NBK Keyport.

5.4.2.3 Changes in Exposure Pathways

Evaluations of the VI pathway were performed at the former landfill area along Bradley road in the late 1980s and early 1990s as part of the OU 1 RI. The VI pathway was reassessed for the former landfill area as part of the fourth FYR using historical indoor air, soil gas, and groundwater data collected in 1990 and 1991. Based on review of the historical indoor air, soil gas, and groundwater data, the COC concentrations would exceed today’s screening levels. However, because LUCs are in place that prevent occupied building on the former landfill, there are no human receptors. Therefore, the VI pathway above the landfill and along Bradley Road is incomplete.

A VI evaluation had not been previously conducted in the buildings east of Bradley Road, even though historically high soil gas concentrations were found at a location near Building 883. Therefore, an evaluation of the VI pathway east of Bradley road was recommended in the fourth FYR (U.S. Navy, 2015b) because the protectiveness of the remedy with regard to building occupancy in this area could be impacted.

This VI study was conducted in March and July 2018 at buildings east and northeast of Bradley Road (U.S. Navy, 2019a).

The results of the OU 1 VI study indicated that contaminants associated with the former landfill do not present an unacceptable risk to industrial workers via the VI pathway in the buildings east and northeast of Bradley Road, based on current industrial use. Therefore, the remedy remains protective.

5.4.2.4 New Contaminants or Contaminant Sources

Although PFAS has been detected in groundwater at OU 1 and OU 2 Area 8 during this FYR period, there have been no new human health pathways identified for exposure to occur as long as LUCs restricting groundwater use for drinking water are maintained. The Navy is currently progressing through the CERCLA process for this COC, and data are still being collected to assess:

- The nature and extent of PFAS at NBK Keyport
- Potential/new migration pathways
- Potential effects of PFAS on ecological receptors
- Potential risks to human health via a seafood ingestion pathway
- The cumulative risk of PFAS and other COCs present at the OUs

For OU 1, PFAS compounds were detected in 2017 and 2019 (see Appendix D). However, individual PFAS concentrations and PFOA plus PFOS concentrations were less than the LHA of 70 ng/L in all monitoring wells in 2017 and 2019.

For OU 2 Area 8, groundwater samples were collected and analyzed for PFAS compounds from seven monitoring wells in 2018 and 2019 (see Appendix G). PFOA plus PFOS concentrations were detected above the LHA of 70 ng/L in two monitoring wells (i.e., MW8-11 at 74 ng/L and MW8-12 at 77 M ng/L) in 2018. Individual PFAS and PFOA plus PFOS concentrations were below the LHA in all monitoring wells in 2019. PFBS was detected in five of the seven groundwater samples at concentrations between 0.77 and 4.7 ng/L, which are well below the EPA RSL of 400,000 ng/L.

An estimated screening level non-cancer HQ is provided as part of this FYR for informational purposes to preliminarily assess remedy protectiveness as it relates to the recently discovered presence of PFAS in groundwater. The estimate of the non-cancer HQ was calculated using a risk ratio comparison wherein the maximum PFOA plus PFOS concentration detected of 77 ng/L was divided by the EPA risk-based screening value of 400 ng/L. This risk-based screening value was derived using EPA RSL Calculator (available at https://epa-prgs.ornl.gov/cgibin/chemicals/csl_search) based on a standard residential tap water use scenario for an adult and child. The RSL calculator includes the toxicity value used in the derivation of the 2016 LHA (i.e., the chronic oral reference dose of 0.00002 mg/kg-day). The estimated HQ is 0.2, less than EPA's acceptable target HQ of 1 for noncarcinogens, indicating no non-cancer effects associated with daily consumption of groundwater. PFAS will be evaluated further as part of a U.S. Navy-wide program to assess its installations for areas where PFAS-containing materials, such as aqueous film forming foam (AFFF), are suspected to have been stored, used or released to the environment. As such, the U.S. Navy is in the process of completing a PA (and will begin a SI) at NBK Keyport.

5.4.3 Review of Ecological Risk Assessment Assumptions

The recent ERA conducted for OU 2 Area 8 (U.S. Navy, 2019d) did not utilize the exposure factors from the original baseline risk assessments (as stipulated by the OU 2 ROD) because new information and activities completed at the Area 8 beach affected how the current risk assessment evaluated tissue and sediment results and quantified risk. Information and revised methods of evaluating environmental media contained in the 2013 revised SMS and in the SCUM II manual were incorporated into the recent ERA for OU 2 Area 8 (since these rules are ARARs in the ROD), in addition to updates that have occurred to federal and state ERA guidance, guidelines, and policy since the OU 2 ROD. A risk assessment work plan was developed for OU 2 Area 8 in collaboration with site stakeholders; therefore, any future ERAs conducted at NBK Keyport will utilize this work plan to the extent practical, such that risk assessments are performed consistently across OUs.

5.5 Any Other Information That Could Call into Question the Protectiveness of the Remedy (Question C)

5.5.1 Chemicals of Emerging Concern

The U.S. Navy recognizes PFAS compounds as chemicals of emerging concern. These substances may be present in the soil and/or groundwater at U.S. Navy sites as a result of historical firefighting activities using AFFF, in additional to other common industrial uses. AFFF was used for plane crashes, equipment testing, and training, as well as in other operations such as hangars where AFFF was used in the fire suppression system and plating shops were AAAF was used as a vapor suppressant on plating baths. As such, the U.S. Navy is in the process of completing a PA (and will begin a SI) at NBK Keyport, as part of the U.S. Navy-wide program to assess its installations for areas where PFAS is suspected to have been stored, used, or released to the environment. The results of the PFAS PA/SI will be addressed in the next FYR for NBK Keyport. PFAS concentrations detected in OU 1 and OU 2 Area 8 pose no non-cancer effects associated with daily consumption of groundwater; therefore, does not impact protectiveness.

5.5.2 Climate Change

Climate change research indicates that any shoreline remedies (e.g., tide gate, cutoff walls, shoreline armoring) may be vulnerable to climate change impacts, including sea level rise and weather pattern changes, not apparent during remedy selection. These aspects of climate change increase the possibility of flooding/inundation or significant saltwater intrusion of the shoreline areas and can increase the energy of storm events and thus, their erosive force.

There are no shoreline remedies implemented at OU 2 Area 2; however, based on its low elevation and proximity to the shallow lagoon, potential sea level rise attributable to climate change may call into question the protectiveness of the remedies at this site in the future and should be monitored during future FYRs.

At OU 1, the sill/causeway that separates Dogfish Bay from the tidal flats and the presence of the tide gate significantly lessen any effects of climate change that would cause tidal flooding of the marsh and erosion of the landfill. Therefore, climate change issues do not currently affect protectiveness of the remedy at OU 1.

At OU 2 Area 8, climate change effects may significantly impact the magnitude and duration of saltwater intrusion, thus causing changes to groundwater geochemistry and the attenuation capacity of the aquifer. Based on the HHRA, groundwater COCs have not impacted sediments and surface water quality offshore significantly enough to cause unacceptable human health risks, indicating that groundwater geochemistry and attenuation capacity has not yet been adversely impacted by saltwater intrusion. Therefore, climate change issues do not currently affect protectiveness of the remedy at OU 2 Area 8.

6.0 ISSUES/RECOMMENDATIONS

This section presents the issues and recommendations identified as a result of this FYR process for NBK Keyport. Table 6-1 summarizes the issues (and subsequent recommendations) that affect current and/or future protectiveness of the remedy. There were no issues (or recommendations) identified for OU 2 Area 2.

Table 6-1. Issues and Recommendations Identified in the Five-Year Review

<table>
<tr><th colspan="5">Issues/Recommendations</th></tr>
<tr><td rowspan="3">OUs: 1</td><td colspan="4">Issue Category: Remedy Performance</td></tr>
<tr><td colspan="4">Issue: Investigations pursuant to recommendations from the fourth FYR (U.S. Navy, 2015b) have documented subsurface geology and contaminant distribution that differs significantly from the CSM understanding at the time of the ROD (U.S. Navy, EPA, and Ecology, 1998).</td></tr>
<tr><td colspan="4">Recommendation:
1. Complete the on-going investigations to update the CSM.
2. Complete the planned updates to the human health and ecological risk assessments using the updated CSM and incorporating the latest guidance and ARARs.
3. In collaboration with the project team, review and revise (as appropriate) the points of compliance and RAOs.
4. Based on the results of items 1 through 3, evaluate the need for any early remedial actions and/or a focused FS leading to an optimized remedy.</td></tr>
<tr><td>Affect Current Protectiveness</td><td>Affect Future Protectiveness</td><td>Party Responsible</td><td>Oversight Party</td><td>Milestone Date</td></tr>
<tr><td>No</td><td>Yes</td><td>U.S. Navy</td><td>Ecology</td><td>December 2023</td></tr>
<tr><td rowspan="3">OUs: 1</td><td colspan="4">Issue Category: Remedy Performance</td></tr>
<tr><td colspan="4">Issue: Investigations pursuant to recommendations from the fourth FYR (U.S. Navy, 2015b) have documented an area of the landfill north of the north phytoremediation plantation with elevated PCB concentrations in soil that may represent a discrete source of the PCBs consistently detected in water from seep SP1-1, and a potential source of recontamination to an area of the wetland previously remediated.</td></tr>
<tr><td colspan="4">Recommendation:
1. Conduct an investigation to delineate and characterize the potential PCB source in soil.
2. In collaboration with the project team, evaluate the need for a removal action to address the PCB source.</td></tr>
<tr><td>Affect Current Protectiveness</td><td>Affect Future Protectiveness</td><td>Party Responsible</td><td>Oversight Party</td><td>Milestone Date</td></tr>
<tr><td>No</td><td>Yes</td><td>U.S. Navy</td><td>Ecology</td><td>December 2022</td></tr>
</table>

Table 6-1 (continued). Issues and Recommendations Identified in the FYR

Issues/Recommendations				
OUs: 2, Area 2	**Issue Category:** Remedy Performance			
	Issue: The consistent vinyl chloride detections above the RG and recent increased concentration in well 2MW-6 may be an indication that cVOC mass detected in shallow groundwater (i.e., wells 2MW-1, 2MW-3, and MW2-10) during the RI may have since migrated deeper and further downgradient than revealed by the monitoring network.			
	Recommendation: Conduct a limited data gap investigation to refine the CSM and verify the leading edge of the cVOC plume, both laterally and vertically, at OU 2 Area 2.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	U.S. Navy	Ecology	December 2022
OUs: 2, Area 8	**Issue Category:** Remedy Performance			
	Issue: During this FYR period, the HHRA concluded that no contingency/additional actions are necessary to protect human health. However, the ERA concluded that acute and chronic exposure to accumulated contaminants in sediment poses a current potential hazard to benthic organisms based on the bioassay results/endpoints. This area of exposure with unacceptable risk is well delineated and of limited extent within the intertidal zone.			
	Recommendation: Implement a contingent groundwater control action as required by the selected remedy (U.S. Navy, EPA, and Ecology, 1994). To identify a feasible contingent action, perform a supplemental RI and focused FS. Once identified and agreed upon by regulators and stakeholders, perform remedial design, implement the remedial action, and potentially conduct a shoreline repair to address elevated COC concentrations in intertidal sediment and on-going discharge of these COCs in seep water. Prepare a ROD amendment or Explanation of Significant Differences (ESD) to document the contingent action taken. Prepare a ROD amendment or Explanation of Significant Differences (ESD) to document the contingent action taken.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
Yes	Yes	U.S. Navy	Ecology	December 2024

6.1 Other Findings/Recommendations

This section presents other findings and recommendations identified through this FYR process that may improve performance of the remedy, reduce costs, improve management of O&M, accelerate site closeout, conserve energy, and/or promote sustainability, but do not affect the current and/or future protectiveness of the remedy. Table 6-2 summarizes these other findings and subsequent recommendations.

Table 6-2. Other Findings and Recommendations Not Affecting Protectiveness

Other Finding/Recommendation	
OUs: Sitewide	**Finding Category:** Monitoring
	Finding: During this FYR period, the PQL used for vinyl chloride is equal to the ROD RG which is associated with a risk of 2 x 10^{-5}. This risk exceeds the ROD target risk goals and MTCA allowable risk but is within EPA's target range.
	Recommendation: Adopt lower reporting limits as measured concentrations decrease to near the current PQL, and before any decision-making regarding unrestricted use of the sites.
	Finding Category: Changed Site Conditions
	Finding: PFAS compounds have been detected in groundwater samples from existing monitoring wells at OU 1 and OU 2.
	Recommendation: Include PFAS in the supplemental remedial investigations currently underway at OU 1 and OU 2 Area 8.
OUs: 1	**Finding Category:** Monitoring
	Finding: The OU 1 LTM reports continue to use ½ the highest "U" value when generating trend graphs, which appears not to conform to the recommendations of the fourth FYR.
	Recommendation: In accordance with Ecology's comments on the recent LTM reports, present a statistical evaluation of contaminant concentration trends over time in each LTM report,
OUs: 1	**Finding Category:** Monitoring
	Finding: The ROD RG for vinyl chloride was based on the PQL achievable at the time of the ROD; however, SIM analysis is now available that can achieve lower reporting limits.
	Recommendation: Compare vinyl chloride results to current ARARs, including analyzing surface water samples for vinyl chloride using SIM analysis to achieve a lower reporting limit.
OUs: 1	**Finding Category:** Monitoring
	Finding: Currently, the surface water PCB data are not compared to ARARs for the protection of human health.
	Recommendation: Compare future surface water PCB data to the current ARAR for human health exposure pathways (including incidental ingestion and fin-fish and shellfish consumption), given that the concentration can now be achieved by the laboratories using congener analysis.
OUs: 1	**Finding Category:** Remedy Performance
	Finding: Information and revised methods of evaluating environmental media contained in the 2013 revised SMS and in the SCUM II manual were incorporated into the recent ERA for OU 2 Area 8, in addition to updates that have occurred to federal and state ERA guidance, guidelines, and policy since the OU 2 ROD.

Table 6-2 (continued). Other Findings and Recommendations Not Affecting Protectiveness

Other Finding/Recommendation	
	Recommendation: Utilize the OU 2 Area 8 ERA Work Plan to the extent practical for any future ERAs conducted at NBK Keyport, in particular the upcoming planned ERA for OU 1, such that risk assessments are performed consistently across OUs.
OUs: 1	**Finding Category:** Institutional Controls
	Finding: During annual LUC inspections and the FYR site inspection, several cracks were observed in the asphalt pavement of the Central Landfill. Also, alder trees and other brush are growing up through penetrations in the asphalt pavement near old foundations in the southern portion of the Central Landfill.
	Recommendation: Conduct landfill venting and cover upgrades, as planned in FY 2021, to address potential risks from methane migration beyond the landfill boundaries and prevent direct contact with the underlying soils in the future, respectively.
OUs: 2, Area 2	**Finding Category:** Monitoring
	Finding: During this FYR period (i.e., total of three monitoring events), all 1,4-dioxane results were either non-detect or below the MTCA B cleanup level of 0.44 μg/L.
	Recommendation: Discontinue monitoring for 1,4-dioxane at OU 2 Area 2, it is not present at levels which pose unacceptable risk.
OUs: 2, Area 8	**Finding Category:** Monitoring/Remedy Performance
	Finding: During this FYR period, several COCs (including 1,1-DCE, 1,1,1-TCA, arsenic, lead, mercury, thallium, and zinc) in groundwater, seep water, and surface water samples were consistently, or more frequently than not, detected below their RGs. In addition, no RG was established in the ROD for vinyl chloride, which is a breakdown product of the chlorinated solvent COCs present at the site.
	Recommendation: As part of the contingent actions for OU 2 Area 8 (including a ROD amendment), update the list of COCs to reflect current conditions in groundwater, seep water, and surface water.
OUs: 2, Area 8	**Finding Category:** Monitoring
	Finding: Although vinyl chloride is not a COC established by the ROD, it is a breakdown compound of other chlorinated solvent COCs and should be included in the LTM analyte list to provide a comprehensive understanding of COC fate and transport over time.
	Recommendation: Add vinyl chloride to the LTM analyte list and compare results to current ARARs to evaluate the magnitude and extent of this contaminant at the site.
OUs: 2, Area 8	**Finding Category:** Remedy Performance/Institutional Controls
	Finding: During the 2018 VI investigation, cVOC concentrations in sub-slab vapor exceeded PALs underneath Buildings 82, 85, and 98; however, the vapor intrusion pathway was found to be incomplete.

Table 6-2 (continued). Other Findings and Recommendations Not Affecting Protectiveness

Other Finding/Recommendation	
	Recommendation: Prepare a building inspection and monitoring plan based on the recommendations of the VI study report to ensure that the VI pathway remains incomplete. Include annual foundation inspections for Buildings 82, 85, and 98 and paired indoor air and subslab vapor monitoring every five years for Buildings 82 and 98. Add paired indoor air and subslab vapor monitoring every five years for Building 85 if warranted based on future changes in building use or occupancy..
OUs: 1 and 2, Area 8	**Finding Category:** Monitoring
	Finding: Climate change effects, particularly weather pattern changes (i.e., local atmospheric pressure and wind conditions) may significantly impact the magnitude and duration of saltwater intrusion and ultimately, the timeframe when best to sample groundwater for freshwater contaminants.
	Recommendation: Update the LTM Work Plan accordingly to use a downhole conductivity probe to identify the saltwater interface in each monitoring well (above which is the ideal/most representative depth for sampling groundwater) prior to sample collection.
OUs: NA, Site 23	**Finding Category:** Institutional Controls
	Finding: Site 23 was removed from the most recent IC Plan (U.S. Navy, 2017b).
	Recommendation: Add Site 23 back into the LUC Plan, along with the other LUC only sites (i.e., Sites 7 and 22), to ensure LUCs are adequately implemented and maintained, preventing exposure to contaminated soil and groundwater.

7.0 PROTECTIVENESS STATEMENT

This section presents the protectiveness determinations and statements as a result of this fifth FYR for NBK Keyport. Table 7-1 lists the individual protectiveness determinations and statements for OU 1 and OU 2. Table 7-2 provides the sitewide protectiveness determination and statement for NBK Keyport for this FYR period. Ecology, EPA, and the Suquamish Tribe do not concur with the Navy's protectiveness determination for OU 1, and feel that a determination of 'protectiveness deferred' would be more appropriate.

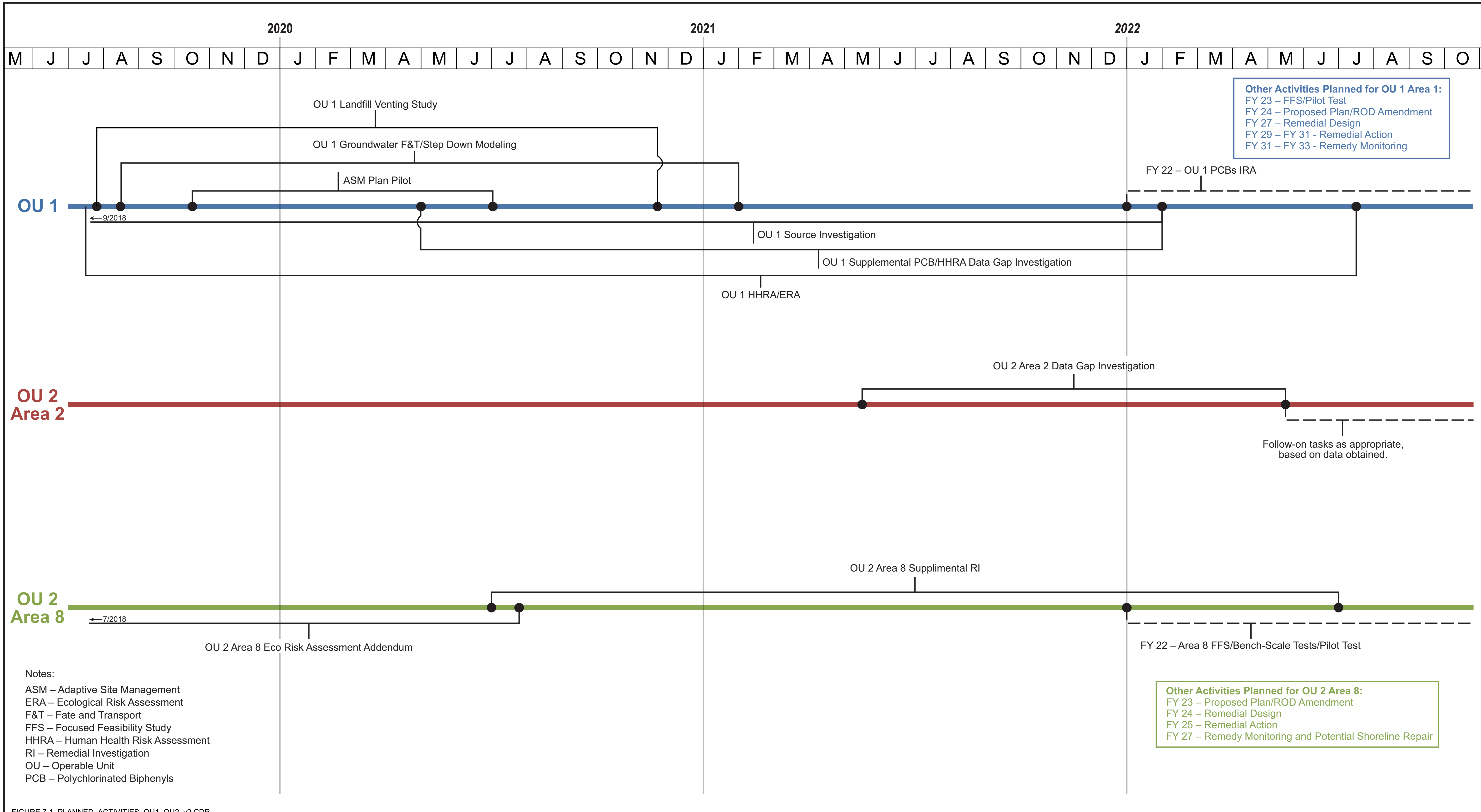
As detailed in Section 6.0, additional or contingent actions are being conducted and/or planned for OU 1 and OU 2 to ensure protection of human health and the environment. Figure 7-1 presents a timetable or schedule for these upcoming/planned actions at OU 1 and OU 2 to support their respective ‘Short-Term Protective’ and ‘Will Be Protective’ determinations (see Table 7-1).

Table 7-1. Protectiveness Statements for OU 1 and OU 2 at NBK Keyport

Protectiveness Statement(s)	
Operable Unit: 1	**Protectiveness Determination:** Short-Term Protective
Protectiveness Statement: The remedy at OU 1 is short-term protective. Exposure pathways that could result in unacceptable risks are being controlled and monitored via LUCs while further information is being obtained. Investigation work is ongoing to verify the risk conclusions in the OU 1 ROD, to allow evaluation of potential additional removal or remedial action(s) that could be taken to shorten the overall restoration timeframe, and to ensure the remedy is protective in the long term.	
Operable Unit: 2 (Area 2 and Area 8)	**Protectiveness Determination:** Not Protective
Protectiveness Statement: The remedy at OU 2 Area 2 is short-term protective. Exposure pathways that could result in unacceptable risks are being controlled and monitored via LUCs; however, the consistent vinyl chloride detections above the RG and recent increased concentration in well 2MW-6 may be an indication that cVOC mass detected in shallow groundwater (i.e., wells 2MW-1, 2MW-3, and MW2-10) during the RI may have since migrated deeper and further downgradient than revealed by the monitoring network. The remedy at OU 2 Area 8 is protective of human health; however, it is not protective of ecological receptors based on a finding of unacceptable risk, for which a contingent remedial action has not yet been implemented, as required by the ROD. To identify a feasible contingent groundwater control action, the Navy will perform a supplemental RI and focused FS. Once identified, and agreed upon by regulators and stakeholders, the Navy will perform remedial design, implement remedial action, and potentially conduct a shoreline repair to address elevated COC concentrations in intertidal sediment and on-going discharge of these COCs in seep water. A ROD amendment or Explanation of Significant Differences (ESD) will be prepared to document the contingent groundwater control action taken. The human health risk assessment at the Area 8 beach intertidal zone concluded that, despite the presence of several COCs in the beach sediment and clam tissue at concentrations exceeding background and reference area concentrations, the incremental site risk over reference area risk for Suquamish subsistence and recreational receptors meets target health goals. The ecological risk assessment concluded that there was no risk to higher trophic level species, but acute and chronic exposure to accumulated contaminants in sediment pose a current potential hazard to benthic organisms based on the bioassay results/endpoints.	

Table 7-2. Sitewide Protectiveness Statement for NBK Keyport

Sitewide Protectiveness Statement
Protectiveness Determination: Not Protective
Protectiveness Statement: The remedies at NBK Keyport are not protective due to an uncontrolled risk and the contingent remedial action has not yet been implemented to address ecological risk at OU 2 Area 8.



U.S. NAVY

Figure 7-1
Planned Remedial Activities at OU 1 and OU 2

NBK KEYPORT
FIFTH
FIVE-YEAR REVIEW

8.0 NEXT REVIEW

The next FYR is scheduled for 2025.

9.0 REFERENCES

Fetter, C.W., Jr. 1980. Applied Hydrogeology. Charles E. Merrill Publishing Company, Columbus, OH. ISB No. 0-675-08126-2. 488 pp.

Suquamish Tribe. 2000. *Fish Consumption Survey of the Suquamish Indian Tribe of the Port Madison Indian Reservation*, Puget Sound Region. August 2000.

U.S. Environmental Protection Agency (EPA). 2018. Vapor Intrusion Screening Level Calculator, https://www.epa.gov/vaporintrusion/vapor-intrusion-screening-level-calculator (accessed January 28, 2019). November

U.S. Environmental Protection Agency (EPA). 2015. *OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air.* Office of Solid Waste and Emergency Response. OSWER Publication 9200.2-154. June 2015.

U.S. Environmental Protection Agency (EPA). 2012. Clarifying the Use of Protectiveness Determinations for Comprehensive Environmental Response, Compensation, and Liability Act Five-Year Reviews. OSWER 9200.2-111. September 2012.

U.S. Environmental Protection Agency (EPA). 2007. *Framework for Selecting and Using Tribal Fish and Shellfish Consumption Rates for Risk-Based Decision Making at CERCLA and RCRA Cleanup Sites in Puget Sound and the Strait of Georgia*. Region 10, Office of Environmental Cleanup, Office of Air, Waste, and Toxics, Office of Environmental Assessment, Seattle, Washington. August.

U.S. Environmental Protection Agency (EPA). 2001. *Comprehensive Five-Year Review Guidance.* Office of Emergency and Remedial Response. EPA 540-R-01-007. OSWER No. 9355.7-03B-P. June 2001.

U.S. Geologic Survey (USGS). 2019. *Draft Groundwater Response to Tidal Fluctuations, Operable Unit 1, Naval Base Kitsap, Keyport, Washington*. Prepared in cooperation with the Department of Navy, Naval Facilities Engineering Command, Northwest.

U.S. Geologic Survey (USGS). 2018. *Analysis of Groundwater Response to Tidal Fluctuations, Operable Unit 2, Area 8, Naval Base Kitsap, Keyport, Washington*. Prepared in cooperation with the Department of Navy, Naval Facilities Engineering Command, Northwest. Open File Report 2018-1082.

U.S. Geologic Survey (USGS). 2015. Groundwater Geochemical and Selected Volatile Organic Compound Data, Operable Unit 1, Naval Undersea Warfare Center, Division Keyport, Washington. Data Series 998. Prepared in cooperation with NAVFAC NW. July.

U.S. Geologic Survey (USGS). 2003. Selected Natural Attenuation Monitoring Data, Operable Unit 1, Naval Undersea Warfare Center, Division Keyport, Washington. Open File Report 2004-1330. Prepared in cooperation with EFA NW. June 2003.

U.S. Navy. 2020. Draft 2019 Long-Term Monitoring Report, Former Plating Shop/Waste Oil Spill Area, Operable Unit 2, Area 8, Naval Base Kitsap, Keyport, Washington. Prepared by Sealaska, Inc. for Naval Facilities Engineering Command Northwest under Contract No. N44255-14-D-9011, Task Order N4425519F4074. August 4.

U.S. Navy. 2019a. Final *2018 Vapor Intrusion Study, Operable Unit 1, Naval Base Kitsap, Keyport, Washington*. Prepared by Battelle and Geosyntec Consultants for Naval Facilities Engineering Command Northwest under Contract No. N39430-16-D-1802, Task Order 014. April 4.

U.S. Navy. 2019b. Draft *2018 Groundwater Monitoring Report, Operable Unit 1, Naval Base Kitsap, Keyport, Washington,* Prepared by Sealaska, Inc. for Naval Facilities Engineering Command Northwest under Contract No. N44255-14-D-9011, Task Order N4425518F4214. September 25.

U.S. Navy. 2019c. Draft 2018 Long-Term Monitoring Report, Former Plating Shop/Waste Oil Spill Area, Operable Unit 2, Area 8, Naval Base Kitsap, Keyport, Washington. Prepared by Sealaska, Inc. for Naval Facilities Engineering Command Northwest under Contract No. N44255-14-D-9011, Task Order N4425518F4214. November 12.

U.S. Navy. 2019d. Internal Draft *Keyport Area 8 ERA Addendum, Naval Base Kitsap, Keyport, Washington,* Prepared for Naval Facilities Engineering Command Northwest under Contract No. N62742-17-D-1800, Task Order N4425518F4174. November 15.

U.S. Navy. 2019e. Final Sampling and Analysis Plan, Project-Specific Sampling and Analysis Plan for Keyport OU 1 Source Investigations, Operable Unit 1, Naval Base Kitsap, Keyport, Washington. Prepared by Battelle Memorial Institute for Naval Facilities Engineering Command Northwest under Contract No. N39430-16-D-1802, Task Order N3943018F4359. May 30.

U.S. Navy. 2019f. Final Sampling and Analysis Plan for Fiscal Year 2018 Keyport Area 8 Indoor Vapor Intrusion Study at Naval Base Kitsap, Keyport, Washington. Prepared by Battelle Memorial Institute and Geosyntec Consultants for Naval Facilities Engineering Command Northwest under Contract No. N39430-16-D-1802, Task Order N3943018F4355. March 20.

U.S. Navy. 2019g. *Final Technical Memorandum: Long-Term Monitoring Program Analyte History, Operable Units 1 and 2, Naval Base Kitsap Keyport*. Technical Memorandum to Carlotta Cellucci, NAVFAC NW, from Scott Elkind, Sealaska Environmental. Prepared under Contract N44255-14-D-9011, Task Order (TO) N4425518F4214. December 17.

U.S. Navy. 2019h. Draft *2018/2019 Annual Operation and Maintenance Report, Operable Unit 1, Naval Base Kitsap, Keyport, Washington*. Prepared under Contract N44255-14-D-9011, Task Order (TO) N4425518F4214. October 25.

U.S. Navy. 2018a. *Operable Unit 2 Area 8 Human Health and Ecological Risk Assessment, Naval Base Kitsap, Keyport, Washington*. Prepared by Resolution Consultants for Naval Facilities Engineering Command Northwest under Contract No. N62470-11-D-8013. May 18.

U.S. Navy. 2018b. *Final 2017 Site Recharacterization Report, Phase II, Operable Unit 1, Naval Base Kitsap, Keyport, Washington*. Prepared by Battelle Memorial Institute for Naval Facilities Engineering Command Northwest under Contract No. N39430-16-D-1802, Delivery Order 0010. December 21.

U.S. Navy. 2018c. Final *2017 Investigation Report, Vapor Intrusion Study, Operable Unit 2, Area 8, Naval Base Kitsap, Keyport, Washington*. Prepared by Battelle and Trihydro for Naval Facilities Engineering Command Northwest under Contract No. N44255-14-D-9013, Delivery Order 0026. July 20.

U.S. Navy, 2018d. Final *Spring 2017 Long-Term Monitoring Report, OU 1, Naval Base Kitsap, Keyport Washington*. Prepared by Sealaska for Naval Facilities Engineering Command Northwest. September 18.

U.S. Navy. 2018e. Final Spring 2017 Long-Term Monitoring Report, Former Plating Shop/Waste Oil Spill Area, Area 8, Operable Unit 2, Naval Base Kitsap, Keyport, Washington. Prepared by Sealaska, Inc. for Naval Facilities Engineering Command Northwest under Contract No. N44255-14-D-9011, Task Order 46. June 5.

U.S. Navy. 2017a. Final *Phase II Investigation Report, Operable Unit 1, Naval Base Kitsap, Keyport, Washington*. Prepared by Resolution Consultants for Naval Facilities Engineering Command Northwest under Contract No. N62470-11-D-8013, CTO JP09. April 21.

U.S. Navy. 2017b. Final *Institutional Controls Plan, Operable Unit 1, Operable Unit 2*, and Areas 22 and 7, *Naval Base Kitsap Keyport*. Prepared by Naval Facilities Engineering Command Northwest. May 1.

U.S. Navy. 2017c. Final *Management and Monitoring Approach Sampling and Analysis Plan, Area 1 Former Landfill, Area 2 Van Meter Road Spill/Drum Storage Site, and Area 8 Plating Shop Waste/oil Spill Area, Long-Term Monitoring, Operable Units 1 & 2 Naval Base Kitsap Keyport*. Prepared by Sealaska Environmental Services, LLC for Naval Facilities Engineering Command Northwest. May 19.

U.S. Navy. 2017d. Final *2016 Annual Operation and Maintenance Report, Operable Unit 1, Naval Base Kitsap, Keyport, Washington*, Prepared by Sealaska Environmental Services, LLC for Naval Facilities Engineering Command Northwest. August 17.

U.S. Navy. 2017e. Final *Spring 2016 Long Term Monitoring Report, Operable Unit 1, Naval Base Kitsap, Keyport, Washington*, Prepared by Sealaska Environmental Services, LLC for Naval Facilities Engineering Command Northwest. August 22.

U.S. Navy. 2017f. Final Spring 2016 Long-Term Monitoring Report, Former Plating Shop/Waste Oil Spill Area, Area 8, Operable Unit 2, Naval Base Kitsap, Keyport, Washington. Prepared by Sealaska, Inc. for Naval Facilities Engineering Command Northwest under Contract No. N44255-14-D-9011, Task Order 27. April 14.

U.S. Navy. 2016a. Final *Institutional Controls Plan, Operable Unit 1, Operable Unit 2*, and Area 23 *Naval Base Kitsap Keyport*. Prepared by Sealaska Environmental Services, LLC for Naval Facilities Engineering Command Northwest. August 10.

U.S. Navy. 2016b. Final 2015 *Annual Operation and Maintenance Report, Operable Unit 1, Naval Base Kitsap, Keyport, Washington*, Prepared by Sealaska Environmental Services, LLC for Naval Facilities Engineering Command Northwest. August 12.

U.S. Navy. 2016c. Final *Operable Unit 2, Area 8 Human Health/Ecological Risk Assessment Workplan, Naval Base Kitsap, Keyport, Washington.* Prepared for Naval Facilities Engineering Command Northwest. December 24.

U.S. Navy. 2016d. Final *Area 8 Marine Investigation Report*, *Naval Base Kitsap Keyport, Keyport, Washington*. Prepared for Naval Facilities Engineering Command Northwest. December 23.

U.S. Navy. 2015a. Final *Site Recharacterization Phase I, Operable Unit 1, Naval Base Kitsap, Keyport, Washington*. Prepared by URS Group, Inc. for Naval Facilities Engineering Command Northwest under Contract No. N44255-09-D-4001, Delivery Order 0088. May 27.

U.S. Navy. 2015b. *Fourth Five-Year Review, Naval Base Kitsap, Keyport, Washington*. Department of the Navy, Naval Facilities Engineering Command Northwest. December 7.

U.S. Navy. 2014a. *Five-year Review Procedures- Update to DoD Manual (DoDM) 4715.20, "Defense Environmental Restoration Program (DERP) Management Manual." March 9, 2012.* Memorandum from the Office of the Under Secretary of Defense dated June 2.

U.S. Navy. 2014b. Final *Quality Control Plan*, *Long-Term Monitoring at Areas 1, 2, and 8, Operable Units 1 and 2*, *Naval Base Kitsap, Keyport, Washington*. Prepared by Sealaska Environmental Services, LLC for NAVFAC NW, under Contract No. N44255-09-D-4005, CTO 084. Poulsbo, Washington. June 10.

U.S. Navy. 2013c. *Toolkit for Preparing Five-Year Reviews*. Naval Facilities Engineering Command Northwest. April 2013.

U.S. Navy. 2012d. *Project-Specific Sampling and Analysis Plan, Keyport Area 8 Marine Sediment Evaluation, Naval Base Kitsap, Keyport, Washington.* Prepared by URS Group, Inc., for Naval Facilities Engineering Command Northwest. Silverdale, Washington. August 2012.

U.S. Navy. 2012h. *Project Work Plans for Long-Term Monitoring Areas 1, 2, and 8 Operable Units 1 and 2. Naval Base Kitsap, Keyport, Washington.* Revision 3. Prepared by CH2M HILL Constructors, Inc. TEC LTM Team for Naval Facilities Engineering Command Northwest. February 2012.

U.S. Navy. 2012i. *Contingent Remedial Action (CRA) Plan. Operable Unit 1. Naval Base Kitsap, Keyport, Washington.* Revision 1. Prepared by Sealaska Environmental Services, LLC for Naval Facilities Engineering Command Northwest. February 2012.

U.S. Navy. 2011b. *Policy for Conducting Five-Year Reviews.* June 7, 2011.

U.S. Navy. 2010a. *Third Five-Year Review. Naval Base Kitsap, Keyport, Washington*. Prepared by URS Group, Inc., for Naval Facilities Engineering Command Northwest. Dated December 8, 2010, executed by the Navy December 30, 2010.

U.S. Navy. 2005a. Second Five-Year Review of Records of Decision, Operable Unit 1 and Operable Unit 2, Naval Undersea Warfare Center, Keyport, Washington. Prepared by URS Group, Inc., for NAVFAC NW under Contract No. N44255-02-D-2008, Delivery Order 0043. Dated May 12, 2005, executed by the Navy June 5, 2005.

U.S. Navy. 2004. *Navy/Marine Corps Policy for Conducting Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Statutory Five-Year Reviews.* November 2001 (Revised May 2004).

U.S. Navy. 2003a. *Contingent Remedial Action Plan for Operable Unit 1, Naval Undersea Warfare Center Division, Keyport, Washington.* Prepared by URS Group, Inc., for Engineering Field Activity, Northwest, under Contract No. N44255-00-D-2476, Delivery Order 30. March 2003.

U.S. Navy. 2001. Long-Term Monitoring Data Report, Former Plating Shop/Waste Oil Spill Area, Area 8, Operable Unit 2, Naval Undersea Warfare Center Division Keyport, Washington. Prepared by CH2M HILL Constructors, Inc., and TEC LTM Team. June 2001.

U.S. Navy. 2001b. Policy on Land Use Controls Associated with Environmental Restoration Activities. Office of the Undersecretary of Defense. January 17.

U.S. Navy. 2000a. Institutional Controls Management Plan for Operable Unit 1 and Operable Unit 2, Naval Undersea Warfare Center Division, Keyport, Washington. Prepared by URS Greiner, Inc., for EFA NW, under CLEAN Contract No. N62474-89-D-9295, Contract Task Order 10. May 2000.

U.S. Navy. 2000b. First Five-Year Review, Operable Unit 1 and Operable Unit 2, Naval Undersea Warfare Center Division, Keyport, Washington. Prepared by CH2M HILL Constructors, Inc., and TEC LTM Team for EFA NW under Contract Task Order 002.

U.S. Navy. 1999c. Closure Report, Sediment Removal and Upgrade of Tide Gate, Operable Unit 1, Naval Undersea Warfare Center Division, Keyport, Washington. Prepared by Foster Wheeler Environmental Corporation for EFA NW under RAC Contract No. N44255-95-D-6030, Delivery Order 61. December 1999.

U.S. Navy. 1999d. Closure Report, Remedial Action, Area 8, Building 72 Plating Shop Demolition and Soil Hot Spot Removal, Naval Undersea Warfare Center Division, Keyport, Washington. Prepared by Foster Wheeler Environmental Corporation for EFA NW.

U.S. Navy. 1997b. Summary Data Assessment Report for Operable Unit 1, Additional Pre-ROD Data Collection for the CLEAN Northwest Area, Naval Undersea Warfare Center Division, Keyport, Washington. Prepared by URS Consultants and Science Applications International Corporation for EFA NW under CLEAN Contract No. N62474-89-D-9295.

U.S. Navy. 1996a. Post-ROD Confirmational Groundwater Monitoring Report for Operable Unit 2, Area 5 Sludge Disposal Area, Naval Undersea Warfare Center Division, Keyport, Washington. Prepared by EA Engineering, Science, and Technology for EFA NW.

U.S. Navy. 1996b. Results of Post-ROD Confirmatory Sampling at Area 9, Liberty Bay, Operable Unit 2, Naval Undersea Warfare Center Division, Keyport, Washington. Prepared by EA Engineering, Science, and Technology for EFA NW.

U.S. Navy. 1993b. Remedial Investigation Report, NUWC Keyport. Prepared by URS Consultants and Science Applications International Corporation for EFA NW under CLEAN Contract No. N62474-89-D-9295, CTO 10. October 1993.

U.S. Navy, U.S. Environmental Protection Agency (EPA), and Washington State Department of Ecology (Ecology). 1998. *Record of Decision for Operable Unit 1, Naval Undersea Warfare Center Division, Keyport, Washington.* Prepared by URS Greiner and Science Applications International Corporation for EFA NW under CLEAN Contract No. N62474-89-D-9295, CTO 10. September 30, 1998.

U.S. Navy, U.S. Environmental Protection Agency (EPA), and Washington State Department of Ecology (Ecology). 1996. Explanation of Significant Differences for the Record of Decision for Operable Unit 2, Naval Undersea Warfare Center Division, Keyport, Washington – Area 8, Plating Shop Waste Area. Prepared by EA Engineering, Science, and Technology for EFA NW. March 15, 1996 (Revised June 1, 1996).

U.S. Navy, U.S. Environmental Protection Agency (EPA), and Washington State Department of Ecology (Ecology). 1994. *Record of Decision for Operable Unit 2, Naval Undersea Warfare Center Division, Keyport, Washington.* Prepared by URS Consultants and Science Applications International Corporation for EFA NW under CLEAN Contract No. N62474-89-D-9295, CTO 10. September 28, 1994.

Washington State Department of Ecology (Ecology). 2019a. *Sediment Cleanup User's Manual II (SCUM II) Guidance for Implementing the Cleanup Provisions of the Sediment Management Standards, Chapter 173-204 WAC*. Publication No. 12-09-057, Original Publication March 2015, Revised December 2019.

Ecology. 2019b. *Trichloroethylene (TCE): Deriving Cleanup Levels under the Model Toxics Control Act (MTCA)*. Summary Table of Standard MTCA Methods B and C Cleanup levels. May.

Ecology. 2016. *Review Draft Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action.* Publication No. 09-09-047. Toxics Cleanup Program. Published October 2009, revised February 2016.

Ecology. 2013. *Model Toxics Control Act Cleanup Regulation*. Chapter 173-340 Washington Administrative Code.

APPENDIX A
NOTICE OF INTENT PROOF OF PUBLICATION

Kitsap Sun

PART OF THE USA TODAY NETWORK

PROOF OF PUBLICATION

BATTELLE
505 KING AVENUE
COLUMBUS, OH 43201

STATE OF WISCONSIN, COUNTY OF BROWN:

I, being first duly sworn on oath, deposes and says: That I am now, and at all times embraced in the publication herein mentioned was the principal clerk of the printers and publishers of KITSAP SUN; that said newspaper has been approved as a legal newspaper by the order of the Superior Court of the County of Kitsap, in which County it is published and is now and has been for more than 6 months prior to the date of the publication hereinafter referred to, published in the English language continually as a daily newspaper in Bremerton, Kitsap County, Washington, a weekly newspaper in Kitsap County, Washington and is now and during all of the said time, was printed in an office maintained in the aforesaid place of publication of said newspaper; that the following is a true text of an advertisement as it was published in regular issues (and not in supplement form) of said newspaper on the following date(s), to wit: And on

09/06/2019, 09/07/2019, 09/08/2019

such newspaper was regularly distributed to its subscribers during all of said period

Subscribed and sworn to before on October 3, 2019

Legal Clerk

Shelly Hora
Notary Public, State of Wisconsin, County of Brown

8-25-23
My commission expires

Publication Cost: $1,420.80
Ad No: GCI0260626
Customer No: 888210
PO #:

SHELLY HORA
Notary Public
State of Wisconsin

Naval Base Kitsap Keyport
Invites You to Participate in the
Fifth 5-Year Review of Cleanup Actions
July 2014 to July 2019

The Navy in cooperation with the U.S. Environmental Protection Agency and the Washington State Department of Ecology is initiating the fifth 5-year review of environmental cleanup actions at Naval Base Kitsap Keyport and invites the public to participate in this process. The purpose of the 5-year review is to ensure that the cleanup actions (remedies) continue to be protective of human health and the environment. These cleanup actions were established in Records of Decision (RODs) prepared under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The 5-year review is required under federal law because the cleanup actions have left some chemical contamination in place.

Site Name, Location, and Address:
Naval Undersea Warfare Center
Keyport, Washington

Lead Agency Conducting the Review:
United States Navy

BACKGROUND
The Naval Undersea Warfare Center was added to the National Priorities List (NPL) in October 1989. The site is now referred to by the Navy as Naval Base Kitsap Keyport. Cleanup actions have been conducted at several areas within Naval Base Kitsap Keyport Operable Units (OUs) 1 and 2 where environmental contamination was identified in the past. OU 1 consists of Area 1 (the former base landfill), and OU 2 consists of the remaining areas of concerns (Areas 2, 3, 5, 8, and 9). These sites have undergone environmental investigation and/or remediation to address the potential impacts of contamination to human health and the environment. Based on initial evaluation and investigations, Areas 3, 5, and 9 have been issued "No Further Action" determinations by the U.S. Environmental Protection Agency, as documented in the OU 2 ROD.

The remedy for Area 1, OU 1 consists of treating volatile organic compound (VOC) hot spots in the landfill using phytoremediation by poplar trees in concert with natural attenuation; removing PCB-contaminated sediments; upgrading the tide gate and landfill cover; implementing institutional controls; and conducting long-term monitoring.
The selected remedy for Area 2, OU 2 consists of institutional controls and groundwater monitoring.

The selected remedy for Area 8, OU 2 includes removal and off-site disposal of impacted soil above the groundwater table, implementing institutional controls, and long-term monitoring of groundwater, sediment, and marine biota.

An initial statutory 5-year review was finalized in 2000, and subsequent 5-year reviews were finalized in 2005, 2010 and 2015.

Site-specific information and links to documents such as records of decisions are available on the following Navy website: https://www.navfac.navy.mil/navfac_worldwide/pacific/fecs/northwest/about_us/northwest_documents/environmental-restoration/nbk_keyport.html

YOU ARE INVITED TO PARTICIPATE IN THIS PROCESS

The Navy welcomes your participation in the 5-year review process. You may participate by submitting your comments or concerns about these environmental cleanup actions at Naval Base Kitsap Keyport by mail, telephone, or email. Point-of-contact information is provided below.

The completed fifth 5-year review document will be available for review at the Navy website listed above. A Notice of Completion will be published at that time in the North Kitsap Herald, Central Kitsap Reporter, Kitsap Sun and at *www.keyport98345.com.*

POINT OF CONTACT AND TELEPHONE NUMBER FOR ADDITIONAL INFORMATION
NAVFAC Northwest Public Affairs Officer
NAVFAC Northwest
1101 Tautog Circle
Silverdale, WA 98315
(360) 396-6387 (telephone)
E-mail: james.k.johnson3@navy.mil

Anticipated Date of 5-Year Review Completion: December 2020

BR-GCI0260626-01

Road Warrior
Travis Baker
Guest columnist

Are right-turn arrows warranted on Viking Way intersections?

The in basket: Ted Newman and Brett Bernier would like to see a red-green right-turn signal installed on Viking Way in Poulsbo where Lindvig Way and Finn Hill Road cross it.

Ted wrote nearly a year ago, saying, "I'm talking northbound to turn right towards downtown Poulsbo. Folks heading through the intersection westbound have their own green light. Having a right-turn arrow would keep the northbound traffic flowing instead of having a line of cars backed up so far.

This month, Brett raised the same issue. "With the increased traffic and backups that I have noticed in the Poulsbo area, it would seem advantageous to put green right-turn lights at the intersections of Viking Avenue and Lindvig Way and also at Bond Road and Highway 305. There is already a green right-turn light on Bond Road heading up towards Highway 3. Has the state looked into the possibility of doing this?"

The out basket: Highway 305 is a state route, so its Olympic Region has the call on that one. The city of Poulsbo owns the Viking/Lindvig intersection and would decide that one.

Mike Lund, Poulsbo's public works director, says "As far as the Viking Ave signal goes, I am not planning on any changes to the system.

"A right green arrow to turn on to Lindvig would really be safe only for the movement when the Lindvig traffic is moving onto Viking.

All other movements, there is potential for conflict.

- Left turn from Viking – potential conflict with turning traffic.
- Finn Hill Movement – potential conflict with traffic.
- Viking Ave straight movements – no need for arrow as traffic already has green right of way.
- Lindvig movement – this would be the only movement that it would be a benefit.

"The traffic does back up onto Viking some at peak times, but it's not that bad. I travel that road a lot myself and understand the issues over there.

"Requiring the right lane to stop is actually a benefit to traffic as a whole for that intersection.

"It keeps the traffic speeds down while turning onto Lindvig.

"It allows some gaps in traffic for the traffic coming out of the commercial development on Lindvig (Third Avenue).

"It also allows the light at Bond and Front Street to catch up on traffic so it's not backed all the way up Lindvig into the Viking intersection more than it currently is."

Doug Adamson, the spokesman for the Olympic Region of state highways, says Brett's idea for Bond and 305 has merit. "We forwarded his comment to our traffic engineers, who will evaluate the possibility," he said.

Both Doug and Mike thanked our readers for their input. "We truly appreciate readers bringing these suggestions to us," said Doug. "Any way we can increase efficiencies for travelers, all the better for everyone involved."

Paving on Mile Hill Drive

The in basket: Patrick Carey writes, "I like the paving on Mile Hill Drive (in Port Orchard.) My question is why was the center lane not paved from under the overpass to the Olney-Jackson Avenue? The rest looks great."

The out basket: Adamson says, "WSDOT strategically repaves areas of the highway that need it the most. This generally means paving efforts focus on the most heavily used lanes.

"Ultimately, your reader is seeing a cost-effective approach to help preserve the highway while keeping it in good working order."

The center lane on Highway 166, which Patrick asked about, gets mostly slow-moving, turning traffic and many fewer vehicles than the through lanes.

You see the same philosophy when the state repaves only the outside lanes of four-lane highways, which handle much heavier truck traffic than the inside lanes.

Kitsap Sun

Customer service
To view important information online related to your subscription, visit **aboutyoursubscription.kitsapsun.com**. You can also manage your subscription at **account.kitsapsun.com**.
Contact the Kitsap Sun for questions or to report issues via email at kitsapsun@gannett.com or by phone at 1-844-900-7106.
Operating hours are:
- Monday-Friday: 8:00 a.m.-6:00 p.m.
- Saturday: 7:00 a.m.-11:00 a.m. for technical support only
- Sunday & holidays: 7:00 a.m.-11:00 a.m.

Full access subscriptions
Subscribe and save today by visiting **kitsapsun.com/subscribe**.
Subscriptions below are billed per month and include access to kitsapsun.com, tablet and smartphone apps and the e-Edition, a digital replica of the print edition.
- Delivery of the Monday through Sunday print editions: $56.00*
- Delivery of the Thursday through Sunday print editions: $25.00*
- Delivery of the Sunday print editions: $20.00*

Plus applicable taxes.
The TV book can be added to select print subscriptions for an additional monthly charge. Contact Customer Service for additional details.

Contact us

Customer Service	1-844-900-7105
Editor	David Nelson | 360-415-2679
Advertising	360-792-3333
Obituaries	360-792-3333, ext. 2

Corrections and clarifications
Our goal is to promptly correct errors. Email us at accuracy@kitsapsun.com to report a mistake or call 360-792-8558. Describe the error, where you saw it, the date, page number, or the URL.

Postal information
Kitsap Sun, USPS #63-980, ISSN #1050-3692, is published Monday through Sunday at 545 Fifth St., Bremerton, WA 98337. Periodicals postage paid at Bremerton, WA 98337. **Postmaster:** Send address changes to Customer Service, PO Box 94090, Albuquerque, NM 87199-9940.

IN BRIEF

King Co. prosecutor will not retry couple in protest shooting

SEATTLE – The King County prosecutor's office will not retry a couple accused in the shooting of an anti-fascist protester at the University of Washington in January 2017.

The prosecutors have been weighing their chances on winning a unanimous verdict in a retrial of Elizabeth and Marc Hokoana.

A jury in King County Superior Court deadlocked in August when the jury foreman says the panel split over ideological lines, and the shooting victim refused to testify.

Judge Kristen Richardson declared a mistrial and the prosecutor's office said Friday a retrial would likely yield the same result.

Elizabeth Hokoana had been charged with assault for shooting Joshua Dukes in the stomach while Marc Hokoana was charged with assault for firing pepper spray into the crowd.

Elizabeth Hokoana says Dukes had a knife and she fired after he grabbed her husband. No knife was found.

Washington state motorist gets 'A for effort' and $228 ticket

SEATTLE – A motorist who police say used a black marker to try to make the vehicle-tab sticker on the license plate appear current got an A for effort along with a $228 ticket for expired tabs.

Washington State Patrol spokeswoman Heather Axtman tweeted a photo of the doctored tabs Thursday, noting the "coloring skills are kind of on point."

But, Axtman said, the effort didn't fool a trooper in Snohomish County.

Naval Base Kitsap Keyport
Invites You to Participate in the
Fifth 5-Year Review of Cleanup Actions
July 2014 to July 2019

The Navy in cooperation with the U.S. Environmental Protection Agency and the Washington State Department of Ecology is initiating the fifth 5-year review of environmental cleanup actions at Naval Base Kitsap Keyport and invites the public to participate in this process. The purpose of the 5-year review is to ensure that the cleanup actions (remedies) continue to be protective of human health and the environment. These cleanup actions were established in Records of Decision (RODs) prepared under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The 5-year review is required under federal law because the cleanup actions have left some chemical contamination in place.

Site Name, Location, and Address:
Naval Undersea Warfare Center
Keyport, Washington

Lead Agency Conducting the Review:
United States Navy

BACKGROUND
The Naval Undersea Warfare Center was added to the National Priorities List (NPL) in October 1989. The site is now referred to by the Navy as Naval Base Kitsap Keyport. Cleanup actions have been conducted at several areas within Naval Base Kitsap Keyport Operable Units (OUs) 1 and 2 where environmental contamination was identified in the past. OU 1 consists of Area 1 (the former base landfill), and OU 2 consists of the remaining areas of concerns (Areas 2, 3, 5, 8, and 9). These sites have undergone environmental investigation and/or remediation to address the potential impacts of contamination to human health and the environment. Based on initial evaluation and investigations, Areas 3, 5, and 9 have been issued "No Further Action" determinations by the U.S. Environmental Protection Agency as documented in the OU 2 ROD.

The remedy for Area 1, OU 1 consists of treating volatile organic compound (VOC) hot spots in the landfill using phytoremediation by poplar trees in concert with natural attenuation, removing PCB-contaminated sediments, upgrading the tide gate and landfill cover, implementing institutional controls, and conducting long-term monitoring.
The selected remedy for Area 2, OU 2 consists of institutional controls and groundwater monitoring.

The selected remedy for Area 8, OU 2 includes removal and off-site disposal of impacted soil above the groundwater table, implementing institutional controls, and long-term monitoring of groundwater, sediment, and marine biota.

An initial statutory 5-year review was finalized in 2000, and subsequent 5-year reviews were finalized in 2005, 2010 and 2015.

Site-specific information and links to documents such as records of decisions are available on the following Navy website: https://www.navfac.navy.mil/navfac_worldwide/pacific/fecs/northwest/about_us/northwest_documents/environmental-restoration/nbk_keyport.html

YOU ARE INVITED TO PARTICIPATE IN THIS PROCESS

The Navy welcomes your participation in the 5-year review process. You may participate by submitting your comments or concerns about these environmental cleanup actions at Naval Base Kitsap Keyport by mail, telephone, or email. Point-of-contact information is provided below.

The completed fifth 5-year review document will be available for review at the Navy website listed above. A Notice of Completion will be published at that time in the North Kitsap Herald, Central Kitsap Reporter, Kitsap Sun and at www.keyport98345.com.

POINT OF CONTACT AND TELEPHONE NUMBER FOR ADDITIONAL INFORMATION
NAVFAC Northwest Public Affairs Officer
NAVFAC Northwest
1101 Tautog Circle
Silverdale, WA 98315
(360) 396-6387 (telephone)
E-mail: james.k.johnson3@navy.mil

Anticipated Date of 5-Year Review Completion: December 2020

Naval Base Kitsap Keyport
Invites You to Participate in the
Fifth 5-Year Review of Cleanup Actions
July 2014 to July 2019

The Navy in cooperation with the U.S. Environmental Protection Agency and the Washington State Department of Ecology is initiating the fifth 5-year review of environmental cleanup actions at Naval Base Kitsap Keyport and invites the public to participate in this process. The purpose of the 5-year review is to ensure that the cleanup actions (remedies) continue to be protective of human health and the environment. These cleanup actions were established in Records of Decision (RODs) prepared under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The 5-year review is required under federal law because the cleanup actions have left some chemical contamination in place.

Site Name, Location, and Address:
Naval Undersea Warfare Center
Keyport, Washington

Lead Agency Conducting the Review:
United States Navy

BACKGROUND
The Naval Undersea Warfare Center was added to the National Priorities List (NPL) in October 1989. The site is now referred to by the Navy as Naval Base Kitsap Keyport. Cleanup actions have been conducted at several areas within Naval Base Kitsap Keyport Operable Units (OUs) 1 and 2 where environmental contamination was identified in the past. OU 1 consists of Area 1 (the former base landfill), and OU 2 consists of the remaining areas of concerns (Areas 2, 3, 5, 8, and 9). These sites have undergone environmental investigation and/or remediation to address the potential impacts of contamination to human health and the environment. Based on initial evaluation and investigations, Areas 3, 5, and 9 have been issued "No Further Action" determinations by the U.S. Environmental Protection Agency, as documented in the OU 2 ROD.

The remedy for Area 1, OU 1 consists of treating volatile organic compound (VOC) hot spots in the landfill using phytoremediation by poplar trees in concert with natural attenuation; removing PCB-contaminated sediments; upgrading the tide gate and landfill cover; implementing institutional controls; and conducting long-term monitoring.
The selected remedy for Area 2, OU 2 consists of institutional controls and groundwater monitoring.

The selected remedy for Area 8, OU 2 includes removal and off-site disposal of impacted soil above the groundwater table, implementing institutional controls, and long-term monitoring of groundwater, sediment, and marine biota.

An initial statutory 5-year review was finalized in 2000, and subsequent 5-year reviews were finalized in 2005, 2010 and 2015.

Site-specific information and links to documents such as records of decisions are available on the following Navy website: https://www.navfac.navy.mil/navfac_worldwide/pacific/fecs/northwest/about_us/northwest_documents/environmental-restoration/nbk_keyport.html

YOU ARE INVITED TO PARTICIPATE IN THIS PROCESS

The Navy welcomes your participation in the 5-year review process. You may participate by submitting your comments or concerns about these environmental cleanup actions at Naval Base Kitsap Keyport by mail, telephone, or email. Point-of-contact information is provided below.

The completed fifth 5-year review document will be available for review at the Navy website listed above. A Notice of Completion will be published at that time in the North Kitsap Herald, Central Kitsap Reporter, Kitsap Sun and at *www.keyport98345.com.*

POINT OF CONTACT AND TELEPHONE NUMBER FOR ADDITIONAL INFORMATION
NAVFAC Northwest Public Affairs Officer
NAVFAC Northwest
1101 Tautog Circle
Silverdale, WA 98315
(360) 396-6387 (telephone)
E-mail: james.k.johnson3@navy.mil

Anticipated Date of 5-Year Review Completion: December 2020

BR-GCI0260626-01

Road Warrior
Travis Baker
Guest columnist

Are right-turn arrows warranted on Viking Way intersections?

The in basket: Ted Newman and Brett Bernier would like to see a red-green right-turn signal installed on Viking Way in Poulsbo where Lindvig Way and Finn Hill Road cross it.

Ted wrote nearly a year ago, saying, "I'm talking northbound to turn right towards downtown Poulsbo. Folks heading through the intersection westbound have their own green light. Having a right-turn arrow would keep the northbound traffic flowing instead of having a line of cars backed up so far.

This month, Brett raised the same issue. "With the increased traffic and backups that I have noticed in the Poulsbo area, it would seem advantageous to put green right-turn lights at the intersections of Viking Avenue and Lindvig Way and also at Bond Road and Highway 305. There is already a green right-turn light on Bond Road heading up towards Highway 3. Has the state looked into the possibility of doing this?"

The out basket: Highway 305 is a state route, so its Olympic Region has the call on that one. The city of Poulsbo owns the Viking/Lindvig intersection and would decide that one.

Mike Lund, Poulsbo's public works director, says "As far as the Viking Ave signal goes, I am not planning on any changes to the system.

"A right green arrow to turn on to Lindvig would really be safe only for the movement when the Lindvig traffic is moving onto Viking.

All other movements, there is potential for conflict.

- Left turn from Viking – potential conflict with turning traffic.
- Finn Hill Movement – potential conflict with traffic
- Viking Ave straight movements – no need for arrow as traffic already has green right of way.
- Lindvig movement – this would be the only movement that it would be a benefit.

"The traffic does back up onto Viking some at peak times, but it's not that bad. I travel that road a lot myself and understand the issues over there.

"Requiring the right lane to stop is actually a benefit to traffic as a whole for that intersection.

"It keeps the traffic speeds down while turning onto Lindvig.

"It allows some gaps in traffic for the traffic coming out of the commercial development on Lindvig (Third Avenue)

"It also allows the light at Bond and Front Street to catch up on traffic so it's not backed all the way up Lindvig into the Viking intersection more than it currently is."

Doug Adamson, the spokesman for the Olympic Region of state highways, says Brett's idea for Bond and 305 has merit. "We forwarded his comment to our traffic engineers, who will evaluate the possibility," he said.

Both Doug and Mike thanked our readers for their input. "We truly appreciate readers bringing these suggestions to us," said Doug. "Any way we can increase efficiencies for travelers, all the better for everyone involved."

Paving on Mile Hill Drive

The in basket: Patrick Carey writes, "I like the paving on Mile Hill Drive (in Port Orchard.) My question is why was the center lane not paved from under the overpass to the Olney-Jackson Avenue? The rest looks great."

The out basket: Adamson says, "WSDOT strategically repaves areas of the highway that need it the most. This generally means paving efforts focus on the most heavily used lanes.

"Ultimately, your reader is seeing a cost-effective approach to help preserve the highway while keeping it in good working order."

The center lane on Highway 166, which Patrick asked about, gets mostly slow-moving, turning traffic and many fewer vehicles than the through lanes.

You see the same philosophy when the state repaves only the outside lanes of four-lane highways, which handle much heavier truck traffic than the inside lanes.

Kitsap Sun
PART OF THE USA TODAY NETWORK

Customer service
To view important information online related to your subscription, visit **aboutyoursubscription.kitsapsun.com**. You can also manage your subscription at **account.kitsapsun.com.**
Contact the Kitsap Sun for questions or to report issues via email at kitsapsun@gannett.com or by phone at 1-844-900-7106.
Operating hours are:
- Monday-Friday: 8:00 a.m.-6:00 p.m.
- Saturday: 7:00 a.m.-11:00 a.m. for technical support only
- Sunday & holidays: 7:00 a.m.-11:00 a.m.

Full access subscriptions
Subscribe and save today by visiting **kitsapsun.com/subscribe.**
Subscriptions below are billed per month and include access to kitsapsun.com, tablet and smartphone apps and the e-Edition, a digital replica of the print edition.
- Delivery of the Monday through Sunday print editions: $56.00*
- Delivery of the Thursday through Sunday print editions: $25.00*
- Delivery of the Sunday print editions: $20.00*

**Plus applicable taxes*
The TV book can be added to select print subscriptions for an additional monthly charge. Contact Customer Service for additional details.

Contact us
Customer Service 1-844-900-7106
Editor .... David Nelson | 360-415-2679
Advertising 360-792-3333
Obituaries .... 360-792-3333, ext. 2

Corrections and clarifications
Our goal is to promptly correct errors. Email us at accuracy@kitsapsun.com to report a mistake or call 360-792-8558. Describe the error, where you saw it, the date, page number, or the URL.

Postal information
Kitsap Sun, USPS #63-980, ISSN #1050-3692, is published Monday through Sunday at 545 Fifth St., Bremerton, WA 98337. Periodicals postage paid at Bremerton, WA 98337. **Postmaster:** Send address changes to Customer Service, PO Box 94090, Albuquerque, NM 87199-9940

IN BRIEF

King Co. prosecutor will not retry couple in protest shooting

SEATTLE – The King County prosecutor's office will not retry a couple accused in the shooting of an anti-fascist protester at the University of Washington in January 2017.

The prosecutors have been weighing their chances on winning a unanimous verdict in a retrial of Elizabeth and Marc Hokoana.

A jury in King County Superior Court deadlocked in August when the jury foreman says the panel split over ideological lines, and the shooting victim refused to testify.

Judge Kristen Richardson declared a mistrial and the prosecutor's office said Friday a retrial would likely yield the same result.

Elizabeth Hokoana had been charged with assault for shooting Joshua Dukes in the stomach while Marc Hokoana was charged with assault for firing pepper spray into the crowd.

Elizabeth Hokoana says Dukes had a knife and she fired after he grabbed her husband. No knife was found.

Washington state motorist gets 'A for effort' and $228 ticket

SEATTLE – A motorist who police say used a black marker to try to make the vehicle-tab sticker on the license plate appear current got an A for effort along with a $228 ticket for expired tabs.

Washington State Patrol spokeswoman Heather Axtman tweeted a photo of the doctored tabs Thursday, noting the "coloring skills are kind of on point."

But, Axtman said, the effort didn't fool a trooper in Snohomish County.

North Kitsap Herald

Affidavit of Publication

State of Washington }
County of Kitsap } ss

Leanna Hartell being first duly sworn, upon oath deposes and says: that he/she is the legal representative of the North Kitsap Herald a weekly newspaper. The said newspaper is a legal newspaper by order of the superior court in the county in which it is published and is now and has been for more than six months prior to the date of the first publication of the Notice hereinafter referred to, published in the English language continually as a weekly newspaper in Kitsap County, Washington and is and always has been printed in whole or part in the North Kitsap Herald and is of general circulation in said County, and is a legal newspaper, in accordance with the Chapter 99 of the Laws of 1921, as amended by Chapter 213, Laws of 1941, and approved as a legal newspaper by order of the Superior Court of Kitsap County, State of Washington, by order dated June 16, 1941, and that the annexed is a true copy of NKH872019 5-YEAR REVIEW as it was published in the regular and entire issue of said paper and not as a supplement form thereof for a period of 3 issue(s), such publication commencing on 09/06/2019 and ending on 09/20/2019 and that said newspaper was regularly distributed to its subscribers during all of said period.

PAID IN FULL

The amount of the fee for such publication is $702.03.

Leanna Hartell

Subscribed and sworn before me on this 20th day of September, 2019.

Diana L. Beaver

Notary Public in and for the State of Washington.

DIANA L BEAVER
NOTARY PUBLIC
COMMISSION EXPIRES 4-29-21
STATE OF WASHINGTON

Battelle |
HOLLY GOLDEN

Classified Proof

Naval Base Kitsap Keyport Invites You to Participate in the Fifth 5-Year Review of Cleanup Actions July 2014 to July 2019

The Navy in cooperation with the U.S. Environmental Protection Agency and the Washington State Department of Ecology is initiating the fifth 5-year review of environmental cleanup actions at Naval Base Kitsap Keyport and invites the public to participate in this process. The purpose of the 5-year review is to ensure that the cleanup actions (remedies) continue to be protective of human health and the environment. These cleanup actions were established in Records of Decision (RODs) prepared under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The 5-year review is required under federal law because the cleanup actions have left some chemical contamination in place.

Site Name, Location, and Address:
Naval Undersea Warfare Center
Keyport, Washington
Lead Agency Conducting the Review:
United States Navy

BACKGROUND

The Naval Undersea

Warfare Center was added to the National Priorities List (NPL) in October 1989. The site is now referred to by the Navy as Naval Base Kitsap Keyport. Cleanup actions have been conducted at several areas within Naval Base Kitsap Keyport Operable Units (OUs) 1 and 2 where environmental contamination was identified in the past. OU 1 consists of Area 1 (the former base landfill), and OU 2 consists of the remaining areas of concerns (Areas 2, 3, 5, 8, and 9). These sites have undergone environmental investigation and/or remediation to address the potential impacts of contamination to human health and the environment. Based on initial evaluation and investigations, Areas 3, 5, and 9 have been issued "No Further Action" determinations by the U.S. Environmental Protection Agency, as documented in the OU 2 ROD.

The remedy for Area 1, OU 1 consists of treating volatile organic compound (VOC) hot spots in the landfill using phytoremediation by poplar trees in concert with natural attenuation; removing PCB-contaminated sediments; upgrading the tide gate and landfill cover; implementing institutional controls; and conducting long-term monitoring.

The selected remedy for Area 2, OU 2 consists of institutional controls and groundwater monitoring.

The selected remedy for Area 8, OU 2 includes removal and off-site disposal of impacted soil above the groundwater table, implementing institutional controls, and long-term monitoring of groundwater, sediment, and marine biota.

An initial statutory 5-year review was finalized in 2000, and subsequent 5-year reviews were finalized in 2005, 2010 and 2015.

Site-specific information and links to documents such as records of decisions are available on the following Navy website: https://www.navfac.navy.mil/navfac_worldwide/pacific/fecs/northwest/about_us/northwest_documents/environmental-restoration/nbk_keyport.html

YOU ARE INVITED TO PARTICIPATE IN THIS PROCESS

The Navy welcomes your participation in the 5-year review process. You may participate by submitting your comments or concerns about these environmental cleanup actions at Naval Base Kitsap Keyport by mail, telephone, or email. Point-of-contact information is provided below.

The completed fifth 5-year review document will be available for review at the Navy website listed above. A Notice of Completion will be published at that time in the North Kitsap Herald, Central Kitsap Reporter, Kitsap Sun and at www.keyport98345.com.

POINT OF CONTACT AND TELEPHONE NUMBER FOR ADDITIONAL INFORMATION

NAVFAC Northwest Public Affairs Officer
NAVFAC Northwest
1101 Tautog Circle
Silverdale, WA 98315
(360) 396-6387 (telephone)
E-mail: james.k.johnson3@navy.mil

Anticipated Date of 5-Year Review Completion: December 2020

Published: North Kitsap Herald
September 6, 13 and 20, 2019
Legal #: NKH872019

Salamanders: tiny creatures with big impact

KITSAP, NATURALLY

By NANCY SEFTON

In one day, a single salamander may eat 20 ants, two flies or beetle larvae, one adult beetle and a springtail.

Have you ever walked through the woods and wondered who's peering at you through the greenery? A black bear maybe? A wildcat? Strangely, one of the most influential "predators" here is probably hiding under a rock! In a lifetime of hiking, you may never glimpse these tiny "heroes," even though the forest floor literally teems with them.

They're called woodland salamanders. These four-legged, flat-headed, long-toed, long-tailed, bug-eyed, slippery amphibians (relatives of frogs) are at home in both land and water. And believe it or not, these tiny critters (from 3 to 7 inches long) are crucial to the flow of nutrients through our forests, and to the fight against climate change.

Salamanders? Who'd have thought?!

Salamanders breed in ponds and streams, dining on aquatic bugs, until they develop lungs that replace the external gills. Then, taking up life on land, they wander widely until they return to the same breeding pond (some species guided by earth's magnetic field).

So how do these shy creatures help us fight global warming? Wrap your mind around this:Fallen leaves accumulate on the forest floor where they're ripped into bits and gobbled by hoards of insects.

The resulting leaf litter contains 50% carbon. Excess carbon dioxide (CO_2), released into the atmosphere, is gradually warming the Earth.

Enter the salamanders! It so happens that they feast on leaf-shredding insects. Voila: fewer bugs and more undamaged leaves.

Now, the important step: if those leaves are left intact, they pile up in layers, holding onto the carbon until it's captured by the soil, and locked up underground.

In one day, a single salamander may eat 20 ants, two flies or beetle larvae, one adult beetle and a springtail. Multiply that by the estimated density of about 750,000 salamanders per square mile of forest, and you have an amazing system that begins with Mother Nature's control over insects with an appetite for dead leaves, and ends with less CO_2 in our atmosphere. A little mind-boggling, but it works.

The proof lies with a recent test where several enclosures (like raised-bed gardens) were created in a northwest forest; screening confined salamanders to certain enclosures, while leaf-gobbling insects had free passage throughout. The results? In enclosures with no salamanders, more leaves were shredded by the bugs, releasing more carbon into the atmosphere. Scientists calculate that on one acre of forest, salamanders send about 180 pounds of carbon into the soil, rather than into the air. It's Nature's fine-tuned system, unless (you guessed it!) humans interfere. Nowadays, logging practices and new wildlife diseases create problems. Amphibians, historically immune to fungal infections, are starting to fall prey to these, thanks perhaps to chemical contamination from human activity. Pavement, introduced into forests, contains chemicals harmful to salamanders and other amphibians, polluting ponds and wetlands.

Long ago, TV newscaster Tom Brokaw reported that amphibian numbers were dropping everywhere. He blamed natural changes beyond human control. Today, "we've met the enemy, and it is us." Nevertheless, small but helpful steps are being taken. Scientists are dealing with the spread of fungal diseases, and loggers are starting to abandon those sobering clear-cuts, leaving some older trees standing to store excess carbon and create havens for wildlife.

The gradual loss of our amphibians is just another shot across the bow. Salamanders are one small piece of the puzzle, but their plight reflects our own need to solve a problem we alone created.

While small, forest salamanders play a big role in balancing natural CO2 emissions. **Photos courtesy Nancy Sefton**

Recalled generator likely the cause of Kingston garage fire

An investigator with the Kitsap County Fire Marshal's Office has determined that a recalled generator was likely the cause of a Sept. 5 blaze at an off-duty firefighter's home near Kingston.

The firefighter's garage was gutted as a result of the blaze and most of its contents were destroyed. According to a release from North Kitsap Fire & Rescue, the damage was limited by the homeowner's quick actions and the fire department's rapid response.

Although the flames didn't spread beyond the detached structure to the nearby home and no one was injured in the incident, officials hope to prevent future incidents by calling attention to generator safety tips.

North Kitsap Fire & Rescue (NKF&R) and Poulsbo Fire Department (PFD) crews were alerted to the fire at 7:55 p.m. Sept. 5, after the off-duty NKF&R lieutenant saw flames coming from his home's detached garage. He immediately asked his wife to call 911 and evacuate the home's other occupants while he attempted to attack the growing fire with extinguishers.

While the lieutenant's efforts slowed the fire's growth, they weren't sufficient to stop it so when the crews first arrived from NKF&R's headquarters, flames had engulfed the far half of the two-car, single-story structure which is situated about ten feet from the residence.

Firefighters, using large volumes of water, were able to quickly squelch the flames to prevent further damage or spread of the fire.

Evidence at the scene along with witness statements points to the fire's origin being in the location of the generator, which had been running due to a power outage Thursday night.

The particular model of generator in question, a Champion 8250 Portable Generator, model 41332, responders say, was under recall as a potential fire hazard.

According to the United States Product Safety Commission, the generator was recalled due to fuel leaks from the generator's carburetor.

Lightning thought to have sparked Sunday brush fire in Kingston

About 1,200 square feet of vegetation was charred in a Sunday brush fire that firefighters believe started with a lightning strike to a large maple tree in Kingston late Saturday night.

North Kitsap Fire & Rescue (NKF&R) crews were called to a Barnswallow Way address off of Norman Road near Kingston just after 2:30 p.m. after the property owners discovered the slow-moving fire.

Upon arrival, firefighters reported active fire with flames reaching two-to-four feet in height, burning out from the base of a maple tree. The tree was split and its bark was charred, suggesting that it was struck during the previous evening's lightning storm.

A large hemlock, that appeared to have fallen long ago, was also burning, according to a release from NKF&R.

Although crews were able to quickly stop the fire's progress and no structures were threatened by the flames, responders say the fire did pose a challenge as they attempted to extinguish the blaze.

The closest vehicle access was 400 feet away and water for the suppression effort had to be provided by a tender truck.

Extinguishing hot spots deep in the forest floor required six firefighters and approximately 6,000 gallons of water and took two hours to contain. Crews returned to the scene periodically during the rest of the day to ensure that the fire hadn't reignited.

With the exception of a lightning-sparked house fire in Suquamish on Saturday evening, no other weather-related incidents have been reported to NKF&R crews.

There were no injuries to firefighters or civilians in Sunday's incident.

City adopts tax ordinance to improve affordable housing

By KEN PARK
Kitsap News Group

Poulsbo City Council unanimously adopted a sales tax ordinance that will provide roughly $34,000 in annual funding to be invested in affordable housing.

Additionally, the council voted unanimously to set up a task force that would work together on a plan for how to use the appropriated funds. This is a requirement of the legislation which has a deadline of January 2020 according to Poulsbo's Finance Director Debbie Booher. To be clear this is not a new tax on Poulsbo citizens, but a reappropriation of taxes already being paid to the state.

"One word of caution is that developing committees can take some time, and we are under a bit of a time crunch because we have to have a plan developed once we start receiving the funds," Booher said.

Councilmember David Musgrove requested that a committee be set up as soon as possible following the unanimous vote.

"To make sure that this goes forward at maximum possible speed and meets the required timelines, I would like to move to commit this item to an ad-hoc committee of six members, so that it can be developed, presented and processed as quickly as possible with all options," Musgrove said.

The sales tax ordinance comes out of recently approved legislation, House Bill 1406.

HB1406 created the sales tax revenue sharing program that allows cities and counties to access a portion of state sales tax revenue to invest in affordable housing.

Washington state collects about 6.5% in sales tax, in this case, the city of Poulsbo would receive 0.073% of that tax which portions out to about $34,000 annually to invest in affordable housing solutions. The city would be able to double that effort if Kitsap County was not also chosen to participate in the sales tax revenue.

The funds can be used to acquire, rehab or construct affordable housing which may include new units of affordable housing within an existing structure or facilities providing supportive housing services, or funding the operations and maintenance of new units of affordable housing.

Since the population of Poulsbo has less than 100,000 people the funds can also be used for rental assistance, something that council member Ken Thomas fully supports.

"While this is not a large amount of money, we can't go out and build any big projects with this. But for a lot of folks who are looking for affordable housing, paying the monthly rent can be a stretch, but they can pull it off. What is often a huge barrier is all the deposits. In my mind the way to leverage the tax revenue that this will bring in is to find a way to help with deposits for utilities, first and last month's rent, so that people can get past those barriers and get a roof over their heads," Thomas said.

Mayor Erickson sees things differently, noting that while rental assistance could be great for one family, it doesn't help many families.

"While I understand what Mr. Thomas said, if we start augmenting people's income, we can only help one family at a time. We really need to look at increasing housing stock. I've got some ideas on what that looks like. $34,000 doesn't sound like a lot of money, but when you talk about getting that every year, year after year, that turns into a very interesting revenue stream in order to invest in additional housing," Erickson said.

One of the other requirements of HB 1406 is that the beneficiaries of the affordable housing sales tax make less than 60% the median income.

According to U.S. Census data, the median income for Poulsbo is $61,455 a year, meaning individuals and families would need to make less than $37,000 a year to qualify under the tax.

Cornfield

Continued from page 4

the same kind of suggestion made the last time the auditor took a measure of the tax breaks in 2014.

Lawmakers did take note the last time. Rep. June Robinson, D-Everett, put forth legislation in 2014 and 2015 to tie the number of jobs at Boeing with the size of the tax break it receives. But those bills went nowhere. Inslee steered clear of them.

The hearing provided Inslee another chance to wage his campaign against corporate extortion a short distance from his office — and with a row of Boeing officials on hand to hear it. He was a no-show.

Also absent — and a subject for another day — were aerospace machinists and engineers who fought for those clawback bills in 2014 and 2015.

Inslee's aerospace advisor, Robin Toth, did attend. She delivered a promotional message of the industry's strength and importance, and of the state's efforts to attract more aerospace companies to Washington. She veered wide of the issue of whether a jobs-related metric should be appended to the tax-break law.

"I don't really have a position on that," she said afterward. "I haven't gotten anything from the governor on that."

Silence at home and protest abroad has been Inslee's M.O. on this subject in two terms.

If he seeks and secures a third — he says he is all in but climate change czar will be hard to pass up if a Democrat becomes president — it may embolden the governor to face those muggers.

Jerry Cornfield is a political reporter for The Daily Herald in Everett, a Sound Publishing Co. publication. Cornfield can be contacted at 360-352-8623 and jcornfield@heraldnet.com.

Brunell

Continued from page 4

parent to Horizon, reported its regional traffic increased 14.6 percent on a 12.9 percent increase in capacity compared to July 2018.

"For years, Boeing and Airbus focused on larger, more-profitable jetliners and shifted away from the smaller planes, which have similar development costs but sell for lower prices.

"Airbus' deal with Bombardier and Boeing's pact with Embraer signal that the big plane-makers intend to deny a foothold in the lucrative narrow-body market to ambitious newcomers, such as Commercial Aircraft Corp. of China," Bloomberg reported in April. (Update: Mitsubishi bought Bombardier's regional jet program in June).

"A longtime supplier of aircraft components to Boeing, Mitsubishi Heavy, the parent of Mitsubishi Regional Jet (MRJ), plans to emerge from its customer's (Boeing) shadow," Bloomberg added. It developed and manufactures major airframe components, including fuselage panels for the Boeing 777 and composite-material wing boxes for the 787.

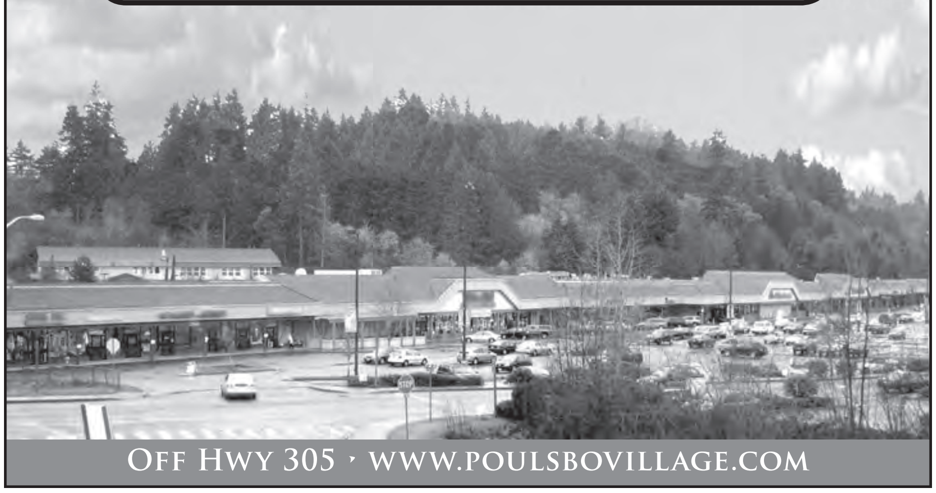
Mitsubishi spent at least $2 billion over more than a decade developing SpaceJet. Its launch partner is All Nippon Airways (ANA) — one of Boeing's first 787 buyers.

"The aviation market in Asia is expected to grow further in the coming years, and there will be demand for these aircraft," said Lee Dong-heon, an analyst at Daishin Securities Co. in Seoul. "The shift in the regional aviation segment we have seen over the last year or so has opened opportunities."

In order to compete, Mitsubishi can't just rely on its home market. The biggest customers therefore could be in the U.S., where large airlines try to cut costs by outsourcing short flights to smaller carriers that fly regional jets, Bloomberg concluded.

The good news is Mitsubishi has strong ties with Boeing and Washington State. MRJ is flight testing the SpaceJet in Moses Lake and established its U.S. headquarters in Renton.

Don C. Brunell is a business analyst, writer and columnist. He can be contacted at theBrunells@msn.com.



Naval Base Kitsap Keyport
Invites You to Participate in the
Fifth 5-Year Review of Cleanup Actions
July 2014 to July 2019

The Navy in cooperation with the U.S. Environmental Protection Agency and the Washington State Department of Ecology is initiating the fifth 5-year review of environmental cleanup actions at Naval Base Kitsap Keyport and invites the public to participate in this process. The purpose of the 5-year review is to ensure that the cleanup actions (remedies) continue to be protective of human health and the environment. These cleanup actions were established in Records of Decision (RODs) prepared under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The 5-year review is required under federal law because the cleanup actions have left some chemical contamination in place.

Site Name, Location, and Address:
Naval Undersea Warfare Center
Keyport, Washington

Lead Agency Conducting the Review:
United States Navy

BACKGROUND
The Naval Undersea Warfare Center was added to the National Priorities List (NPL) in October 1989. The site is now referred to by the Navy as Naval Base Kitsap Keyport. Cleanup actions have been conducted at several areas within Naval Base Kitsap Keyport Operable Units (OUs) 1 and 2 where environmental contamination was identified in the past. OU 1 consists of Area 1 (the former base landfill), and OU 2 consists of the remaining areas of concerns (Areas 2, 3, 5, 8, and 9). These sites have undergone environmental investigation and/or remediation to address the potential impacts of contamination to human health and the environment. Based on initial evaluation and investigations, Areas 3, 5, and 9 have been issued "No Further Action" determinations by the U.S. Environmental Protection Agency, as documented in the OU 2 ROD.

The remedy for Area 1, OU 1 consists of treating volatile organic compound (VOC) hot spots in the landfill using phytoremediation by poplar trees in concert with natural attenuation; removing PCB-contaminated sediments; upgrading the tide gate and landfill cover; implementing institutional controls; and conducting long-term monitoring.
The selected remedy for Area 2, OU 2 consists of institutional controls and groundwater monitoring.

The selected remedy for Area 8, OU 2 includes removal and off-site disposal of impacted soil above the groundwater table, implementing institutional controls, and long-term monitoring of groundwater, sediment, and marine biota.

An initial statutory 5-year review was finalized in 2000, and subsequent 5-year reviews were finalized in 2005, 2010 and 2015.

Site-specific information and links to documents such as records of decisions are available on the following Navy website: https://www.navfac.navy.mil/navfac_worldwide/pacific/fecs/northwest/about_us/northwest_documents/environmental-restoration/nbk_keyport.html

YOU ARE INVITED TO PARTICIPATE IN THIS PROCESS

The Navy welcomes your participation in the 5-year review process. You may participate by submitting your comments or concerns about these environmental cleanup actions at Naval Base Kitsap Keyport by mail, telephone, or email. Point-of-contact information is provided below.

The completed fifth 5-year review document will be available for review at the Navy website listed above. A Notice of Completion will be published at that time in the North Kitsap Herald, Central Kitsap Reporter, Kitsap Sun and at *www.keyport98345.com.*

POINT OF CONTACT AND TELEPHONE NUMBER FOR ADDITIONAL INFORMATION
NAVFAC Northwest Public Affairs Officer
NAVFAC Northwest
1101 Tautog Circle
Silverdale, WA 98315
(360) 396-6387 (telephone)
E-mail: james.k.johnson3@navy.mil

Anticipated Date of 5-Year Review Completion: December 2020

BR-GCI0260626-01

Central Kitsap Reporter

Affidavit of Publication

State of Washington }
County of Kitsap } ss

Leanna Hartell being first duly sworn, upon oath deposes and says: that he/she is the legal representative of the Central Kitsap Reporter a weekly newspaper. The said newspaper is a legal newspaper by order of the superior court in the county in which it is published and is now and has been for more than six months prior to the date of the first publication of the Notice hereinafter referred to, published in the English language continually as a weekly newspaper in Kitsap County, Washington and is and always has been printed in whole or part in the Central Kitsap Reporter and is of general circulation in said County, and is a legal newspaper, in accordance with the Chapter 99 of the Laws of 1921, as amended by Chapter 213, Laws of 1941, and approved as a legal newspaper by order of the Superior Court of Kitsap County, State of Washington, by order dated June 16, 1941, and that the annexed is a true copy of CKR872023 as it was published in the regular and entire issue of said paper and not as a supplement form thereof for a period of 3 issue(s), such publication commencing on 09/06/2019 and ending on 09/20/2019 and that said newspaper was regularly distributed to its subscribers during all of said period.

PAID IN FULL

The amount of the fee for such publication is $702.03.

Leanna Hartell

Subscribed and sworn before me on this 20th day of September, 2019.

Diana L. Beaver

DIANA L BEAVER NOTARY PUBLIC COMMISSION EXPIRES 4-29-21 STATE OF WASHINGTON

Notary Public in and for the State of Washington.

Battelle |
HOLLY G.

Naval Base Kitsap Keyport Invites You to Participate in the Fifth 5-Year Review of Cleanup Actions July 2014 to July 2019

The Navy in cooperation with the U.S. Environmental Protection Agency and the Washington State Department of Ecology is initiating the fifth 5-year review of environmental cleanup actions at Naval Base Kitsap Keyport and invites the public to participate in this process. The purpose of the 5-year review is to ensure that the cleanup actions (remedies) continue to be protective of human health and the environment. These cleanup actions were established in Records of Decision (RODs) prepared under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The 5-year review is required under federal law because the cleanup actions have left some chemical contamination in place.

Site Name, Location, and Address:
Naval Undersea Warfare Center
Keyport, Washington

Lead Agency Conducting the Review:
United States Navy

BACKGROUND

The Naval Undersea

Warfare Center was added to the National Priorities List (NPL) in October 1989. The site is now referred to by the Navy as Naval Base Kitsap Keyport. Cleanup actions have been conducted at several areas within Naval Base Kitsap Keyport Operable Units (OUs) 1 and 2 where environmental contamination was identified in the past. OU 1 consists of Area 1 (the former base landfill), and OU 2 consists of the remaining areas of concerns (Areas 2, 3, 5, 8, and 9). These sites have undergone environmental investigation and/or remediation to address the potential impacts of contamination to human health and the environment. Based on initial evaluation and investigations, Areas 3, 5, and 9 have been issued "No Further Action" determinations by the U.S. Environmental Protection Agency, as documented in the OU 2 ROD.

The remedy for Area 1, OU 1 consists of treating volatile organic compound (VOC) hot spots in the landfill using phytoremediation by poplar trees in concert with natural attenuation; removing PCB-contaminated sediments; upgrading the tide gate and landfill cover; implementing institutional controls; and conducting long-term monitoring.

The selected remedy for Area 2, OU 2 consists of institutional controls and groundwater monitoring.

The selected remedy for Area 8, OU 2 includes removal and off-site disposal of impacted soil above the groundwater table, implementing institutional controls, and long-term monitoring of groundwater, sediment, and marine biota.

An initial statutory 5-year review was finalized in 2000, and subsequent 5-year reviews were finalized in 2005, 2010 and 2015.

Site-specific information and links to documents such as records of decisions are available on the following Navy website: https://www.navfac.navy.mil/navfac_worldwide/pacific/fecs/northwest/about_us/northwest_documents/environmental-restoration/nbk_keyport.html

YOU ARE INVITED TO PARTICIPATE IN THIS PROCESS

The Navy welcomes your participation in the 5-year review process. You may participate by submitting your comments or concerns about these environmental cleanup actions at Naval Base Kitsap Keyport by mail, telephone, or email. Point-of-contact information is provided below.

The completed fifth 5-year review document will be available for review at the Navy website listed above. A Notice of Completion will be published at that time in the North Kitsap Herald, Central Kitsap Reporter, Kitsap Sun and at www.keyport98345.com.

POINT OF CONTACT AND TELEPHONE NUMBER FOR ADDITIONAL INFORMATION

NAVFAC Northwest Public Affairs Officer
NAVFAC Northwest
1101 Tautog Circle
Silverdale, WA 98315
(360) 396-6387 (telephone)
E-mail: james.k.johnson3@navy.mil

Anticipated Date of 5-Year Review Completion: December 2020

Published: Central Kitsap Reporter September 6, 13 and 20, 2019

Legal #: CKR872023

Run with the Cops 5K Sept. 7 at Olympic College

By TYLER SHUEY
Kitsap News Group

Local law enforcement agencies will participate in the Run with the Cops 5K for Special Olympics Washington Saturday, Sept. 7, at Olympic College in Bremerton.

The family-friendly event is part of a series of 5K races around the state this summer. It is a key fundraiser for the Law Enforcement Torch Run campaign for Special Olympics Washington, which raises funds and awareness for athletes with intellectual disabilities.

In 2018, the Run with the Cops series raised more than $30,000 for Special Olympics Washington from sponsors and more than 400 participants.

The race begins at 8:30 a.m. Online registration is available until 9 a.m. Friday, Sept. 6. Day of registration opens at 7 a.m. at Olympic College in Bremerton.

Adult pre-registration is $30 and will increase to $40 on the day of the run. One child registration (10 years and younger) is free with one paid adult. Additional child registration is $20 for pre-registration and $25 for registration the day of the event.

For more information, visit RunWithTheCopsWA.com.

Walk to End Alzheimer's event set for Saturday, Sept. 7, in Bremerton

By TYLER SHUEY
Kitsap News Group

The Alzheimer's Association, Washington State Chapter will be putting on the Kitsap Peninsula Walk to End Alzheimer's Saturday, Sept. 7 at Louis Mentor Boardwalk in Bremerton.

The Walk to End Alzheimer's is the world's largest event to raise funds and awareness for Alzheimer's disease. Last year, 384 people participated in the local event, raising $42,819. Funds raised for the event are used for Alzheimer's research and to provide care and support services for local families impacted by the disease.

"This is a wonderful event where people come together, honor their loved ones and raise funds to fight Alzheimer's," Jim Wilgus said, executive director for the Alzheimer's Association, Washington State Chapter. "There's a real sense of community and camaraderie at the Walk to End Alzheimer's — a sense of hope that, by working together, we will end this disease."

Registration for the walk begins at 8 a.m., followed by an opening ceremony at 9 a.m. and the two-mile walk at 9:30 a.m. The free event is family-friendly and the walk route is fully accessible. Participants who donate or raise $100 or more will receive a Walk to End Alzheimer's t-shirt.

In Washington, there are more than 110,000 people living with Alzheimer's and another 348,000 unpaid caregivers providing support to their loved ones, according to AAWSC. It is the sixth-leading cause of death nationally, and the third-leading cause of death in the state.

"Alzheimer's disease is the only leading cause of death that currently cannot be prevented, cured or even slowed," Wilgus said. 'The Walk to End Alzheimer's is an opportunity for people to get involved and take action against this devastating disease and move us closer to a world without Alzheimer's."

For questions about the Kitsap Peninsula Walk to End Alzheimer's, contact Walk Manager Roxy Robertson at rorobertson@alz.org or at 206-363-5500. To register, visit alz.org/walk or call 1-800-272-3900.

Naval Base Kitsap Keyport
Invites You to Participate in the
Fifth 5-Year Review of Cleanup Actions
July 2014 to July 2019

The Navy in cooperation with the U.S. Environmental Protection Agency and the Washington State Department of Ecology is initiating the fifth 5-year review of environmental cleanup actions at Naval Base Kitsap Keyport and invites the public to participate in this process. The purpose of the 5-year review is to ensure that the cleanup actions (remedies) continue to be protective of human health and the environment. These cleanup actions were established in Records of Decision (RODs) prepared under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The 5-year review is required under federal law because the cleanup actions have left some chemical contamination in place.

Site Name, Location, and Address:
Naval Undersea Warfare Center
Keyport, Washington

Lead Agency Conducting the Review:
United States Navy

BACKGROUND
The Naval Undersea Warfare Center was added to the National Priorities List (NPL) in October 1989. The site is now referred to by the Navy as Naval Base Kitsap Keyport. Cleanup actions have been conducted at several areas within Naval Base Kitsap Keyport Operable Units (OUs) 1 and 2 where environmental contamination was identified in the past. OU 1 consists of Area 1 (the former base landfill), and OU 2 consists of the remaining areas of concerns (Areas 2, 3, 5, 8, and 9). These sites have undergone environmental investigation and/or remediation to address the potential impacts of contamination to human health and the environment. Based on initial evaluation and investigations, Areas 3, 5, and 9 have been issued "No Further Action" determinations by the U.S. Environmental Protection Agency, as documented in the OU 2 ROD.

The remedy for Area 1, OU 1 consists of treating volatile organic compound (VOC) hot spots in the landfill using phytoremediation by poplar trees in concert with natural attenuation; removing PCB-contaminated sediments; upgrading the tide gate and landfill cover; implementing institutional controls; and conducting long-term monitoring.
The selected remedy for Area 2, OU 2 consists of institutional controls and groundwater monitoring.

The selected remedy for Area 8, OU 2 includes removal and off-site disposal of impacted soil above the groundwater table, implementing institutional controls, and long-term monitoring of groundwater, sediment, and marine biota.

An initial statutory 5-year review was finalized in 2000, and subsequent 5-year reviews were finalized in 2005, 2010 and 2015.

Site-specific information and links to documents such as records of decisions are available on the following Navy website: https://www.navfac.navy.mil/navfac_worldwide/pacific/fecs/northwest/about_us/northwest_documents/environmental-restoration/nbk_keyport.html

YOU ARE INVITED TO PARTICIPATE IN THIS PROCESS

The Navy welcomes your participation in the 5-year review process. You may participate by submitting your comments or concerns about these environmental cleanup actions at Naval Base Kitsap Keyport by mail, telephone, or email. Point-of-contact information is provided below.

The completed fifth 5-year review document will be available for review at the Navy website listed above. A Notice of Completion will be published at that time in the North Kitsap Herald, Central Kitsap Reporter, Kitsap Sun and at *www.keyport98345.com.*

POINT OF CONTACT AND TELEPHONE NUMBER FOR ADDITIONAL INFORMATION
NAVFAC Northwest Public Affairs Officer
NAVFAC Northwest
1101 Tautog Circle
Silverdale, WA 98315
(360) 396-6387 (telephone)
E-mail: james.k.johnson3@navy.mil

Anticipated Date of 5-Year Review Completion: December 2020

BR-GC0260626-01

Kitsap Strong fundraiser Saturday

By **TYLER SHUEY**
Kitsap News Group

Kitsap Strong, a community initiative to improve the health and well-being of children, family, and adults, will send dozens of "edgers" rappelling off the Norm Dicks Government Center as part of their Over the Edge fundraiser Sept. 14.

The free resource fair from 11 a.m. to 2 p.m. will provide kids activities, including a bouncy house, food vendors, and the Peninsula Community Health Services Mobile Clinic. Edgers will be announced as they descend during the fair.

Notable elected officials participating in the rappelling this year include Kitsap County Commissioner Ed Wolfe, Bremerton Mayor Greg Wheeler, former Bremerton Mayor Patty Lent, and Bainbridge Island Mayor and President and CEO of Kitsap Community Foundation Kol Medina.

"Although rappelling off a building is very much out of my comfort zone, the opportunity to help Kitsap Strong and encourage others to participate in this challenge is one I can't pass up," Medina said.

Participants were each asked to raise $1,000 in funds, either individually or as part of a team, according to a press release. Community members are invited to donate to individual or team rappellers or register to participate at kitsapstrong.org.

Other requirements for edgers include a weight range between 100 to 300 pounds and a parent or guardian signature for participants under the age of 18. No experience or advanced training is required, the release states. Over the Edge will also provide all gear and day-of-event training and support.

Transit driver cited after nearly hitting two boys on their bikes

By **TYLER SHUEY**
Kitsap News Group

Photo courtesy of the Kitsap County Sheriff's Office

A Kitsap Transit bus driver was recently cited after an August 16 incident where two 12-year-old boys on their bikes were nearly hit by the bus, according to Kitsap County Sheriff's Deputy Scott Wilson.

The incident occurred just before 9 a.m. at the intersection of Aegean Boulevard and Sunset Avenue in East Bremerton. The two boys had to jump off their bikes to avoid being hit by the bus, according to Wilson.

The 64-year-old female bus driver told authorities that she did not see the boys on their bikes and that she made too sharp of a left turn, resulting in a portion of the bus being in the eastbound lane of Aegean Boulevard where the two boys on their bikes were stopped. One boy did suffer scrapes while jumping out of the way of the bus, Wilson said.

The driver was cited for failure to drive on the right side of the road and did not show any signs of impairment, according to Wilson.

Micek

Continued from page 4

And here we are again, with Trump raiding the Treasury — not to help soldiers, but to reinforce his own vanity and secure his own political fortunes. And roughly half the nation will be asked to make that sacrifice.

The Pentagon's diversion of funds will affect "upgrades to infrastructure and training facilities at military installations in 23 states," the Post reported, including the home states of some of Trump's most ardent backers on Capitol Hill.

Upgrades to military bases in 19 foreign countries will also be impacted, and all at a time when American forces are being relied upon to carry a heavier load around the world.

And for what? A border wall that 60 percent of respondents to a recent Gallup poll oppose, even as an equally consistent majority support a path to citizenship for undocumented immigrants.

Trump has already acknowledged to lawmakers that actual immigration reform and enhanced border security are more effective than any physical barrier. Yet here the White House is, looting funds from badly needed military projects, just to satisfy Trump's edifice complex.

Serving in the military is dangerous enough. One can't help but wonder how much more of this "love" from the White House our forces can be asked to endure.

An award-winning political journalist, John L. Micek is the editor-in-chief of The Pennsylvania Capital-Star in Harrisburg, Pennsylvania. Email him at jmicek@penncapital-star.com and follow him on Twitter @ByJohnLMicek.

Naval Base Kitsap Keyport
Invites You to Participate in the
Fifth 5-Year Review of Cleanup Actions
July 2014 to July 2019

The Navy in cooperation with the U.S. Environmental Protection Agency and the Washington State Department of Ecology is initiating the fifth 5-year review of environmental cleanup actions at Naval Base Kitsap Keyport and invites the public to participate in this process. The purpose of the 5-year review is to ensure that the cleanup actions (remedies) continue to be protective of human health and the environment. These cleanup actions were established in Records of Decision (RODs) prepared under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The 5-year review is required under federal law because the cleanup actions have left some chemical contamination in place.

Site Name, Location, and Address:
Naval Undersea Warfare Center
Keyport, Washington

Lead Agency Conducting the Review:
United States Navy

BACKGROUND
The Naval Undersea Warfare Center was added to the National Priorities List (NPL) in October 1989. The site is now referred to by the Navy as Naval Base Kitsap Keyport. Cleanup actions have been conducted at several areas within Naval Base Kitsap Keyport Operable Units (OUs) 1 and 2 where environmental contamination was identified in the past. OU 1 consists of Area 1 (the former base landfill), and OU 2 consists of the remaining areas of concerns (Areas 2, 3, 5, 8, and 9). These sites have undergone environmental investigation and/or remediation to address the potential impacts of contamination to human health and the environment. Based on initial evaluation and investigations, Areas 3, 5, and 9 have been issued "No Further Action" determinations by the U.S. Environmental Protection Agency, as documented in the OU 2 ROD.

The remedy for Area 1, OU 1 consists of treating volatile organic compound (VOC) hot spots in the landfill using phytoremediation by poplar trees in concert with natural attenuation; removing PCB-contaminated sediments; upgrading the tide gate and landfill cover; implementing institutional controls; and conducting long-term monitoring.
The selected remedy for Area 2, OU 2 consists of institutional controls and groundwater monitoring.

The selected remedy for Area 8, OU 2 includes removal and off-site disposal of impacted soil above the groundwater table, implementing institutional controls, and long-term monitoring of groundwater, sediment, and marine biota.

An initial statutory 5-year review was finalized in 2000, and subsequent 5-year reviews were finalized in 2005, 2010 and 2015.

Site-specific information and links to documents such as records of decisions are available on the following Navy website: https://www.navfac.navy.mil/navfac_worldwide/pacific/fecs/northwest/about_us/northwest_documents/environmental-restoration/nbk_keyport.html

YOU ARE INVITED TO PARTICIPATE IN THIS PROCESS

The Navy welcomes your participation in the 5-year review process. You may participate by submitting your comments or concerns about these environmental cleanup actions at Naval Base Kitsap Keyport by mail, telephone, or email. Point-of-contact information is provided below.

The completed fifth 5-year review document will be available for review at the Navy website listed above. A Notice of Completion will be published at that time in the North Kitsap Herald, Central Kitsap Reporter, Kitsap Sun and at *www.keyport98345.com.*

POINT OF CONTACT AND TELEPHONE NUMBER FOR ADDITIONAL INFORMATION
NAVFAC Northwest Public Affairs Officer
NAVFAC Northwest
1101 Tautog Circle
Silverdale, WA 98315
(360) 396-6387 (telephone)
E-mail: james.k.johnson3@navy.mil

Anticipated Date of 5-Year Review Completion: December 2020

BR-GC0260626-01

It's 'F-bombs' away! Our cursed 2020 campaign

OPINION

By TOM PURCELL

Some presidential candidates, past and present, sure have cursed up a storm.

The Washington Examiner notes Julian Castro said the "BS" word on HBO. Ohio Rep. Tim Ryan called on Republicans to "get their 's-word' together." Hawaii Rep. Tulsi Gabbard used the "b-word" to describe President Trump and New York Sen. Kirsten Gillibrand told a group of activists that "if we are not helping people, we should go the 'f-word' home."

Then there's the queen mother of today's cussing campaigners: Beto "F-bomb" O'Rourke.

He has used the "f-word" as a noun, verb, adjective, adverb, pronoun, preposition, conjunction, interjection — pretty much everything but a dangling participle, whatever the "h-e-double-hockey-sticks" that is.

O'Rourke has been struggling in the polls since Mayor Pete "Trump 'P.O.'d' our allies" Buttigieg stole his thunder. O'Rourke's cursing appears to be a ploy for attention, which is all it's getting him.

I agree with political observers who cite two reasons for the increasing use of salty language.

Emma Byrne, author of "Swearing is Good for You: The Amazing Science of Bad Language," tells Smithsonian there is a science to why we curse. She says "peppering our language with dirty words can actually help us gain credibility and establish a sense of camaraderie" — if it's done properly.

She distinguishes between "propositional swearing, which is deliberate and planned, and non-propositional swearing, which can happen when we're surprised, or among friends or confidants."

O'Rourke's swearing comes across as contrived — a sign of weakness from an unserious candidate trying to make headlines.

That brings us to the second reason for politicians' increasingly salty language: President Trump, who, according to Factba.se transcripts, has cursed publicly at least 87 times since 2017.

The thinking is that Trump's "everyday Joe" cursing has lowered the bar for political discourse, but that other politicians emulating him fail to understand that he's a master of non-propositional swearing, which — at least among his supporters — may actually boost his political status.

When Trump curses, Byrne says, it comes across as a "sign of honesty" from a non-politician who "tells it like it is."

It's enough to make a Trump opponent curse.

Trump certainly isn't the first president to use profanities. Time reports that after a Revolutionary War battle, George Washington "swore … till the leaves shook on the trees."

During the 1948 election, President Truman acquired the nickname "Give 'Em Hell Harry" at a time when "hell" offended no small number of Americans.

Once his now-infamous tapes went public, President Nixon turned out to be a master of naughty words.

And Lyndon Baines Johnson — perhaps our most gifted presidential user of curse words — had a reputation for verbal obscenity.

In the past, political leaders cussed in private, not in public. Today, though, it's not just politicians swearing more. It's everyone.

A 2017 study by San Diego State University psychologist Jean M. Twenge showed a dramatic increase in cursing, which she attributed to America's growing individualism, "a cultural system that emphasizes the self more and social rules less." She explained that "as social rules fell by the wayside, and people were told to express themselves, swearing became more common."

That doesn't bode well for our cussing politicians. The more they and everyone else use taboo terms, the less taboo those terms become and the less impact they have.

If the use of salty language in our increasingly strident political discourse troubles you, here's a key takeaway from the 2020 campaign season:

We're all cursed.

Tom Purcell, author of "Misadventures of a 1970's Childhood," a humorous memoir available at amazon.com, is a Pittsburgh Tribune-Review humor columnist and is nationally syndicated exclusively by Cagle Cartoons Inc. Purcell can be contacted at Tom@TomPurcell.com.

Brunell

Continued from page 4

At stake, particularly in the market for jets with fewer than 100 seats, is $135 billion in sales over the next 20 years or so, according to industry group Japan Aircraft Development Corp.

Horizon's business is growing rapidly. In July, Alaska Air Group, parent to Horizon, reported its regional traffic increased 14.6 percent on a 12.9 percent increase in capacity compared to July 2018.

"For years, Boeing and Airbus focused on larger, more-profitable jetliners and shifted away from the smaller planes, which have similar development costs but sell for lower prices.

"Airbus' deal with Bombardier and Boeing's pact with Embraer signal that the big plane-makers intend to deny a foothold in the lucrative narrow-body market to ambitious newcomers, such as Commercial Aircraft Corp. of China," Bloomberg reported in April. (Update: Mitsubishi bought Bombardier's regional jet program in June).

"A longtime supplier of aircraft components to Boeing, Mitsubishi Heavy, the parent of Mitsubishi Regional Jet (MRJ), plans to emerge from its customer's (Boeing) shadow," Bloomberg added. It developed and manufactures major airframe components, including fuselage panels for the Boeing 777 and composite-material wing boxes for the 787.

Mitsubishi spent at least $2 billion over more than a decade developing SpaceJet. Its launch partner is All Nippon Airways (ANA) — one of Boeing's first 787 buyers.

"The aviation market in Asia is expected to grow further in the coming years, and there will be demand for these aircraft," said Lee Dong-heon, an analyst at Daishin Securities Co. in Seoul. "The shift in the regional aviation segment we have seen over the last year or so has opened opportunities."

In order to compete, Mitsubishi can't just rely on its home market. The biggest customers therefore could be in the U.S., where large airlines try to cut costs by outsourcing short flights to smaller carriers that fly regional jets, Bloomberg concluded.

The good news is Mitsubishi has strong ties with Boeing and Washington State. MRJ is flight testing the SpaceJet in Moses Lake and established its U.S. headquarters in Renton.

—Don C. Brunell is a business analyst, writer and columnist. He can be contacted at theBrunells@msn.com.

Cornfield

Continued from page 4

The hearing provided Inslee another chance to wage his campaign against corporate extortion a short distance from his office — and with a row of Boeing officials on hand to hear it. He was a no-show.

Also absent — and a subject for another day — were aerospace machinists and engineers who fought for those clawback bills in 2014 and 2015.

Inslee's aerospace advisor, Robin Toth, did attend. She delivered a promotional message of the industry's strength and importance, and of the state's efforts to attract more aerospace companies to Washington. She veered wide of the issue of whether a jobs-related metric should be appended to the tax-break law.

"I don't really have a position on that," she said afterward. "I haven't gotten anything from the governor on that."

Silence at home and protest abroad has been Inslee's M.O. on this subject in two terms.

If he seeks and secures a third — he says he is all in but climate change czar will be hard to pass up if a Democrat becomes president — it may embolden the governor to face those muggers.

Jerry Cornfield is a political reporter for The Daily Herald in Everett, a Sound Publishing Co. publication. Cornfield can be contacted at 360-352-8623 and jcornfield@heraldnet.com.

APPENDIX B
COMPLETED INTERVIEW RECORDS

Fifth Five-Year Review Interview Record
NBK Keyport
Keyport, WA

TYPE 2 INTERVIEW - REGULATORY AGENCY

Name: Mahbub Alam	
Title: Environmental Engineer	**Association to NBK Keyport:** Regulatory review
Organization: WA Department of Ecology	**Years of Association:** 3
Telephone: 3604076913	**Email:** mala461@ecy.wa.gov
Contact Made By:	**Date:** 11/7/2019

QUESTIONNAIRE

1. Please describe your degree of familiarity with the Naval Base Kitsap (NBK) Keyport Records of Decision (RODs) for Operable Units (OUs) 1 and 2; the implementation of the remedies at these OUs; the monitoring and maintenance that has taken place since implementation of the remedies; and recommendations made during the fourth five-year review (FYR) finalized in 2015. For reference OU 1 includes only one active site, whereas OU 2 includes two active sites, as follows:

OU 1 – Former Base Landfill

OU 2 Area 2 – Van Meter Spill and Drum Storage Areas

OU 2 Area 8 – Former Plating Shop

Response:

I am familiar with the sites and their remedies. As Ecology project manager, I have been involved in the regulatory oversight for these operable units.

2. What is your overall impression of the on-going effectiveness of the components of the OU 1 remedy? For reference, the primary remedy components are:

- Phytoremediation at the former landfill using hybrid poplar trees
- Removal of PCB-contaminated sediments from the marsh
- Upgrade of the tide gate
- Upgrade and maintenance of the landfill cover
- Long-term monitoring
- Contingent actions for off-base domestic wells
- Institutional controls

Response:

The remedy of the OU 1 has failed to attain remedial action objectives (RAOs). The site does not seem to pose immediate danger to human health and environment but may pose risk in the long term. The site is going through re-characterization, source area assessments, and Tier II ecological and human health risk assessments.

3. What is your overall impression of the on-going effectiveness of the components of the OU 2 remedy? For reference, the primary remedy components are:

- Institutional controls and groundwater monitoring at Area 2
- Excavation and off-site disposal of vadose-zone soil at Area 8
- Institutional controls and monitoring of groundwater, sediments, and shellfish at Area 8

Response:

The remedy at OU 2 Area 2 remains effective but it has not achieved cleanup levels or taking longer to achieve cleanup level.

However, the remedy for OU 2 Area 8 is not effective. Recent groundwater seeps bioassay results as part of ecological risk assessment showed adverse effects to ecological receptors. In addition, the site groundwater is long way from attaining drinking water quality which calls into question of monitored natural attenuation (MNA). The remedy needs to be revised for groundwater treatment/control besides MNA and institutional control to obtain remedial action objectives.

4. The phytoremediation component of the OU 1 remedy is not operating as anticipated in the southern portion of the former landfill. The Navy has been performing additional investigations, including a USGS modeling effort, to evaluate possible actions to shorten the restoration timeframe and improve the remedy performance. What is your impression of the progress towards reassessing this component of the remedy?

Response:

I think the overall progress made by the Navy is good. However, it appears the whole site, not only the southern plantation which has the highest contamination, has some hot spot areas that need remediation. In addition, it appears the soil mound north of northern plantation are contaminated with TPH and PCBs (new findings). It needs further investigation and assessment to see if these contaminations pose any risks or hazards to human health and environment.

5. To the best of your knowledge, has the on-going program of institutional controls inspections and environmental monitoring at OUs 1 and 2 been sufficiently thorough and frequent to meet the goals of the RODs? Have the monitoring data been timely and of acceptable quality? Please indicate the basis for your assessment.

Response:

The IC inspections have been routine and thorough to my knowledge. The Navy provides a report depicting the IC inspection results. The monitoring data so far have been of acceptable quality. A Tier II QAPP is always prepared and reviewed by the agencies. The data report showing the monitoring data also meets expected quality.

6. To the best of your knowledge, have the recommendations made during the fourth FYR been adequately implemented/incorporated into the remedy operation, maintenance, and monitoring program? Please indicate the basis for your assessment.

Response:

While I was not involved in the last FYR process, it appears the Navy has made significant progress on the recommendations. All recommendations were taken up for follow up although some milestone dates may have missed. There are still issues in both OU 1 and OU 2 and Ecology expects this FYR will include more robust recommendations to move these sites closer to meeting RAOs.

7. What is your overall impression of meeting the recommendations from the fourth FYR?

Response:

See above response for question #6.

8. What do you see as major accomplishments for OUs 1 and 2 since the fourth FYR?

Response:

OU 1 - Site re-characterization to refine the conceptual site model (CSM). Startup of Tier II Human health and Ecological risk assessment. Completion of VI study to evaluate and eliminate the vapor pathway.
OU 2 - Completion of Human health and Ecological risk assessment. Completion of VI study to evaluate and eliminate the vapor pathway.

9. Are you aware of any (Tribal or) community concerns regarding implementation of the remedies at OUs 1 and 2? If so, please give details.

Response:

No.

10. Are you aware of, and do you feel well informed about the additional investigations that have occurred at OU 1 and OU 2 Area 8 over the past five years? Please elaborate.

Response:

I am aware of all the investigations happening in OU 1 and OU 2 Area 8. The Navy has arranged project team meetings regularly to brief the stakeholders about plans, data, and comment responses. Emphasis on Field visits, use of collaboration websites for site documents sharing, e.g., box, were some additional efforts made by the Navy for the Agencies.

11. To the best of your knowledge, since June 2014, have there been any new scientific findings that relate to potential site risks that might call into question the protectiveness of the remedies?

Response:

PFAS contamination at Navy sites have become an issue lately. It is unknown whether PFAS contamination exists or affects protectiveness at this time. The Navy has performed a preliminary assessment (PA) for Keyport without any stakeholder involvement. Ecology expect the Navy will involve the stakeholders in the next phase of assessment.

12. Since June 2014, have there been any complaints, violations, or other incidents related to NBK Keyport installation restoration that required a response by your office? If so, please provide details of the event(s) and results of the response(s).

Response:

To the best of my knowledge, I am not aware of any incidents related to Keyport.

13. Do you have any other comments, concerns, or suggestions regarding the effectiveness of the cleanup measures implemented so far in protecting human health and the environment at NBK Keyport?

Response:

For OU 1, the Navy needs to revise the CSM to a point that remedial actions can be implemented to remediate not only the hot spots (source areas) but also the other areas as needed so that the surface water, sediment and groundwater can be returned to their beneficial uses within a reasonable timeframe. For OU2, the Navy needs to implement a groundwater remedy to protect the affected ecological receptors and restore the aquifer to drinking water quality.

Fifth Five-Year Review Interview Record
NBK Keyport
Keyport, WA

TYPE 2 INTERVIEW - REGULATORY AGENCY

Name: John Evered	
Title: Toxicologist/Sediment Specialist	**Association to NBK Keyport:** Regulatory support staff
Organization: WA Dept of Ecology	**Years of Association:** 4.5
Telephone: 360 407 7071	**Email:** jeve461@ecy.wa.gov
Contact Made By: Jody Lipps	**Date:** 11/22/19

QUESTIONNAIRE

1. Please describe your degree of familiarity with the Naval Base Kitsap (NBK) Keyport Records of Decision (RODs) for Operable Units (OUs) 1 and 2; the implementation of the remedies at these OUs; the monitoring and maintenance that has taken place since implementation of the remedies; and recommendations made during the fourth five-year review (FYR) finalized in 2015. For reference OU 1 includes only one active site, whereas OU 2 includes two active sites, as follows:

OU 1 – Former Base Landfill

OU 2 Area 2 – Van Meter Spill and Drum Storage Areas

OU 2 Area 8 – Former Plating Shop

Response:

I have provided support to the Ecology project manager related to sediment issues since 2015. I have primarily been involved with the issues related to the investigation and remedy at OU 2 area 8 and provided sediment technical support to the assessment at the OU 1 landfill. I have not been involved any remedial decisions or investigations at OU 2 area 2

2. What is your overall impression of the on-going effectiveness of the components of the OU 1 remedy? For reference, the primary remedy components are:

- Phytoremediation at the former landfill using hybrid poplar trees
- Removal of PCB-contaminated sediments from the marsh
- Upgrade of the tide gate
- Upgrade and maintenance of the landfill cover
- Long-term monitoring
- Contingent actions for off-base domestic wells
- Institutional controls

Response:

Although OU 1 seems to not pose any immediate risks to human health or the environment, recent sampling results suggest that the contamination present may pose risks in the long term. I believe the recently proposed tier II human health and ecological risk assessments, site re-characterization and source area assessment will provide important information related to remedy effectiveness and protectiveness.

3. What is your overall impression of the on-going effectiveness of the components of the OU 2 remedy? For reference, the primary remedy components are:

- Institutional controls and groundwater monitoring at Area 2
- Excavation and off-site disposal of vadose-zone soil at Area 8
- Institutional controls and monitoring of groundwater, sediments, and shellfish at Area 8

Response:

I have not been involved in decisions related to OU 2 area 2, so I defer to Ecology's project manager who stated that the remedy remains effective but has not achieved cleanup goals. Recent results from the groundwater seep bioassays as part of the OU 2 area 8 ecological risk assessment show adverse effects to receptors, suggesting that the remedy is not protective. Monitored natural attenuation has not been effective in meeting drinking water groundwater standard or preventing impacts to the sediments and shellfish at Area 8.

4. The phytoremediation component of the OU 1 remedy is not operating as anticipated in the southern portion of the former landfill. The Navy has been performing additional investigations, including a USGS modeling effort, to evaluate possible actions to shorten the restoration timeframe and improve the remedy performance. What is your impression of the progress towards reassessing this component of the remedy?

Response:

I defer to the Ecology project manager who stated that the whole site, not only the southern plantation, has contamination hot spots. For example the soil mound in the north plantation with recently discovered TPH and PCB contamination that likely will require further investigation.

5. To the best of your knowledge, has the on-going program of institutional controls inspections and environmental monitoring at OUs 1 and 2 been sufficiently thorough and frequent to meet the goals of the RODs? Have the monitoring data been timely and of acceptable quality? Please indicate the basis for your assessment.

Response:

To the best of my knowledge IC inspections and environmental monitoring at OU 1 and OU 2 area 8 have been sufficient to attempt to meet the goals of the ROD. Monitoring has been timely, conducted in accordance with an approved QAPP, and data quality is as expected.

6. To the best of your knowledge, have the recommendations made during the fourth FYR been adequately implemented/incorporated into the remedy operation, maintenance, and monitoring program? Please indicate the basis for your assessment.

Response:

Although I was not directly involved in the development process of the last five year review, I believe the Navy has made progress on the previous recommendations. Following the recommendation at OU2 Area 8 to complete an additional risk assessment, risks were identified that will require the implementation of additional groundwater controls. Additional PCB seep data was also collected per a recommendation at OU 1 as well as a vapour intrusion evaluation at OU 1 and OU2 area 8.

7. What is your overall impression of meeting the recommendations from the fourth FYR?

Response:

See answer to question #6

8. What do you see as major accomplishments for OUs 1 and 2 since the fourth FYR?

Response:

OU 1 - Complete a site re-characterization to refine the conceptual site model and initiate a tier II human health and ecological risk assessment.

OU 2 - Completion of a human health and ecological risk assessments, specifically seep bioassay's following project teams recommendation, that identified risks to sediment benthic organisms.

9. Are you aware of any (Tribal or) community concerns regarding implementation of the remedies at OUs 1 and 2? If so, please give details.

Response:

None other than have been raised by the Suquamish Tribe in project meetings.

10. Are you aware of, and do you feel well informed about the additional investigations that have occurred at OU 1 and OU 2 Area 8 over the past five years? Please elaborate.

Response:

The Navy and their consultants have kept project team members well informed of additional investigations occurring at OU 1 and OU 2 area 8. Project team meetings have been arranged as needed to brief stakeholders on issues requiring input and adequate review periods have been provided for documents requiring comment and review.

11. To the best of your knowledge, since June 2014, have there been any new scientific findings that relate to potential site risks that might call into question the protectiveness of the remedies?

Response:

The emergence of PFAS as a contaminant of concern may call in to question the protection of the remedies, in particular at OU 2 area 8. The presence of a metal plating shop up-gradient of the beach is concerning, due to the use of PFOS as a fire suppressant during the electroplating process. Metal plating facilities have been identified as potential source areas during the PFAS preliminary assessment at Puget Sound Naval Shipyard. I request that Ecology's project manager be included in the next phase of PFAS assessment or investigation.

12. Since June 2014, have there been any complaints, violations, or other incidents related to NBK Keyport installation restoration that required a response by your office? If so, please provide details of the event(s) and results of the response(s).

Response:

I am not aware of any complaints, violations or other incidents related to NBK that required a response by my office.

13. Do you have any other comments, concerns, or suggestions regarding the effectiveness of the cleanup measures implemented so far in protecting human health and the environment at NBK Keyport?

Response:

No further comments. I look forward to completing the ecological and human health risk assessment at OU 1 and helping identify effective groundwater controls at OU 2 area 8.

Fifth Five-Year Review Interview Record
NBK Keyport
Keyport, WA

TYPE 3 INTERVIEW - COMMUNITY

Name: Clayton Schule

Title: Keyport Neighbor and Former Worker	**Association to NBK Keyport:** Keyport Neighbor and Former Worker
Organization: Keyport Improvement Club (KIC)	**Years of Association:** 15
Telephone: (360)779-6563	**Email:** keyportschules@wavecable.com
Contact Made By: Clay Schule	**Date:** 10/25/19

QUESTIONNAIRE

1. Please describe your degree of familiarity with the Naval Base Kitsap (NBK) Keyport Records of Decision (RODs) for Operable Units (OUs) 1 and 2; the implementation of the remedies at these OUs; the monitoring and maintenance that has taken place since implementation of the remedies; and recommendations made during the fourth five-year review (FYR) finalized in 2015. For reference OU 1 includes only one active site, whereas OU 2 includes two active sites, as follows:

OU 1 – Former Base Landfill

OU 2 Area 2 – Van Meter Spill and Drum Storage Areas

OU 2 Area 8 – Former Plating Shop

Response:

I am a resident of Dogfish Bay (OU 1), significantly effected by the base landfill areas. I have reviewed the previous assessments of the work done to alleviate environmental damage done by the former base landfill. I would describe those efforts as cover it, contain it and let nature take it's course.

2. What is your overall impression of the on-going effectiveness of the components of the OU 1 remedy? For reference, the primary remedy components are:

- Phytoremediation at the former landfill using hybrid poplar trees
- Removal of PCB-contaminated sediments from the marsh
- Upgrade of the tide gate
- Upgrade and maintenance of the landfill cover
- Long-term monitoring
- Contingent actions for off-base domestic wells
- Institutional controls

Response:

After the original containment and Phytoremediation, there has been nothing of any great effect done to reduce the runoff from the former landfill into the "tide flats" and then into Dogfish Bay. We have watched the implanting of native little neck clams to help with the clean up, but without clean up of the inflow from the landfill to the marsh to the tide flat, etc., it did nothing.
As with many long term military facilities, the remedial action requires more active measures.

3. What is your overall impression of the on-going effectiveness of the components of the OU 2 remedy? For reference, the primary remedy components are:

- Institutional controls and groundwater monitoring at Area 2
- Excavation and off-site disposal of vadose-zone soil at Area 8
- Institutional controls and monitoring of groundwater, sediments, and shellfish at Area 8

Response:

In reading the remedy reports, it appears that the monitoring of these site are not as active as they need to be. Without the active monitoring, corrective actions are subject.

4. Are you aware of any community concerns regarding implementation of the remedies at OUs 1 and 2? If so, please give details.

Response:

I'm not sure of community response, but the ability for human consumption of shellfish from Dogfish bay would be an excellent measure of clean up.

5. Are you aware of, and do you feel well informed about the additional investigations that have occurred at OU 1 and OU 2 Area 8 over the past five years? Please elaborate.

Response:

I've read the report, but no other information.

6. What effects has the remedy operation, maintenance, and monitoring program at the OU 1 and OU 2 sites had on the surrounding community?

Response:

I'm sure the from the worst (I've not seen) it must have improved. But our children play in the waters associated with these sites. I watch for them removing shellfish from Dogfish Bay, and warn of consuming them.

7. Please provide the newspaper, website, or Facebook page you used to obtain local information.

Response:

I live there!

8. Do you have any other comments, concerns, or suggestions regarding the effectiveness of the cleanup measures implemented so far in protecting human health and the environment at NBK Keyport?

Response:

I would like more reporting of the real effects of the runoff on local waters like Dogfish Bay.

9. Do you know of any other individuals who should be interviewed as part of this FYR process? If so, please provide their name(s) and contact information.

Response:

Please come to a meeting of the Keyport Improvement club.

APPENDIX C
OU 1 CUMULATIVE LONG-TERM MONITORING DATA

Table C-1. OU 1 Chlorinated VOC Groundwater Sampling Results through June 2019

Location ID	Sampling Date	1,1-DCA	1,2-DCA	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride
GW Remediation Goals		800	5	0.5	70	100	5	200	5	0.5
North Plantation – Shallow Groundwater Wells										
1MW-1	8/25/1995	14	1 U	**5.1**	**590 J**	**180 J**	1 U	1 U	1 U	**1,000 J**
1MW-1	12/6/1995	1	1 U	1 U[1]	**87 J**	7.7	1 U	1 U	1 U	**210 J**
1MW-1	3/12/1996	8.5	0.5 U	**2.6**	**450 J**	**120 J**	0.5 U	0.5 U	0.62	**710**
1MW-1	6/26/1996	15	0.5 U	**3.2**	**460 J**	**220 J**	0.5 U	0.5 U	0.51 U	**1,200 J**
1MW-1	3/3/1998	4.5	0.5 U	0.42 J	**81 J**	34 J	0.5 U	0.5 U	0.5 U	**250 J**
1MW-1	6/11/1999	19	3 U	**4**	**420**	**240**	3 U	3 U	3 U	**1,300**
1MW-1	10/20/1999	17	0.5 U	**3.1**	**320**	**190**	0.5 U	0.5 U	0.5 U	**970**
1MW-1	4/25/2000	18	0.5 U	**3.1**	**380 J**	**200 J**	0.5 U	0.5 U	0.5 U	**1,200 J**
1MW-1	6/7/2000	14	0.5 U	**1.7**	**240 J**	**210 J**	0.5 U	0.5 U	0.58	**1,200 J**
1MW-1	7/24/2000	25 U	25 U[1]	25 U[1]	**280 J**	**170 J**	25 U[1]	25 U	25 U[1]	**920 J**
1MW-1	10/31/2000	17	1 U	**2**	**270**	**160**	1 U	1 U	1 U	**1,300**
1MW-1	4/27/2001	17	1 UJ	**3.9**	**250 J**	**170 J**	1 U	1 UJ	0.6 J	**770 J**
1MW-1	6/20/2001	19 J	0.58 U	**2.5 J**	**240 J**	**170 J**	0.55 U	0.56 U	0.59 U	**860**
1MW-1	7/30/2001	14 J	1 U	**2.4**	**240 J**	**170**	1 U	1 U	1 U	**1,500 J**
1MW-1	10/29/2001	14 J	1 U	**1.5**	**160 J**	**130**	1 U	1 U	1 U	**970 J**
1MW-1	4/30/2002	16 J	2.5 U	**2.6 J**	**280 J**	**180 J**	2.5 U	2.5 U	2.5 U	**750 J**
1MW-1	6/19/2002	12 J	0.57 U	**1.7 J**	**170 J**	**130 J**	0.55 U	0.57 U	0.59 U	**970 J**
1MW-1	7/23/2002	15 J	2.5 U	**2.6 J**	**280 J**	**200 J**	2.5 U	2.5 U	2.5 U	**1,100 J**
1MW-1	10/24/2002	15 J	2 U	**2 U[1]**	**180 J**	**130 J**	2 U	2 U	2 U	**570 J**
1MW-1	4/29/2003	10 J	0.23 U	**1.4 J**	**160 J**	94 J	0.22 U	0.23 U	0.24 U	**780 J**
1MW-1	10/14/2003	14 J	0.57 U	**1.4 J**	**140 J**	**140 J**	0.55 U	0.57 U	0.59 U	**840 J**
1MW-1	4/22/2004	12	0.12 U	**2 J**	**150 J**	**130 J**	0.11 U	0.12 U	0.31 J	**760 J**
1MW-1	10/13/2004	15	0.12 U	**1.2**	**130 J**	**140 J**	0.11 U	0.12 U	0.23 J	**900 J**
1MW-1	4/14/2005	0.4	0.2 U	0.2 U	0.4	0.6	0.2 U	0.2 U	0.2 U	**4.8**
1MW-1	10/13/2005	13	0.2 U	**0.9**	**100**	91	0.2 U	0.2 U	0.2 U	**830**
1MW-1	7/10/2006	11 DJ	2.5 UJ	**1.1 DJ**	**72 DJ**	**100 DJ**	2.5 UJ	2.5 UJ	2 JD	**820 DJ**
1MW-1	10/16/2006	12	0.5 U	**0.52**	56	92 D	0.5 U	0.5 U	0.14 J	**660 D**
1MW-1	6/13/2007	11	0.5 U	**0.68**	66 D	84 D	0.5 U	0.5 U	0.18 J	**600 D**
1MW-1	10/18/2007	13	0.5 U	**0.63**	69	86 D	0.5 U	0.5 U	0.15 J	**540 D**
1MW-1	5/13/2008	10 D	1 U	0.46 D	33 D	67 D	1 U	1 U	0.16 JD	**580 D**
1MW-1	10/28/2008	10 D	1 U	0.46 JD	39 D	71 D	1 U	1 U	1 U	**490 D**
1MW-1	6/18/2009	9.6 D	1 U	0.46 D	43 D	73 D	1 U	1 U	1 U	**570 D**
1MW-1	10/27/2009	8.3 D	1 U	0.2 JD	14 D	46 D	1 U	1 U	1 U	**420 D**
1MW-1	6/15/2010	9.2	0.5 U	0.45 J	39 D	60 D	0.5 U	0.5 U	0.17 J	**380 D**
1MW-1	10/25/2010	8.4 D	1.3 U	0.4 JD	31 D	31 D	1.3 U	1.3 U	1.3 U	**400 D**
1MW-1	7/18/2011	9.1	0.5 U	0.39 J	37	67	0.5 U	0.5 U	0.14 J	**370 D**
1MW-1	10/25/2011	8.1	0.5 U	0.27	31	60	0.5 U	0.5 U	0.5 U	**280 D**
1MW-1	6/12/2012	8.4	0.5 U	0.26 J	24	49	0.5 U	0.5 U	0.11 J	**290 D**
1MW-1	6/23/2014	6.1	0.5 U	0.19 J	17	35	0.5 UJ	0.5 U	0.5 U	**280 D**
1MW-1	6/21/2016	4.6	0.08 J	0.5 U	13	25	0.5 U	0.5 U	0.5 U	**230 D**
1MW-1	6/11/2019	3.2	0.2 UM	0.12 JM	9.9	23	0.5 U	0.2 U	0.2 U	**230 D**
MW1-02	8/28/1995	1 U	1 U	**4.2**	**1,400 J**	23	1 U	1 U	**36 J**	**150 J**
MW1-02	12/6/1995	1 U	1 U	**3.5**	**1,300 J**	22	1 U	1 U	**35 J**	**140 J**
MW1-02	3/11/1996	0.5 U	0.5 U	**4.8**	**1,800 J**	30 J	0.5 U	0.5 U	**41**	**200 J**
MW1-02	6/25/1996	0.23 J	0.5 U	**5.1 J**	**1,500 J**	31 J	0.5 U	0.5 U	**43 J**	**180 J**
MW1-02	3/2/1998	0.5 U	0.5 U	**3.4**	**1,200 J**	21	0.5 U	0.5 U	**29 J**	**110 J**
MW1-02	6/11/1999	3 U	3 U	**5**	**1,200**	26	3 U	3 U	**27**	**160**

Table C-1. OU 1 Chlorinated VOC Groundwater Sampling Results through June 2019

Location ID	Sampling Date	1,1-DCA	1,2-DCA	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride
GW Remediation Goals		800	5	0.5	70	100	5	200	5	0.5
MW1-02	10/20/1999	0.5 U	0.5 U	**3.4**	**1,000**	21	0.5 U	0.5 U	**23**	**110**
MW1-02	4/25/2000	0.5 U	0.5 U	**6**	**1,900 J**	49 J	0.5 U	0.5 U	**13**	**220 J**
MW1-02	6/8/2000	0.3 J	0.2 J	**3.2 J**	**890 J**	21 J	0.5 U	0.5 U	**22 J**	**110 J**
MW1-02	7/24/2000	25 U	25 U[1]	25 U[1]	**750 J**	25 U	25 U[1]	25 U	25 U[1]	**87 J**
MW1-02	10/31/2000	1 U	1 U	**2.2**	**810**	15	1 U	1 U	**12**	**85**
MW1-02	4/26/2001	1 U	1 UJ	**6.3**	**1,200 J**	44	1 U	1 UJ	**21**	**120 J**
MW1-02	6/20/2001	0.91 U	1.2 U	**3.6 J**	**950 J**	18 J	1.1 U	1.2 U	**19 J**	**89 J**
MW1-02	7/30/2001	1 U	1 U	**2.1**	**660 J**	43 J	1 U	1 U	**19**	**130 J**
MW1-02	10/29/2001	1 U	1 U	**2.4**	**700 J**	18	1 U	1 U	**14**	**93**
MW1-02	4/30/2002	2.5 U	2.5 U	**3.6 J**	**1,200 J**	29 J	2.5 U	2.5 U	**5 J**	**140 J**
MW1-02	6/19/2002	0.26 J	0.23 U	**2.2 J**	**660 J**	13 J	0.22 U	0.23 U	**15 J**	**75 J**
MW1-02	7/23/2002	1 U	1 U	**2.6 J**	**720 J**	16 J	1 U	1 U	**17 J**	**100 J**
MW1-02	10/24/2002	2.5 U	2.5 U	**2.7 J**	**910 J**	17 J	2.5 U	2.5 U	**21 J**	**120 J**
MW1-02	4/30/2003	0.37 U	0.46 U	**3.4 J**	**870 J**	18 J	0.44 U	0.46 U	**13 J**	**130 J**
MW1-02	10/15/2003	0.26 J	0.12 U	**2.6**	**710 J**	15	0.11 U	0.12 U	**19**	**120 J**
MW1-02	4/22/2004	0.37 J	0.12 U	**3.9**	**1,200 J**	22	0.11 U	0.12 U	**14**	**200 J**
MW1-02	10/13/2004	0.45 J	0.12 U	**3.6**	**930 J**	23	0.11 U	0.12 U	**6.6**	**160 J**
MW1-02	4/12/2005	0.3	0.2 U	**2.2**	**690**	15	0.2 U	0.2 U	**13**	**180**
MW1-02	10/12/2005	0.4	0.2 U	**2.9**	**810**	20	0.2 U	0.2 U	4.1	**140**
MW1-02	7/10/2006	2.5 U	2.5 U	**2.8 D**	**660 D**	17 D	2.5 U	2.5 U	2 JD	**150 D**
MW1-02	10/16/2006	0.33 J	0.5 U	**2**	**560 D**	16	0.5 U	0.5 U	1.3	**110 D**
MW1-02	6/13/2007	0.36 JD	1 U	**2.1 D**	**680 D**	16 D	1 U	1 U	**5.2 D**	**140 D**
MW1-02	10/18/2007	0.28 JD	1 U	**1.9 D**	**590 D**	15 D	1 U	1 U	**9.5 D**	**98 D**
MW1-02	5/8/2008	0.28 J	0.5 U	**1.8**	**460 D**	13	0.5 U	0.5 U	**7.5**	**110 D**
MW1-02	10/28/2008	0.25 JD	1.3 U	**1.8 D**	**420 D**	11 D	1.3 U	1.3 U	**9.1 D**	**88 D**
MW1-02	6/19/2009	0.22 JD	1 U	**1.5 D**	**460 D**	11 D	1 U	1 U	**6.4 D**	**87 D**
MW1-02	10/27/2009	0.26 JD	1 U	**1.8 D**	**440 D**	11 D	1 U	1 U	**6.2 D**	**91 D**
MW1-02	6/15/2010	0.27 J	0.5 U	**1.9**	**490 D**	13	0.5 U	0.5 U	**7.5**	**92 D**
MW1-02	10/25/2010	0.24 JD	1 U	**1.4 D**	**410 D**	10 D	1 U	1 U	**5.8 D**	**96 D**
MW1-02	7/19/2011	0.37 J	0.5 U	**1.7**	**440 D**	14	0.5 U	0.5 U	3	**90 D**
MW1-02	10/25/2011	0.28 J	0.5 U	**1.1**	**360 D**	9.9	0.5 U	0.5 U	2.3	**67**
MW1-02	6/12/2012	0.35 J	0.5 U	**1.8**	**450 D**	14	0.5 U	0.5 U	**5.8**	**81 D**
MW1-02	6/23/2014	0.34 J	0.5 U	**1.5**	**390 D**	13	0.5 UJ	0.5 U	4.7	**110 D**
MW1-02	6/21/2016	0.41 J	0.5 U	**1.2**	**330 D**	11	0.5 U	0.5 U	1.2	**89 D**
MW1-02	6/19/2017	0.31 J	0.5 U	**0.65**	**200 D**	6.6	0.5 U	0.5 U	2.1	**54**
MW1-02	6/18/2019	0.37	0.2 U	**0.63**	**160 D**	7	0.5 U	0.2 U	1.1	**79 DM**
MW1-03	3/8/1996	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-03	6/21/1996	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-03	9/11/1996	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-03	10/20/1999	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.7	0.5 U
MW1-03	4/25/2000	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-03	7/24/2000	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-03	10/31/2000	1 U	1 U	1 U[1]	1 U	1 U	1 U	1 U	1 U	1 U[1]
MW1-03	4/27/2001	1 U	1 UJ	1 U[1]	1 U	1 U	1 U	1 UJ	1 U	1 U[1]
MW1-03	7/30/2001	1 U	1 U	1 U[1]	1 U	1 U	1 U	1 U	1 U	1 U[1]
MW1-03	10/29/2001	1 U	1 U	1 U[1]	1	1.1	1 U	1 U	1 U	**3.3**
MW1-03	4/30/2002	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-03	7/23/2002	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

Table C-1. OU 1 Chlorinated VOC Groundwater Sampling Results through June 2019

Location ID	Sampling Date	1,1-DCA	1,2-DCA	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride
GW Remediation Goals		800	5	0.5	70	100	5	200	5	0.5
MW1-03	10/24/2002	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-03	4/29/2003	0.091 U	0.12 U	0.12 U	0.12 U	0.14 U	0.11 U	0.12 U	0.12 U	0.22 U
MW1-03	10/14/2003	0.091 U	0.12 U	0.12 U	0.12 U	0.14 U	0.11 U	0.12 U	0.12 U	0.22 U
MW1-03	4/21/2004	0.091 U	0.12 U	0.12 U	0.12 U	0.14 U	0.11 U	0.12 U	0.12 U	0.22 U
MW1-03	10/13/2004	0.091 U	0.12 U	0.12 U	0.12 U	0.15 U	0.11 U	0.12 U	0.12 U	0.23 J
MW1-03	4/12/2005	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
MW1-03	10/12/2005	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
MW1-03	7/12/2006	0.5 U	0.5 U	0.2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 U
MW1-03	10/16/2006	0.5 U	0.5 U	0.3 U	0.17 J	0.5 U	0.5 U	0.5 U	0.5 U	0.09 J
MW1-03	6/13/2007	0.5 U	0.5 U	0.2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 U
MW1-03	10/19/2007	0.5 U	0.5 U	0.2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 U
MW1-03	5/7/2008	0.5 U	0.5 U	0.2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 U
MW1-03	10/28/2008	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 U
MW1-03	6/19/2009	0.5 U	0.5 U	0.2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 U
MW1-03	10/27/2009	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-03	6/15/2010	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-03	10/25/2010	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-03	7/19/2011	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-03	10/25/2011	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-03	6/12/2012	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-03	6/23/2014	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U
MW1-03	6/22/2016	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-41	10/21/1999	0.5 U	0.5 U	0.5 U	0.6	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-41	4/26/2000	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-41	6/8/2000	0.2 J	0.5 U	0.5 U	0.82	0.5 U	0.5 U	0.5 U	0.5 U	**0.53**
MW1-41	7/24/2000	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-41	11/2/2000	1 U	1 U	1 U1	1 U	1 U	1 U	1 U	1 U	1 U[1]
MW1-41	4/26/2001	1 U	1 UJ	1 U1	1 U	1 U	1 U	1 UJ	1 U	1 U[1]
MW1-41	6/20/2001	0.1 J	0.12 U	0.12 U	0.4 J	0.14 U	0.11 U	0.12 U	0.12 U	0.4 J
MW1-41	6/20/2001	0.091 U	0.12 U	0.12 U	0.41 J	0.14 U	0.11 U	0.12 U	0.12 U	0.42 J
MW1-41	7/30/2001	1 U	1 U	1 U[1]	1 U	1 U	1 U	1 U	1 U	**0.6 J**
MW1-41	10/29/2001	1 U	1 U	1 U[1]	1 U	1 U	1 U	1 U	1 U	**0.5 J**
MW1-41	4/30/2002	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-41	6/19/2002	0.091 U	0.12 U	0.12 U	0.41 J	0.14 U	0.11 U	0.12 U	0.12 U	0.43 J
MW1-41	7/23/2002	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-41	10/24/2002	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-41	4/30/2003	0.091 U	0.12 U	0.12 U	0.43 U	0.14 U	0.11 U	0.12 U	0.12 U	0.43 U
MW1-41	10/15/2003	0.091 U	0.12 U	0.12 U	0.37 J	0.14 U	0.11 U	0.12 U	0.12 U	0.28 J
MW1-41	4/22/2004	0.091 U	0.12 U	0.12 U	0.3 J	0.14 U	0.11 U	0.12 U	0.12 U	0.3 J
MW1-41	10/13/2004	0.1 J	0.12 U	0.12 U	0.41 J	0.15 U	0.11 U	0.12 U	0.12 U	0.35 J
MW1-41	4/12/2005	0.2 U	0.2 U	0.2 U	0.3	0.2 U	0.2 U	0.2 U	0.2 U	0.3
MW1-41	10/12/2005	0.2 U	0.2 U	0.2 U	0.5	0.2 U	0.2 U	0.2 U	0.2 U	0.3
MW1-41	7/10/2006	0.5 U	0.5 U	0.2 U	0.26 J	0.5 U	0.5 U	0.5 U	0.5 U	0.23
MW1-41	10/16/2006	0.5 U	0.5 U	0.3 U	0.34 J	0.5 U	0.5 U	0.5 U	0.5 U	0.22
MW1-41	6/13/2007	0.5 U	0.5 U	0.2 U	0.25 J	0.5 U	0.5 U	0.5 U	0.5 U	0.21
MW1-41	10/18/2007	0.5 U	0.5 U	0.2 U	0.31 J	0.5 U	0.5 U	0.5 U	0.5 U	0.18 J
MW1-41	5/8/2008	0.5 U	0.5 U	0.2 U	0.27 J	0.11 J	0.5 U	0.5 U	0.5 U	0.19 J
MW1-41	10/28/2008	0.08 J	0.5 U	0.5 U	0.32 J	0.12 J	0.5 U	0.5 U	0.5 U	0.16 J

Table C-1. OU 1 Chlorinated VOC Groundwater Sampling Results through June 2019

Location ID	Sampling Date	1,1-DCA	1,2-DCA	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride
GW Remediation Goals		800	5	0.5	70	100	5	200	5	0.5
MW1-41	6/19/2009	0.5 U	0.5 U	0.2 U	0.26 J	0.07 J	0.5 U	0.5 U	0.5 U	0.2
MW1-41	10/27/2009	0.5 U	0.5 U	0.5 U	0.28 J	0.1 J	0.5 U	0.5 U	0.5 U	0.17 J
MW1-41	6/15/2010	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 J
MW1-41	10/25/2010	0.5 U	0.5 U	0.5 U	0.29 J	0.5 U	0.5 U	0.5 U	0.5 U	0.18 J
MW1-41	7/18/2011	0.5 U	0.5 U	0.5 U	0.26 J	0.08 J	0.5 U	0.5 U	0.5 U	0.16 J
MW1-41	10/25/2011	0.5 U	0.5 U	0.5 U	0.23 J	0.09 J	0.5 U	0.5 U	0.5 U	0.12 J
MW1-41	6/19/2019	0.04 J	0.2 U	0.2 U	0.16 J	0.2 U	0.2 U	0.2 U	0.2 U	0.12
South Plantation – Shallow Groundwater Wells										
MW1-04	8/23/1995	1 U	1 U	**7.7**	**6,400 J**	80 J	2.2	1 U	**11,000 J**	**2,000 J**
MW1-04	12/5/1995	1 U	1 U	**5.2**	**3,900 J**	500 U[1]	1.7	1 U	**8,600 J**	**2,800 J**
MW1-04	3/5/1996	0.67 J	0.5 UJ	**5.6 J**	**3,500 J**	56 J	0.96 J	0.5 UJ	**6,300 J**	**1,100 J**
MW1-04	6/20/1996	0.64	0.5 U	**13**	**5,900 J**	41	4	0.5 U	**22,000 J**	**970 J**
MW1-04	3/3/1998	0.5 U	0.5 U	**16**	**13,000 J**	**140 J**	3.8	0.5 U	**22,000 J**	**1,900 J**
MW1-04	6/14/1999	2 J	3 U	**24**	**12,000 J**	**140**	4	3 U	**26,000**	**1,800**
MW1-04	10/21/1999	0.8	0.5 U	**10**	**5,300**	70	0.7	0.5 U	**3,600**	**1,100**
MW1-04	4/26/2000	1.4	0.5 U	**16**	**8,500 J**	**100 J**	2.9	0.5 U	**19,000 J**	**1,300 J**
MW1-04	6/7/2000	0.3 J	0.5 U	**6.2**	**15,000 J**	**100 J**	1.3	0.5 U	**38,000**	**1,300**
MW1-04	7/25/2000	250 U	250 U[1]	250 U[1]	**8,500 J**	250 U[1]	250 U[1]	250 U[1]	**18,000 J**	**860 J**
MW1-04	11/9/2000	1 U	1 U	**0.9 J**	**660**	12	1 U	1 U	**490**	**190**
MW1-04	4/27/2001	1 U	1 UJ	**6.6**	**3,700 J**	74 J	0.8 J	1 UJ	**3,900 J**	**700 J**
MW1-04	6/20/2001	4.6 U	5.7 U[1]	**18 J**	**12,000 J**	**110 J**	5.5 U[1]	5.6 U	**13,000 J**	**1,700 J**
MW1-04	7/31/2001	1 U	1 U	**2.9**	**2,200 J**	95 J	0.6 J	1 U	**2,700 J**	**400 J**
MW1-04	10/30/2001	1 U	1 U	**0.5 J**	**270 J**	3	1 U	1 U	**170**	**49**
MW1-04	5/1/2002	2.5 U	2.5 U	2.5 U[1]	**600 J**	3.7 J	2.5 U	2.5 U	**730 J**	**54 J**
MW1-04	6/17/2002	9.1 U	12 U[1]	**30 J**	**15,000 J**	**100 J**	11 U[1]	12 U	**42,000 J**	**970 J**
MW1-04	7/25/2002	1 U	1 U	**1.1 J**	**600 J**	2.7 J	1 U	1 U	**580 J**	**95 J**
MW1-04	10/25/2002	0.5 U	0.5 U	**0.8**	**430 J**	3.9	0.5 U	0.5 U	**490 J**	**36 J**
MW1-04	4/29/2003	4.6 U	5.7 U[1]	16 U[1]	**7,000 J**	53 J	5.5 U[1]	5.7 U	**11,000 J**	**1,100 J**
MW1-04	10/15/2003	2.3 U	2.9 U	**9 J**	**4,000 J**	50 J	2.8 U	2.9 U	**2,500 J**	**1,800 J**
MW1-04	4/21/2004	9.1 U	12 U[1]	**18 J**	**8,100 J**	71 J	11 U[1]	12 U	**20,000 J**	**460 J**
MW1-04	10/14/2004	1.2	0.12 U	**28**	**15,000 J**	94 J	3.8	0.12 U	**22,000 J**	**770 J**
MW1-04	4/13/2005	0.2 U	0.2 U	200 U[1]	**10,000**	200 U[1]	2.3	0.2 U	**16,000**	**800**
MW1-04	10/13/2005	0.2 U	0.2 U	**13**	**8,600**	100 U[1]	1.5	0.2 U	**7,800**	**1,900**
MW1-04	7/12/2006	50 U	50 U[1]	**16 JD**	**6,300 D**	53 D	50 U[1]	50 U	**14,000 D**	**540 D**
MW1-04	10/17/2006	0.23 J	0.5 U	**17**	**11,000 D**	77 D	0.63	0.5 U	**3000 D**	**4500 D**
MW1-04	6/14/2007	100 U	100 U[1]	100 U[1]	**11,000 D**	72 JD	100 U[1]	100 U	**24,000 D**	**850 D**
MW1-04	10/17/2007	10 U	10 U[1]	**5 D**	**3,400 D**	23 D	10 U[1]	10 U	**3,100 D**	**240 D**
MW1-04	5/7/2008	50 U	50 U[1]	**18 JD**	**7,500 D**	73 D	50 U[1]	50 U	**24,000 D**	**410 D**
MW1-04	10/28/2008	13 U	13 U[1]	**4.5 JD**	**3,400 D**	23 D	13 U[1]	13 U	**6,600 D**	**180 D**
MW1-04	6/25/2009	50 U	50 U[1]	**23 D**	**12,000 D**	93 D	50 U[1]	50 U	**30,000 JD**	**510 D**
MW1-04	10/27/2009	5 U	5 U	**3.4 JD**	**1,600 D**	10 D	5 U	5 U	**2,000 D**	**100 D**
MW1-04	6/16/2010	50 U	50 U[1]	**25 JD**	**17,000 D**	**170 D**	50 U[1]	50 U	**32,000 D**	**960 D**
MW1-04	10/25/2010	10 U	10 U[1]	**4.2 JD**	**2,700 D**	21 D	10 U[1]	10 U	**5,400 D**	**130 D**
MW1-04	7/18/2011	50 U[1/]	0.5 U	**17 JD**	**1,100 D**	95 D	50 U1/	50 U	**22,000 D**	**440 D**
MW1-04	10/25/2011	2.5 U	2.5 U	**1.6 JD**	**840 D**	6.3 D	2.5 U	2.5 U	**380 D**	**56 D**
MW1-04	6/12/2012	25 U	25 U[1]	**7 JD**	**7,000 D**	46 D	25 U[1]	25 U	**16,000 D**	**130 D**
MW1-04	6/17/2013	25 U	25 U[1]	**8.5 JD**	**7,700 D**	46 D	25 U[1]	25 U	**15,000 D**	**130 D**

Table C-1. OU 1 Chlorinated VOC Groundwater Sampling Results through June 2019

Location ID	Sampling Date	1,1-DCA	1,2-DCA	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride
GW Remediation Goals		800	5	0.5	70	100	5	200	5	0.5
MW1-04	6/17/2014	10 U	10 U[1]	**4.2 JD**	**3,500 D**	27 D	10 U[1]	10 U	**6,100 D**	**110 D**
MW1-04	6/24/2015	2.5 U	2.5 U	**2.9 D**	**1,800 D**	16 D	2.5 U	2.5 U	**1,600 D**	**96 D**
MW1-04	6/23/2016	2.5 U	2.5 U	**2.9 D**	**1,800 D**	14 D	2.5 U	2.5 U	**1,700 D**	**85 D**
MW1-04	6/19/2017	10 U	10 U[1]	**6.6 J D**	**5600 D**	56 D	10 U[1]	10 U	**11000 D**	**240 D**
MW1-04	6/19/2019	0.2 U	0.2 U	**1.3**	**580 D**	7.3	0.5 U	0.2 U	**680 D**	**34**
MW1-05	8/23/1995	5.8 J	1 U	1 U[1]	17	1.3	1 U	1 U	1.9	**140 J**
MW1-05	12/5/1995	110 J	1 U	1 U[1]	**74 J**	16	1 U	1 U	**7.3**	**4,300 J**
MW1-05	3/6/1996	34	0.5 U	0.5 U	60	7	0.5 U	0.5 U	3	**1,100**
MW1-05	6/20/1996	29 J	0.5 U	0.24 J	**93 J**	6.5	0.5 U	0.5 U	1.7	**1,500 J**
MW1-05	3/4/1998	67 J	0.26 J	0.5 U	8.9	7.2	0.5 U	0.5 U	1.6	**1,000 J**
MW1-05	6/14/1999	9	3 U	3 U[1]	9	2 J	3 U	3 U	2 J	**290**
MW1-05	10/21/1999	9.6	0.5 U	0.5 U	0.5	0.5	0.5 U	0.5 U	0.5 U	**18**
MW1-05	4/25/2000	1.1	0.5 U	0.5 U	1.2	0.5 U	0.5 U	0.5 U	0.5 U	**30**
MW1-05	6/7/2000	6.9	0.5 U	0.5 U	1.8	0.64	0.5 U	0.5 U	1.6	**22**
MW1-05	7/25/2000	1.8	0.5 U	0.5 U	3.4	0.5 U	0.5 U	0.5 U	0.5 U	**31**
MW1-05	11/6/2000	1.7	1 U	1 U[1]	1 U	1 U	1 U	1 U	1 U	**7**
MW1-05	4/26/2001	1 U	1 UJ	1 U[1]	1 U	1 U	1 U	1 UJ	1 U	**24**
MW1-05	6/20/2001	1.5	0.12 U	0.12 U	0.46 J	0.28 J	0.11 U	0.12 U	0.46 J	**32**
MW1-05	7/31/2001	0.5 J	1 U	1 U[1]	1 U	1 U	1 U	1 U	1 U	**13**
MW1-05	10/30/2001	1.7	1 U	1 U[1]	0.5 J	1 U	1 U	1 U	1 U	**3.5**
MW1-05	5/1/2002	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	**1.7**
MW1-05	6/17/2002	0.93	0.12 U	0.12 U	0.74	0.16 J	0.11 U	0.12 U	0.85	**11**
MW1-05	7/24/2002	0.65	0.5 U	0.5 U	0.63 J	0.5 U	0.5 U	0.5 U	0.66	**2.5**
MW1-05	10/25/2002	15	0.5 U	0.5 U	0.82	0.5 U	0.5 U	0.5 U	0.8	**5.6**
MW1-05	4/29/2003	0.32 U	0.12 U	0.12 U	0.3 U	0.14 U	0.11 U	0.12 U	0.33 U	**5.6**
MW1-05	10/15/2003	2	0.12 U	0.12 U	0.41 J	0.22 J	0.11 U	0.12 U	0.24 J	**3.1**
MW1-05	4/22/2004	0.24 J	0.12 U	0.12 U	0.27 J	0.14 U	0.11 U	0.12 U	0.24 J	**0.83**
MW1-05	10/14/2004	1.4	0.12 U	0.12 U	0.56	0.31 J	0.11 U	0.12 U	0.55	**2**
MW1-05	4/13/2005	0.2 U	0.2 U	0.2 U	2	0.2 U	0.2 U	0.2 U	**10**	**0.9**
MW1-05	10/12/2005	3	0.2 U	0.2 U	0.7	0.2 U	0.2 U	0.2 U	0.5	**5.9**
MW1-05	7/12/2006	0.48 J	0.5 U	0.2 U	0.4 J	0.5 U	0.5 U	0.5 U	0.5 U	**0.91**
MW1-05	10/16/2006	6.8	0.5 U	0.3 U	0.9	0.4 J	0.5 U	0.5 U	0.65	**11**
MW1-05	6/14/2007	0.44 J	0.5 U	0.5 U	0.27 J	0.5 U	0.5 U	0.5 U	0.27 J	**0.7**
MW1-05	10/17/2007	2.1	0.5 U	0.2 U	0.55	0.17 J	0.5 U	0.5 U	0.34 J	**4**
MW1-05	5/12/2008	0.16 J	0.5 U	0.2 U	0.26 J	0.1 J	0.5 U	0.5 U	0.27 J	0.42
MW1-05	10/29/2008	1.4	0.5 U	0.5 U	0.54	0.24 J	0.5 U	0.5 U	0.39 J	**2.2**
MW1-05	6/26/2009	3.4	0.5 U	0.2 U	0.51	0.59	0.5 U	0.5 U	0.47 J	**6.6**
MW1-05	10/27/2009	0.97	0.5 U	0.5 U	0.44 J	0.23 J	0.5 U	0.5 U	0.44 J	**1.9**
MW1-05	6/16/2010	2.6	0.5 U	0.5 U	0.62	0.55	0.5 U	0.5 U	0.52	**8.1**
MW1-05	10/25/2010	0.37 J	0.5 U	0.5 U	0.35 J	0.5 U	0.5 U	0.5 U	0.32 J	**0.74**
MW1-05	7/18/2011	1.9	0.5 U	0.5 U	0.6	0.47 J	0.5 U	0.5 U	0.42 J	**9.4**
MW1-05	10/26/2011	1.4	0.5 U	0.5 U	0.46 J	0.16 J	0.5 U	0.5 U	0.4 J	**3.6**
MW1-05	6/12/2012	0.25 J	0.5 U	0.5 UJ	0.24 J	0.1 J	0.5 U	0.5 U	0.27 J	**2.2**
MW1-05	6/17/2013	0.1 J	0.5 U	0.5 U	0.19 J	0.5 U	0.5 U	0.5 U	0.16 J	0.31 J
MW1-05	6/17/2014	0.78	0.5 U	0.5 U	0.85	0.2 J	0.5 U	0.5 U	0.24 J	**17**
MW1-05	6/24/2015	0.6	0.5 U	0.5 U	0.53	0.08 J	0.5 U	0.5 U	0.29 J	**7.7 J**
MW1-05	6/22/2016	4	0.5 U	0.11 J	5.5	1.2	0.5 U	0.5 U	0.46 J	**64**
MW1-05	6/19/2017	2.7	0.5 U	0.09 J	5.7	1.1	0.5 U	0.5 U	0.58	**53**

Table C-1. OU 1 Chlorinated VOC Groundwater Sampling Results through June 2019

Location ID	Sampling Date	1,1-DCA	1,2-DCA	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride
GW Remediation Goals		800	5	0.5	70	100	5	200	5	0.5
MW1-16	8/31/1995	**12,000 J**	**15 J**	**680 J**	**14,000 J**	**520 J**	0.51 J	**5,600 J**	**250 J**	**12,000 J**
MW1-16	6/20/1996	**30,000 J**	**35 J**	**180 J**	**3,100 J**	**180 J**	1.3 J	**430 J**	**34 J**	**2,200 J**
MW1-16	3/4/1998	**24,000 J**	**24 J**	**110 J**	**18,000 J**	**180 J**	1.5	**840 J**	**4,000 J**	**3,900 J**
MW1-16	6/14/1999	**15,000 J**	**17**	**48**	**6,900**	**160**	1 J	140	**550**	**4,100**
MW1-16	10/21/1999	**6,500**	**9**	**5**	28	26	1.2	23	**9.2**	**28**
MW1-16	4/26/2000	**1,700 J**	0.5 UJ	0.5 UJ	**70 J**	7.4 J	0.69 J	16 J	3.3 J	**4.3 J**
MW1-16	6/7/2000	**2,500**	2.7	**2 J**	13	13	1 J	29	**20**	**6.6**
MW1-16	7/25/2000	**2,300 J**	50 U[1]	50 U[1]	50 U	50 U	50 U[1]	50 U	50 U[1]	50 U[1]
MW1-16	11/6/2000	**3,900**	4.2	**1.3**	12	16	1 U	21 J	4.1	1 U[1]
MW1-16	4/27/2001	**1,100 J**	1.6 J	1 U[1]	2.4	7.5	0.4 J	7.2 J	2.2	**19**
MW1-16	6/20/2001	**2,900 J**	**7 J**	**23 J**	**9,300 J**	98 J	5.5 U[1]	28 J	**370 J**	**1,400 J**
MW1-16	7/31/2001	**1,900 J**	1.9	**2.2**	60	12	1 U	15	**8.3**	**68 J**
MW1-16	10/30/2001	**3,400 J**	4.1	**2.1**	13	17	1 U	13	3.5	**11**
MW1-16	5/1/2002	**1,200 J**	2.5 U	2.5 U[1]	3.9 J	7.9 J	2.5 U	5.6 J	2.5 U	**2.7 J**
MW1-16	6/17/2002	**10,000 J**	12 U[1]	**42 J**	**24,000 J**	**240 J**	11 U[1]	38 J	**150 J**	**3,000 J**
MW1-16	7/24/2002	**3,200 J**	5 U	5 U[1]	**340 J**	17 J	5 U	10 J	**5.5 J**	**86 J**
MW1-16	10/25/2002	**9,000 J**	25 U[1]	25 U[1]	**190 J**	38 J	25 U[1]	25 U	25 U[1]	**80 J**
MW1-16	4/29/2003	330 J	0.41 U	0.37 U	1.6	3.9	0.31 U	0.52	1.3	**2.1**
MW1-16	10/15/2003	**1,700 J**	1.2 U	1.2 U[1]	6.2 J	13 J	1.1 U	5.3 J	2.4 J	**5.5 J**
MW1-16	4/21/2004	160 J	0.21 J	0.24 J	1.8	3	0.13 J	0.2 J	1	**1.7**
MW1-16	10/13/2004	**4,200 J**	3.7	**1.1**	11	23	0.42 J	10	4.5	**9.3**
MW1-16	4/13/2005	88	0.2 U	0.2 U	1.2	2.8	0.2 U	0.2 U	0.6	**0.6**
MW1-16	10/13/2005	220	0.2 J	0.2 J	13 J	7 J	0.2 U	0.2 U	2 J	**5.9 J**
MW1-16	7/14/2006	240 D	1 U	0.4 D	3.3 D	3.2 D	1 U	1 U	1.2 D	**2.8 D**
MW1-16	10/17/2006	**1,000 D**	0.47 J	**0.63**	**440 D**	26	0.13 J	0.23 J	2.6	**290 D**
MW1-16	6/14/2007	40	0.5 U	0.13 J	1.6	2.2	0.5 U	0.5 U	0.7	**0.89**
MW1-16	10/17/2007	98 D	2.5 U	1 U	6.5 D	6.1 D	2.5 U	2.5 U	1.8 JD	**2.5 D**
MW1-16	5/12/2008	17	0.5 U	0.14 J	1.1	1.9	0.5 U	0.5 U	0.65	**0.68**
MW1-16	10/29/2008	68 D	0.14 JD	0.2 JD	12 D	6.7 D	1 U	1 U	1 D	**6.3 D**
MW1-16	6/25/2009	37	0.5 U	0.23	29	2.6	0.5 U	0.08 J	3.1	**11**
MW1-16	10/27/2009	68 D	1 U	0.4 JD	35 D	4.2 D	1 U	1 U	3.2 D	**13 D**
MW1-16	6/16/2010	92 D	0.5 U	0.5 U	0.95	2.8	0.5 U	0.2 J	0.57	0.47 J
MW1-16	10/25/2010	52	0.5 U	0.08 J	8.1	2.2	0.5 U	0.5 U	0.43 J	**4**
MW1-16	7/18/2011	5.3	0.5 U	0.1 J	1.6	1.1	0.5 U	0.5 U	0.39 J	**0.72**
MW1-16	10/25/2011	**1,500** D	1.3 JD	**1.2** JD	**1,300** D	34 D	2.5 U	0.85 JD	1.4 JD	**360** D
MW1-16	6/12/2012	28	0.5 U	0.5 UJ	1.3	0.65	0.5 U	0.5 U	0.21 J	0.26 J
MW1-16	6/17/2013	15	0.5 U	0.15 J	14	1.8	O.5 U	0.5 U	0.32 J	**4.8**
MW1-16	6/17/2014	2.5	0.5 U	0.5 U	0.63	0.39 J	0.5 UJ	0.5 U	0.11 J	0.29 J
MW1-16	6/24/2015	5.2	0.5 U	0.5 U	1.1	0.93	0.5 U	0.5 U	0.31 J	**0.54 J**
MW1-16	6/22/2016	4.4	0.5 U	0.5 U	2	1.3	0.5 U	0.5 U	0.16 J	**1.5**
MW1-16	6/19/2017	2	0.5 U	0.5 U	0.69	0.41 J	0.5 U	0.5 U	0.5 U	**0.54**
MW1-20	8/30/1995	1 U	1 U	1 U[1]	1 U	1 U	1 U	1 U	1 U	1 U[1]
MW1-20	12/8/1995	1 U	1 U	1 U[1]	1 U	1 U	1 U	1 U	1 U	1 U[1]
MW1-20	3/11/1996	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-20	6/27/1996	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-20	10/21/1999	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-20	4/26/2000	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

Table C-1. OU 1 Chlorinated VOC Groundwater Sampling Results through June 2019

Location ID	Sampling Date	1,1-DCA	1,2-DCA	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride
GW Remediation Goals		800	5	0.5	70	100	5	200	5	0.5
MW1-20	7/25/2000	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-20	10/31/2000	1 U	1 U	1 U[1]	1 U	1 U	1 U	1 U	1 U	1 U[1]
MW1-20	7/31/2001	1 U	1 U	1 U[1]	1 U	1 U	1 U	1 U	1 U	1 U[1]
MW1-20	10/30/2001	1 U	1 U	1 U[1]	1 U	1 U	1 U	1 U	1 U	1 U[1]
MW1-20	5/1/2002	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-20	7/25/2002	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-20	10/25/2002	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-20	4/29/2003	0.091 U	0.12 U	0.12 U	0.12 U	0.14 U	0.11 U	0.12 U	0.12 U	0.22 U
MW1-20	10/14/2003	0.091 U	0.12 U	0.12 U	0.12 U	0.14 U	0.11 U	0.12 U	0.12 U	0.22 U
MW1-20	4/21/2004	0.091 U	0.12 U	0.12 U	0.12 U	0.14 U	0.11 U	0.12 U	0.12 U	0.22 U
MW1-20	10/13/2004	0.091 U	0.12 U	0.12 U	0.12 U	0.15 U	0.11 U	0.12 U	0.12 U	0.22 U
MW1-20	4/13/2005	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
MW1-20	10/12/2005	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
MW1-20	7/12/2006	0.5 U	0.5 U	0.2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 U
MW1-20	10/16/2006	0.5 U	0.5 U	0.3 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.05 J
MW1-20	6/13/2007	0.5 U	0.5 U	0.2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 U
MW1-20	10/19/2007	0.5 U	0.5 U	0.2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 U
MW1-20	5/7/2008	0.5 U	0.5 U	0.2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 U
MW1-20	10/28/2008	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 U
MW1-20	6/24/2009	0.5 U	0.5 U	0.2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 U
MW1-20	10/27/2009	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-20	6/15/2010	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-20	10/25/2010	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-20	7/18/2011	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-20	10/25/2011	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-20	6/12/2012	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-20	6/17/2013	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-20	6/17/2014	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-20	6/24/2015	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ
MW1-20	6/22/2016	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-20	6/19/2017	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Central Landfill – Shallow Groundwater Well										
MW1-17	8/29/1995	1 U	1 U	1 U[1]	6.4	0.94 J	1 U	1 U	1 U	**6.9**
MW1-17	12/4/1995	1 U	1 U	1 U[1]	5.1	1 U	1 U	1 U	1 U	**4.3**
MW1-17	3/6/1996	0.5 U	0.5 U	0.5 U	0.32 J	0.29 J	0.5 U	0.5 U	0.5 U	0.47 J
MW1-17	6/24/1996	0.5 U	0.2 J	0.5 U	1.4 U	0.51	0.4 J	0.5 U	0.5 U	1.2 U[1]
MW1-17	6/7/2000	0.1 J	0.5 U	0.5 U	0.5 U	0.64	0.5 U	0.5 U	0.3 J	0.5 U
MW1-17	6/20/2001	0.12 J	0.12 U	0.12 U	0.12 U	0.71	0.11 U	0.12 U	0.12 U	0.22 U
MW1-17	6/19/2002	0.11 J	0.12 U	0.12 U	0.12 U	0.43 J	0.11 U	0.12 U	0.12 U	**0.66**
MW1-17	4/29/2003	0.091 U	0.12 U	0.12 U	0.18 U	0.39 U	0.11 U	0.12 U	0.12 U	**1.4**
MW1-17	4/22/2004	0.091 U	0.12 U	0.12 U	3.4	0.31 J	0.11 U	0.12 U	0.89	**3.8**
MW1-17	4/14/2005	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
MW1-17	7/10/2006	0.5 UJ	0.5 UJ	0.25 J	50 J	0.23 J	0.5 UJ	0.5 UJ	0.5 UJ	**14 J**
MW1-17	6/14/2007	0.5 U	0.5 U	0.31 J	**76 D**	0.5 U	0.5 U	0.5 U	0.5 U	**14**
MW1-17	5/7/2008	0.5 U	0.5 U	0.19 J	33	0.14 J	0.5 U	0.5 U	0.5 U	**5.9**
MW1-17	6/18/2009	0.5 U	0.5 U	0.43	**100 D**	0.22 J	0.5 U	0.5 U	0.13 J	**18**
MW1-17	6/15/2010	0.5 U	0.5 U	0.42 J	61 D	0.16 J	0.5 U	0.5 U	0.5 U	**15**
MW1-17	7/18/2011	0.5 U	0.5 U	0.42 J	**90** D	0.18 J	0.5 U	0.5 U	0.5 U	**15**

Table C-1. OU 1 Chlorinated VOC Groundwater Sampling Results through June 2019

Location ID	Sampling Date	1,1-DCA	1,2-DCA	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride
GW Remediation Goals		800	5	0.5	70	100	5	200	5	0.5
MW1-17	6/12/2012	0.5 U	0.5 U	**1.4** J	**360 D**	0.34 J	0.5 U	0.5 U	0.2 J	**40**
MW1-17	6/17/2013	0.5 U	0.5 U	**1.9**	**430 D**	0.55	0.5 U	0.5 U	0.46 J	**89 D**
MW1-17	6/18/2014	0.5 U	0.5 U	**1.5**	**360 D**	0.31 J	0.5 U	0.5 U	0.5 U	**62**
MW1-17	6/24/2015	1 U	1 U	**2.1 D**	**630 D**	0.46 JD	1 U	1 U	1 U	**120 JD**
MW1-17	6/21/2016	0.5 U	0.5 U	**1.6**	**440 D**	0.45 J	0.5 U	0.5 U	0.5 U	**100 D**
MW1-17	6/19/2017	0.5 U	0.5 U	**1.2**	**440 D**	0.39 J	0.5 U	0.5 U	0.5 U	**72**
Deeper Groundwater Wells										
MW1-09	8/21/1995	1 U	1 U	1 U[1]	1 U	1 U	1 U	1 U	1 U	1 U[1]
MW1-09	12/5/1995	1 U	1 U	1 U[1]	1 U	1 U	1 U	1 U	1 U	1 U[1]
MW1-09	3/5/1996	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-09	6/7/2000	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 J	0.5 U
MW1-09	6/17/2002	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.2 U
MW1-09	4/23/2004	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.2 U
MW1-09	7/13/2006	0.5 UJ	0.5 UJ	0.2 UJ	0.17 J	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.2 UJ
MW1-09	5/12/2008	0.5 U	0.5 U	0.2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 U
MW1-09	6/16/2010	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-09	6/14/2012	0.5 U	0.5 U	0.5 UJ	0.14 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-09	6/24/2014	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-09	6/22/2016	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-09	6/27/2019	0.2 UM	0.2 UM	0.2 U	0.2 UM	0.2 UM	0.2 UM	0.2 UM	0.2 UM	0.02 UM
MW1-25	8/17/1995	4.8	1 U	**7.3**	440 R	35 R	1 U	1 U	98 R	340 R
MW1-25	12/6/1995	3.9	1 U	**6.1**	630 R	38 R	1 U	1 U	74 R	230 R
MW1-25	3/11/1996	0.5 U	0.5 U	**1.1**	**260**	6.3	0.5 U	0.5 U	**11**	**44**
MW1-25	6/25/1996	0.5 U	0.5 U	**4.7 J**	630 R	45 R	0.5 U	0.5 U	74 R	240 R
MW1-25	6/8/2000	6.9	0.3 J	**7.2**	**2,000**	41	0.5 U	0.5 U	**39**	**260**
MW1-25	8/6/2002	8.6 J	10 U[1]	**7.6 J**	**2,000 D**	41 D	10 U[1]	10 U	**20 D**	**240 D**
MW1-25	6/19/2003	67 U	NA	**67 U**	**1,800**	34	67 U[1]	67 U	**14**	**210**
MW1-25	4/22/2004	5.9 D	2.5 U	**6.6 D**	**1,600 D**	33 D	2.5 U	2.5 U	**7.5 D**	**170 D**
MW1-25	7/13/2006	6 D	5 U	**7.3 D**	**1700 D**	37 D	5 U	5 U	4.3 JD	**270 D**
MW1-25	5/8/2008	4.5 D	2.5 U	**4.8 D**	**1200 JD**	28 D	2.5 U	2.5 U	1.3 JD	**210 D**
MW1-25	6/16/2010	4.2 D	2.5 U	**5.1 D**	**1,400 D**	28 D	2.5 U	2.5 U	1.9 JD	**180 D**
MW1-25	6/23/2014	4.9 D	2.5 U	**5.7 D**	**1,300 D**	27 D	2.5 UJ	2.5 U	0.95 JD	**220 D**
MW1-25	6/20/2019	3.6	0.19 U	**2.9**	**1,100 D**	20	0.5 UM	0.2 U	0.43	**270 D**
MW1-28	12/7/1995	1.1	1 U	**5.1**	720 R	58 R	1 U	1 U	2.3	420 R
MW1-28	3/8/1996	2.1	0.5 U	**5**	**320**	78	0.5 U	0.5 U	1.6	**480**
MW1-28	6/25/1996	2.4 J	0.5 U	**6.3**	540 R	78 R	0.5 U	0.5 U	2.2 J	480 R
MW1-28	9/9/1996	2.3	0.5 U	**5.4**	510 R	66 R	0.5 U	0.5 U	1.2	540 R
MW1-28	6/7/2000	3.2	0.5 U	**5.1**	**1,300 J**	74	0.5 U	0.5 U	0.81	**520**
MW1-28	8/6/2002	4.6 J	10 U[1]	**5.4 J**	**1,500 D**	84 D	10 U[1]	10 U	10 U[1]	**600 D**
MW1-28	6/19/2003	50 U	NA	50 U[1]	**1,200**	34	50 U[1]	50 U	50 U[1]	**470**
MW1-28	4/22/2004	3.9	0.5 U	**5.3**	**1,300 D**	71 D	0.5 U	0.5 U	0.52	**540 D**
MW1-28	7/13/2006	6.1 D	5 U	**7.2 D**	**1500 D**	94 D	5 U	5 U	1.6 JD	**710 D**
MW1-28	5/8/2008	6.1 D	2.5 U	**5.7 D**	**1400 D**	78 D	2.5 U	2.5 U	0.9 JD	**650 D**
MW1-28	6/17/2010	6.3 D	2.5 U	**6.1 D**	**1,700 D**	91 D	2.5 U	2.5 U	0.7 JD	**540 D**
MW1-28	6/24/2014	6.2 D	2.5 U	**5.9 D**	**1,600 D**	94 D	2.5 UJ	2.5 U	0.75 JD	**560 D**
MW1-28	6/24/2019	5.6	0.12 J	**5.1**	**1,500 D**	74 D	0.5 U	0.2 U	0.2 U	**590 D**
MW1-29	6/27/2019	0.2 UM	0.2 U	0.2 UM	0.2 UM	0.2 UM	0.5 UM	0.2 UM	0.2 UM	0.02 UJ
MW1-38	6/19/1996	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

Table C-1. OU 1 Chlorinated VOC Groundwater Sampling Results through June 2019

Location ID	Sampling Date	1,1-DCA	1,2-DCA	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride
GW Remediation Goals		800	5	0.5	70	100	5	200	5	0.5
MW1-38	6/27/1996	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-38	9/10/1996	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-38	4/23/2004	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-38	7/13/2006	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-38	5/12/2008	0.5 U	0.5 U	0.2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 U
MW1-38	6/17/2010	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-38	6/13/2012	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-38	6/24/2014	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U
MW1-38	6/22/2016	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW1-38	6/19/2019	0.2 UM	0.2 U	0.2 UM	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.022 M
MW1-39	6/17/1996	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	**0.8**
MW1-39	6/27/1996	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U[1]
MW1-39	9/10/1996	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	**0.76**
MW1-39	6/8/2000	0.5 U	0.5 U	0.5 U	0.4 J	0.5 U	0.5 U	0.5 U	0.5 U	**2**
MW1-39	8/6/2002	0.5 U	0.5 U	0.5 U	0.32 J	0.5 U	0.5 U	0.5 U	0.5 U	**1.8**
MW1-39	6/19/2003	1 U	NA	1 U[1]	0.56	1 U	1 U	1 U	1 U	**1.3**
MW1-39	4/23/2004	0.5 U	0.5 U	0.5 U	0.33 J	0.5 U	0.5 U	0.5 U	0.5 U	**2**
MW1-39	7/13/2006	0.5 U	0.5 U	0.2 U	0.45 J	0.5 U	0.5 U	0.5 U	0.5 U	**2.7**
MW1-39	5/12/2008	0.5 U	0.5 U	0.2 U	0.43 J	0.5 U	0.5 U	0.5 U	0.5 U	**2.3**
MW1-39	6/17/2010	0.5 U	0.5 U	0.5 U	0.6	0.5 U	0.5 U	0.5 U	0.5 U	0.09 J
MW1-39	6/13/2012	0.5 U	0.5 U	0.5 U	0.9	0.5 U	0.5 U	0.5 U	0.5 U	**2**
MW1-39	6/24/2014	0.5 U	0.5 U	0.5 U	0.94	0.5 U	0.5 UJ	0.5 U	0.5 U	**2.1**
MW1-39	6/22/2016	0.5 U	0.5 U	0.5 U	0.93	0.5 U	0.5 U	0.5 U	0.5 U	**1.8**
MW1-39	6/17/2019	0.2 UM	0.2 UM	0.2 U	0.65	0.2 UM	0.2 U	0.2 U	0.2 UM	**1.6**
MW1-60	9/18/2018	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ
Regional Aquifer Domestic Water-Supply Wells										
Navy #5	12/8/1995	1 U	1 U	1 U[1]	1 U	1 U	1 U	1 U	1 U	1 U[1]
Navy #5	3/3/1998	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Navy #5	6/2/1999	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Navy #5	6/7/2000	0.5 U	0.5 U	0.5 U	0.3 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Navy #5	6/19/2001	0.091 U	0.12 U	0.12 U	0.12 U	0.14 U	0.11 U	0.12 U	0.12 U	0.22 U
Navy #5	6/27/2002	0.091 U	0.12 U	0.12 U	0.12 U	0.14 U	0.11 U	0.12 U	0.12 U	0.22 U
Navy #5	4/30/2003	0.091 U	0.12 U	0.12 U	0.12 U	0.14 U	0.11 U	0.12 U	0.12 U	0.22 U
Navy #5	4/23/2004	0.091 U	0.12 U	0.12 U	0.14 J	0.14 U	0.11 U	0.12 U	0.12 U	0.22 U
Navy #5	6/16/2004	0.091 U	0.12 U	0.12 U	0.12 U	0.14 U	0.11 U	0.12 U	0.12 U	0.22 U
Navy #5	4/14/2005	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Navy #5	7/14/2006	0.5 U	0.5 U	0.2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 U
Navy #5	6/15/2007	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Navy #5	5/9/2008	0.5 U	0.5 U	0.2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 U
Navy #5	6/18/2009	0.5 U	0.5 U	0.2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 U
Navy #5	6/16/2010	0.5 U	0.5 U	0.2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Navy #5	7/18/2011	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Navy #5	6/13/2012	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Navy #5	6/19/2013	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U
Navy #5	6/24/2014	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U
Navy #5	6/24/2015	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ
Navy #5	6/23/2016	0.5 U	0.5 U	0.5 U	0.07 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Navy #5	6/21/2017	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

Table C-1. OU 1 Chlorinated VOC Groundwater Sampling Results through June 2019

Location ID	Sampling Date	1,1-DCA	1,2-DCA	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride
GW Remediation Goals		800	5	0.5	70	100	5	200	5	0.5
Navy #5	6/11/2017	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.02 UJQ
PUD	12/8/1995	1 U	1 U	1 U[1]	1 U	1 U	1 U	1 U	1 U	1 U[1]
PUD	3/3/1998	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
PUD	6/2/1999	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
PUD	6/8/2000	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
PUD	6/19/2001	0.091 U	0.12 U	0.12 U	0.12 U	0.14 U	0.11 U	0.12 U	0.12 U	0.22 U
PUD	7/1/2002	0.091 U	0.12 U	0.12 U	0.12 U	0.14 U	0.11 U	0.12 U	0.12 U	0.22 U
PUD	4/30/2003	0.091 U	0.12 U	0.12 U	0.12 U	0.14 U	0.11 U	0.12 U	0.12 U	0.22 U
PUD	4/23/2004	0.091 U	0.12 U	0.12 U	0.12 U	0.14 U	0.11 U	0.12 U	0.12 U	0.22 U
PUD	4/14/2005	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
PUD	7/14/2006	0.5 U	0.5 U	0.2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 U
PUD	6/14/2007	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
PUD	5/9/2008	0.5 U	0.5 U	0.2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 U
PUD	6/17/2009	0.5 U	0.5 U	0.2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 U
PUD	6/16/2010	0.5 U	0.5 U	0.2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
PUD	7/19/2011	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
PUD	6/13/2012	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
PUD	6/19/2013	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U
PUD	6/25/2014	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U
PUD	6/25/2015	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ
PUD	6/22/2016	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
PUD	6/21/2017	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
PUD	6/10/2019	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.02 UJQ
Piezometers										
P1-01	6/11/2019	0.2 UM	0.2 U	0.2 U	0.077 JM	0.2 UM	0.5 U	0.2 U	0.2 U	0.02 UJ
P1-02	6/19/2019	0.2 U	0.2 U	0.2 UM	0.1 J	0.2 U	0.5 U	0.2 U	0.2 U	0.064
P1-03	6/27/2019	0.11 JM	0.2 U	0.2 UM	0.085 JM	0.2 UM	0.5 UM	0.2 U	0.2 UM	0.02 UM
P1-04	6/17/2019	0.31	0.2 UM	**1.5**	**480 D**	11	0.5 U	0.2 UM	0.28	**150 D**
P1-05	6/27/2019	0.16 JM	0.3	0.2 UM	0.13 JM	0.38	0.5 UM	0.2 U	0.2 UM	0.02 UM

Notes:

All concentrations are in µg/L.
GW denotes groundwater.
Bold indicates detected value is equal to or exceeds the groundwater remediation goal.
D – the reported result is from a dilution
DCA – dichloroethane
DCE – dichloroethene
J – estimated result
µg/L – micrograms per liter
M – manual integrated compound

Yellow and green highlight indicates samples collected during this FYR period.
NA – not analyzed
PCE – tetrachloroethene
Q – one or more quality control criteria failed
R – rejected result, quality control indicates the data are not usable
TCA – trichloroethane
TCE – trichloroethene
U – not detected at value shown
U[1] – not detected at value shown and value exceeds remediation goal
UJ – not detected at the estimated value shown

Table C-2. OU 1 1,4-Dioxane Groundwater Sampling Results through June 2019

Location ID	Sampling Date	1,4-Dioxane (µg/L)
Remediation Goal		NE (MTCA Method B = 0.44)
North Plantation – Shallow Groundwater Wells		
1MW-1	7/10/2006	**1.1**
1MW-1	6/11/2019	**0.56**
MW1-02	7/10/2006	**14**
MW1-02	9/19/2018	**5.9**
MW1-02	6/18/2019	**7.6**
MW1-03	7/12/2006	1 U
MW1-14	6/11/2019	0.28 M
MW1-41	7/10/2006	**8.5**
MW1-41	9/19/2018	**28**
MW1-41	6/19/2019	**5.1 J**
South Plantation – Shallow Groundwater Wells		
MW1-04	7/12/2006	1 U
MW1-04	6/19/2019	0.2 U
MW1-05	7/12/2006	1 U
MW1-16	7/14/2006	1 U
MW1-20	7/12/2006	1 U
Central Landfill – Shallow Groundwater Well		
MW1-17	7/10/2006	1
Deeper Groundwater Wells		
MW1-09	7/13/2006	1 U
MW1-09	6/14/2012	1 U
MW1-09	6/24/2014	1 U
MW1-09	6/22/2016	0.4 U
MW1-09	6/18/2019	0.2 U
MW1-25	7/13/2006	**29**
MW1-25	9/20/2018	**31**
MW1-25 [1/]	6/20/2019	**12**
MW1-25 [2/]	6/20/2019	**27 HDJ**
MW1-28	7/13/2006	**29**
MW1-28	9/19/2018	**7.4**
MW1-28	6/24/2019	**31 D**
MW1-29	6/17/2019	0.2 UM
MW1-38	7/13/2006	**4.1**
MW1-38	6/13/2012	**2.5**
MW1-38	6/24/2014	**2.3**
MW1-38	6/22/2016	**2.2**
MW1-38	6/19/2019	**1.7**
MW1-39	7/13/2006	**1.9**
MW1-39	6/13/2012	**1.2**
MW1-39	6/24/2014	**1.1**
MW1-39	6/22/2016	**0.85**
MW1-39	6/17/2019	0.42 M
Regional Aquifer Domestic Water-Supply Wells		
Navy #5	7/14/2006	1 U
Navy #5	6/24/2014	1 U
Navy #5	6/23/2016	0.4 U
Navy #5	6/10/2019	0.19 U
PUD	7/14/2006	1 U
PUD	6/25/2014	1 U
PUD	6/22/2016	0.4 U
PUD	6/11/2019	0.19 U
Piezometers		
P1-01	6/11/2019	0.26 M
P1-02	6/19/2019	**7.7**
P1-03	6/17/2019	**8.6**
P1-04	6/17/2019	**24 D**
P1-05	6/17/2019	**6.6 D**

Notes:

[1/] The MW1-25 samples were analyzed by two laboratories. The initial analysis was completed by Test America, West Sacramento, California. See Section 3.2 for an explanation.

[2/] The MW1-25 samples were analyzed by two laboratories. The second analysis was completed by Test America, Seattle, Washington. See Section 3.2 for an explanation.

All concentrations are in micrograms per liter (µg/L).

Bold indicates detected value is equal to or exceeds the MTCA Method B – carcinogen - cleanup level.

Yellow and green highlighting indicates samples collected during this FYR period.

D – result reported from a diluted analysis

DUP – field duplicate sample

H – sample was prepped or analyzed beyond the specified holding time

J – analyte positively identified, but result is estimated

J1 – the quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria

M – manual integrated compound

MTCA – Model Toxics Control Act

NE – not established (MTCA Method B – carcinogen – cleanup level = 0.44 µg/L)

PUD – Public Utility District

U – not detected at value shown

Table C-3. OU 1 PCB Aroclors Groundwater Sampling Results for September 2018

Location ID	Sampling Date	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	Total PCBs
GW Remediation	**Goal (µg/L)**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**0.044**
MW1-02	9/19/2018	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.010 U
MW1-02 (DUP)	9/19/2018	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.010 U
MW1-14	9/19/2018	0.10 U	0.10 U	0.10 U	0.10 U	0.63 PDJ	0.20 PDJ	0.10 U	**0.83 PDJ**
P1-01	9/19/2018	0.02 UJ	0.02 UJ	0.02 UJ	0.02 UJ	0.02 UJ	0.02 UJ	0.02 UJ	0.020 UJ

Notes:

All concentrations are in micrograms per liter (µg/L).

Bold indicates detected concentration is equal to or exceeds MTCA Method B risk based cleanup level of 0.044 µg/L for total PCBs in groundwater.

D – the report results is from a diluted analysis

DUP – field duplicate sample

GW – groundwater

J – analyte positively identified, but result is estimated

NE – not established

P – the relative percent difference is greater than 40% between the results on the two analytical columns

PCBs – polychlorinated biphenyls

U – the analyte was not detected at or above the indicated practical quantitation limit

UJ – analyte not detected, but the reported quantitation/detection limit is estimated

Table C-4. OU 1 PCB Congeners Groundwater Sampling Results for September 2018

Congener	MW1-02	MW1-02 (DUP)	MW1-14	P1-01
PCB-1	1.5 J	7.2 J M	18,000 D	65 J M
PCB-2	0.44 J M	0.63 J q	1,200 J D	4.4 J
PCB-3	0.87 J M q	3 J M	8,600 D	6.4 J q
PCB-4	3.3 J M q	6.1 J M	15,000 D	36 J M
PCB-5	190 U	190 U	3,800 U M	190 U
PCB-6	190 U	190 U	43,000 D	180 J
PCB-7	190 U	190 U	1,900 J D	190 U
PCB-8	190 U	5.1 J M q	35,000 D M	15 J
PCB-9	190 U	190 U	2,600 J D	190 U
PCB-10	190 U	190 U	890 J D	190 U
PCB-11	190 U	190 U	1,500 J D	190 U
PCB-12/13	380 U	380 U	1,800 J D	380 U
PCB-14	190 U	190 U	3,800 U	4.2 J M q
PCB-15	190 U	190 U	13,000 D	190 U
PCB-16	190 U	1.7 J M q	10,000 D	5.9 J q
PCB-17	2 J q	3.2 J q	14,000 D	5.9 J
PCB-18/30	380 U	380 U	37,000 D	16 J
PCB-19	190 U	2.4 J q	2,700 J D	3 J q
PCB-20/28	5.4 J q	11 J	150,000 D	29 J
PCB-21/33	380 U	3.5 J q	52,000 D	13 J
PCB-22	1.4 J q	1.7 J	11,000 D	190 U
PCB-23	190 U	190 U	3,800 U	190 U
PCB-24	190 U	190 U	200 J D q	190 U
PCB-25	1.6 J q	4.7 J	73,000 D	47 J
PCB-26/29	1.4 J M q	18 J	460,000 D	340 J
PCB-27	190 U	190 U	2,400 J D	2.2 J q
PCB-31	190 U	10 J	210,000 D	43 J
PCB-32	1.8 J	4.1 J	36,000 D	11 J
PCB-34	190 U	190 U	4,200 D M q	4.4 J M
PCB-35	190 U	190 U	3,800 U	190 U
PCB-36	190 U	190 U	37,000 D M	190 U M
PCB-37	190 U	190 U	7,500 D M q	190 U
PCB-38	190 U	190 U	3,800 U	7.1 J
PCB-39	190 U	190 U	3,800 U	190 U
PCB-40/71	1.9 J q	11 J	530,000 D	380 U M
PCB-41	190 U	190 U	18,000 U	98 J M
PCB-42	2.3 J M q	7.5 J	270,000 D	35 J
PCB-43	190 U	190 U	16,000 U	190 U
PCB-44/47/65	570 U	73 J	2,200,000 D	260 J
PCB-45	190 U M	8 J M	27,000 D M	6.1 J M
PCB-46	190 U	190 U	24,000 D M	190 U
PCB-48	190 U	1.8 J M	52,000 D	190 U
PCB-49/69	380 U	39 J	1,500,000 D	190 J
PCB-50/53	0.89 J q	5.1 J	110,000 D	15 J
PCB-51	24 J M	19 J M	12,000 U	21 J M

Table C-4. OU 1 PCB Congeners Groundwater Sampling Results for September 2018

Congener	MW1-02	MW1-02 (DUP)	MW1-14	P1-01
PCB-52	190 U	140 J	5,700,000 E D J	620
PCB-54	0.46 J q	0.6 J q	250 J D	190 U
PCB-55	0.63 J M q	190 U	10,000 U	190 U
PCB-56	1 J q	4.1 J q	380,000 D	17 J
PCB-57	190 U	190 U	9,700 U	190 U
PCB-58	190 U	190 U M	150,000 D	190 U M
PCB-59/62/75	0.6 J M q	1.3 J	45,000 D	5.2 J
PCB-60	190 U	1.9 J	110,000 D	3.3 J
PCB-61/70/74/76	760 U	47 J	4,100,000 D	170 J
PCB-63	190 U	190 U	48,000 D	5.3 J q
PCB-64	190 U	9.7 J q	520,000 D	37 J
PCB-66	190 U	21 J M	1,400,000 D	71 J
PCB-67	190 U	190 U	9,000 U	190 U
PCB-68	2.8 J	4.9 J	14,000 D	6.6 J
PCB-72	190 U	0.68 J M q	35,000 D	6.4 J
PCB-73	190 U	190 U	9,600 U	190 U
PCB-77	19 U	19 U	16,000 D M	19 U
PCB-78	190 U	190 U	28,000 D M	4.1 J q
PCB-79	190 U	190 U	58,000 D M	8.8 J
PCB-80	190 U	190 U	33,000 D	190 U
PCB-81	19 U	19 U	13,000 U M	19 U
PCB-82	190 U	9.4 J	1,000,000 D	25 J
PCB-83	190 U M	11 J M	630,000 D M	29 J M
PCB-84	5.3 J	32 J	2,500,000 E D J	100 J
PCB-85/116/117	3.1 J q	13 J	1,400,000 D	34 J
PCB-86/87/97/108/119/125	9.4 J M q	49 J M	5,800,000 D M	150 J M
PCB-88/91	3.4 J	15 J	1,100,000 D	41 J
PCB-89	190 U	190 U	120,000 U	190 U
PCB-90/101/113	570 U	78 J	8,600,000 E D J	230 J
PCB-92	190 U	14 J q	1,600,000 D	58 J
PCB-93/100	380 U	380 U	100,000 U	380 U
PCB-94	190 U	190 U	110,000 U	190 U
PCB-95	190 U	97 J	7,000,000 E D J	320
PCB-96	190 U	190 U	37,000 D	3.7 J
PCB-98/102	380 U	380 U	170,000 D M	380 U
PCB-99	5.6 J M q	30 J M	4,000,000 E D M J	100 J M
PCB-103	190 U	190 U	94,000 U	190 U
PCB-104	190 U	190 U	260 J D	190 U
PCB-105	19 U	24	3,800,000 E D J	57
PCB-106	190 U	190 U	89,000 U	190 U
PCB-107/124	380 U	1.4 J M q	250,000 D	380 U
PCB-109	190 U	3.2 J M q	530,000 D M	15 J M
PCB-110/115	380 U	86 J	10,000,000 E D M J	300 J
PCB-111	190 U	190 U	83,000 U	190 U

Table C-4. OU 1 PCB Congeners Groundwater Sampling Results for September 2018

Congener	MW1-02	MW1-02 (DUP)	MW1-14	P1-01
PCB-112	190 U M	190 U M	85,000 U M	190 U M
PCB-114	19 U	19 U	240,000 D M	19 U
PCB-118	19 U	56	7,900,000 E D J	160
PCB-120	190 U	190 U	83,000 U	190 U
PCB-121	190 U	190 U	77,000 U	190 U
PCB-122	190 U	190 U	96,000 U	190 U
PCB-123	19 U	19 U	120,000 U	19 U M
PCB-126	19 U	19 U	120,000 U	19 U
PCB-127	190 U	190 U	92,000 U	190 U
PCB-128/166	380 U	11 J	1,300,000 D	26 J
PCB-129/138/163	570 U	53 J	7,700,000 E D J	120 J
PCB-130	0.97 J q	3.2 J	490,000 D	190 U
PCB-131	190 U	1.4 J	120,000 D	190 U
PCB-132	190 U	21 J	2,600,000 E D J	42 J
PCB-133	190 U	190 U	69,000 D	190 U
PCB-134/143	380 U	3.4 J q	420,000 D	380 U
PCB-135/151	380 U	13 J	1,400,000 D M	27 J q
PCB-136	2 J q	7.8 J	760,000 D	16 J
PCB-137	190 U M	2.2 J q	520,000 D	5.7 J q
PCB-139/140	380 U	1.1 J	170,000 D	380 U
PCB-141	190 U	6.2 J	980,000 D	14 J
PCB-142	190 U	190 U M	25,000 U	190 U
PCB-144	190 U	1.9 J	250,000 D	190 U
PCB-145	190 U	190 U	16,000 U	190 U
PCB-146	2 J q	5.9 J	730,000 D	14 J
PCB-147/149	380 U	35 J	4,500,000 E D J	81 J
PCB-148	190 U	190 U	22,000 U	190 U
PCB-150	190 U	190 U	15,000 U	190 U
PCB-152	190 U	190 U	15,000 U	190 U
PCB-153/168	380 U	31 J	4,400,000 E D J	69 J
PCB-154	190 U	190 U	54,000 D M	190 U
PCB-155	0.43 J q	190 U	14,000 U	190 U
PCB-156/157	38 U	10 J	1,300,000 D M	24 J
PCB-158	1.5 J	5.7 J q	830,000 D	13 J
PCB-159	190 U	190 U	10,000 D	190 U
PCB-160	190 U M	190 U M	16,000 U M	190 U M
PCB-161	190 U M	190 U M	17,000 U M	190 U M
PCB-162	190 U	190 U	30,000 D	190 U
PCB-164	190 U	3.3 J	400,000 D	11 J
PCB-165	190 U	190 U	17,000 U	190 U
PCB-167	19 U	2.3 J q	370,000 D	5.8 J
PCB-169	0.63 J q	1.3 J M	3,800 U	19 U
PCB-170	0.4 J q	4.3 J	610,000 D	14 J
PCB-171/173	380 U	0.97 J q	210,000 D	3.3 J q

Table C-4. OU 1 PCB Congeners Groundwater Sampling Results for September 2018

Congener	MW1-02	MW1-02 (DUP)	MW1-14	P1-01
PCB-172	190 U	0.61 J q	82,000 D	190 U
PCB-174	190 U	4 J	430,000 D	7.5 J
PCB-175	190 U M	190 U	18,000 D	190 U
PCB-176	190 U	0.39 J q	50,000 D	190 U
PCB-177	190 U	2.1 J q	250,000 D	3.6 J q
PCB-178	190 U M	0.59 J q	52,000 D	190 U
PCB-179	0.41 J q	1.1 J q	120,000 D	3.5 J
PCB-180/193	380 U	6.4 J	820,000 D	17 J q
PCB-181	190 U	190 U	16,000 D	190 U
PCB-182	190 U	190 U	3,800 D	190 U
PCB-183	190 U	190 U	260,000 D M	190 U
PCB-184	190 U	190 U	660 J D	190 U
PCB-185	190 U M	190 U M	3,800 U M	190 U M
PCB-186	190 U	190 U M	440 J D	190 U
PCB-187	190 U	3.1 J	310,000 D	7.3 J
PCB-188	190 U	190 U M	480 J D	190 U
PCB-189	0.54 J	0.97 J	30,000 D	19 U
PCB-190	190 U	0.7 J q	100,000 D	1.5 J
PCB-191	190 U	190 U	23,000 D	190 U
PCB-192	190 U	190 U	3,800 U	190 U
PCB-194	190 U	0.9 J q	100,000 D	3.5 J q
PCB-195	190 U	190 U	35,000 D	190 U
PCB-196	190 U	190 U	38,000 D	190 U M
PCB-197	190 U	190 U	2,200 J D	190 U
PCB-198/199	380 U	0.59 J q	65,000 D	1.9 J
PCB-200	190 U	190 U	7,900 D	190 U
PCB-201	190 U	190 U	6,400 D	190 U
PCB-202	190 U	1 J	8,400 D	190 U
PCB-203	190 U	190 U	45,000 D	1.1 J q
PCB-204	190 U	190 U	3,800 U	190 U
PCB-205	190 U	0.76 J q	5,700 D	190 U
PCB-206	190 U	190 U	32,000 D	4 J q
PCB-207	190 U	190 U	2,600 J D	190 U
PCB-208	190 U	190 U	4,200 D	4 J
PCB-209	0.41 J q	1 J M	1,300 J D	8.7 J q
Total PCB Congeners in pg/L	90.38	1,246	**108,300,080**	4,590
Total PCB Congeners in µg/L	0.00009	0.0012	**108.3**	0.0046
Cleanup Goal (µg/L)	**0.044**	**0.044**	**0.044**	**0.044**

Notes:
All concentrations are in picograms per gram (pg/L), except where noted.
Bold indicates detected concentration exceeds MTCA Method B risk based cleanup level of 0.044 µg/L for total PCBs.
D – the reported from a diluted analysis

J – analyte positively identified, but result is estimated
M – a manual integration was performed by the laboratory analyst
PCB – polychlorinated biphenyl
q – the reported concentration is the estimated maximum possible concentration for this analyte.
The measured ion ratio does not meet qualitative identification criteria and indicates a possible interference.

Table C-5. OU 1 Chlorinated VOC Surface and Seep Water Sampling Results through June 2019

Location ID	Sampling Date	1,1-DCA	1,2-DCA	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride
Remediation Goals		NE	59	1.9	NE	33,000	4.2	41,700	56	2.9
South Plantation										
MA12	3/14/1996	5 U	0.5 U	0.56	180 J	1.6	0.5 U	0.5 U	26	**56 J**
MA12	7/1/1996	11	0.5 U	1	480 J	3.5	0.5 U	0.5 U	**64 J**	**56 J**
MA12	6/11/1999	15	3 U	**2 J**	910	8	3 U	3 U	**130**	**210**
MA12	10/21/1999	12	0.5 U	**1.9**	600	5.5	0.5 U	0.5 U	**110**	**130**
MA12	4/26/2000	21	0.5 U	1.3	630 J	10	0.5 U	0.5 U	**190 J**	**240 J**
MA12	6/6/2000	16	5 U	5 U[1]	670	5.5	5 U	5 U	**110**	**140**
MA12	7/25/2000	25 U	25 U	25 U[1]	750 J	25 U	25 U[1]	25 U	**180 J**	**140 J**
MA12	11/9/2000	14	1 U	1.2	680	5.2	1 U	1 U	**170**	**140**
MA12	4/27/2001	15	1 UJ	1.6	600 J	12	1 U	1 UJ	**100 J**	**92 J**
MA12	6/22/2001	15 J	0.29 U	0.98 J	520 J	6.8 J	0.28 U	0.28 U	**62 J**	**80 J**
MA12	7/31/2001	17	1 U	1.1	500 J	28 J	1 U	1 U	**90**	**150**
MA12	10/30/2001	6.8	1 U	0.8 J	260 J	2.7	1 U	1 U	**82**	**67**
MA12	5/1/2002	7 J	1 U	1 U	440 J	3.1 J	1 U	1 U	**96 J**	**49 J**
MA12	6/19/2002	7.2	0.12 U	0.7	340 J	3	0.11 U	0.12 U	53 J	**57 J**
MA12	7/25/2002	8.3 J	1 U	1.2 J	580 J	4.7 J	1 U	1 U	**86 J**	**94 J**
MA12	10/25/2002	5.1 J	1.3 U	1.3 U	420 J	2.7 J	1.3 U	1.3 U	**59 J**	**55 J**
MA12	4/30/2003	4 J	0.23 U	0.84 U	390 J	2.8 J	0.22 U	0.23 U	**60 J**	**49 J**
MA12	10/22/2003	3.5	0.12 U	0.52	160 J	1.3	0.11 U	0.12 U	28	**45**
MA12	4/21/2004	5.7	0.12 U	0.81	430 J	3.2	0.11 U	0.12 U	**83 J**	**46**
MA12	10/14/2004	11	0.12 U	**2**	660 J	4.7	0.11 U	0.12 U	**57**	**110 J**
MA12	4/14/2005	7.3	0.2 U	0.8	450	5.4	0.2 U	0.2 U	**83**	**51**
MA12	10/13/2005	4.9	0.4	1.3	540	4.8	0.2 U	0.2 U	47	**92**
MA12	7/12/2006	6 D	2.5 U	**2.3 D**	800 D	11 D	2.5 U	2.5 U	**110 D**	**120 D**
MA12	10/17/2006	3.3	0.5 U	1.2 D	460 D	4.1	0.5 U	0.5 U	**59**	**75**
MA12	6/15/2007	3.9 D	1 U	1.3 D	840 D	5.6 D	1 U	1 U	**150 D**	**120 D**
MA12	10/18/2007	0.67	0.5 U	0.29 D	130 D	0.83	0.5 U	0.5 U	12	**28**
MA12	5/9/2008	4.3 D	1 U	1.3 D	670 D	5.8 D	1 U	1 U	**140 D**	**93 D**
MA12	10/28/2008	3 D	1.3 U	1.2 JD	400 D	3.1 D	1.3 U	1.3 U	**65 D**	**49 D**
MA12	6/17/2009	3.9 D	2.5 U	**1.9 D**	1000 D	9 D	2.5 U	2.5 U	**170 D**	**110 D**
MA12	10/27/2009	2.1	0.5 U	1	320 D	2.4	0.5 U	0.5 U	53	**67**
MA12	6/16/2010	2.7 D	1.3 U	1.1 JD	670 D	4.8 D	1.3 U	1.3 U	**87** D	**65 D**
MA12	10/25/2010	0.67	0.5 U	0.32 J	170 D	1	0.5 U	0.5 U	28	**27**
MA12	7/19/2011	2.3 D	1 U	0.98 JD	670 D	4.4 D	1 U	1 U	**100** D	**91 D**
MA12	10/25/2011	2.5	0.5 U	1.1	420 D	3.8	0.5 U	0.5 U	**67**	**51 D**
MA12	6/12/2012	1.8 D	1 U	1.4 D	830 D	5.8 D	1 U	1 U	**120** D	**68 D**
MA12	6/19/2013	1.2 D	1 U	1.5 D	750 D	5.1 D	1 U	1 U	**140** D	**48 D**
MA12	6/18/2014	0.67	0.5 U	0.82	480 D	3.4	0.5 U	0.5 U	**84** D	**42**
MA12	6/24/2015	0.49 J	0.5 U	0.72	380 D	2.7	0.5 U	0.5 U	**56**	**26**
MA12	6/23/2016	0.37 J	0.09 J	0.73	330 D	2.5	0.5 U	0.5 U	**72**	**32**
MA12	6/19/2017	0.4 J	0.5 U	0.77	500 D	2.8	0.5 U	0.5 U	44	**42**
MA12	6/18/2019	0.24	0.2 UM	0.48 M	240 D	1.2	0.5 U	0.2 U	15	**12**

Table C-5. OU 1 Chlorinated VOC Surface and Seep Water Sampling Results through June 2019

Location ID	Sampling Date	1,1-DCA	1,2-DCA	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride
Remediation Goals		NE	59	1.9	NE	33,000	4.2	41,700	56	2.9
Central Landfill										
MA11	9/6/1995	1 U	1 UJ	1 U	0.51 J	1 UJ	1 U	1 U	1 U	1 **U**
MA11	12/6/1995	1 U	1 U	1 U	10	1 U	1 U	1 U	1 U	**3.5**
MA11	3/13/1996	0.43 J	0.5 U	0.5 U	13	0.5 U	0.5 U	0.5 U	1.6	**5.9**
MA11	7/2/1996	0.5 U	0.5 U	0.5 U	0.52	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MA11	6/6/2000	1.2	0.5 U	0.5 U	33	0.56	0.5 U	0.5 U	7.9	**9.2**
MA11	6/22/2001	0.16 J	0.12 U	0.12 U	4.6	0.14 U	0.11 U	0.12 U	0.66	0.98
MA11	6/19/2002	0.54	0.12 U	0.12 U	22	0.24 J	0.11 U	0.12 U	4.2	**5.6**
MA11	4/30/2003	0.41 U	0.12 U	0.12 U	33	0.31 U	0.11 U	0.12 U	6.1	**6**
MA11	4/21/2004	0.33 J	0.12 U	0.12 U	23	0.31 J	0.11 U	0.12 U	4.9	**4**
MA11	4/14/2005	0.2 U	0.2 U	0.2 U	11	0.2 U	0.2 U	0.2 U	2.5	1.4
MA11	7/12/2006	0.5 U	0.5 U	0.2 U	0.14 J	0.5 U	0.5 U	0.5 U	0.5 U	0.2 U
MA11	6/15/2007	0.5 U	0.5 U	0.5 U	0.54	0.5 U	0.5 U	0.5 U	0.5 U	0.07 J
MA11	5/9/2008	0.07 J	0.5 U	0.2 U	10	0.15 J	0.5 U	0.5 U	2.1	1.8
MA11	6/24/2009	0.5 U	0.5 U	0.2 U	3.8	0.5 U	0.5 U	0.5 U	0.67	0.38
MA11	6/16/2010	0.5 U	0.5 U	0.5 U	12	0.5 U	0.5 U	0.5 U	1.6	1.4
MA11	7/19/2011	0.5 U	0.5 U	0.5 U	12	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MA11	6/14/2012	0.5 U	0.5 U	0.5 UJ	19	0.21 J	0.5 U	0.5 U	2.8	1.2
MA11	6/19/2013	0.5 U	0.5 U	0.5 U	0.19 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MA11	6/18/2014	0.5 U	0.5 U	0.5 U	8.1	0.5 U	0.5 U	0.5 U	1.5	0.61
MA11	6/23/2016	0.5 U	0.5 U	0.5 U	0.23 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MA11	6/20/2017	0.5 U	0.5 U	0.5 U	0.15 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MA11	6/18/2019	0.2 U	0.2 UM	0.2 UJ	0.2 UJ	0.2 UJ	0.5 UJ	0.2 UJ	0.2 UJ	0.02 UM
North Plantation										
SP1-1	9/5/1995	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.66 J
SP1-1	12/5/1995	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SP1-1	3/13/1996	0.5 U	0.5 U	0.5 U	170 J	1.8	0.5 U	0.5 U	0.5 U	**420 J**
SP1-1	7/2/1996	0.5 U	0.5 U	0.5 U	7.4	0.76	0.5 U	0.5 U	0.5 U	**31 J**
SP1-1	9/10/1996	0.2 J	0.5 U	0.5 U	0.33 J	0.5 U	0.5 U	0.5 U	0.5 U	1.1
SP1-1	6/11/1999	3 U	3 U	3 U[1]	4	3 U	3 U	3 U	3 U	**32**
SP1-1	10/20/1999	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
SP1-1	4/26/2000	0.5 U	0.5 U	0.5 U	32	2.5	0.5 U	0.5 U	1.7	**210 J**
SP1-1	7/25/2000	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
SP1-1	11/9/2000	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1
SP1-1	4/27/2001	1 U	1 UJ	1 U	1.3	0.7 J	1 U	1 UJ	1 U	**8.4**
SP1-1	7/31/2001	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SP1-1	10/30/2001	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SP1-1	5/1/2002	0.5 U	0.5 U	0.5 U	5	1	0.5 U	0.5 U	0.5 U	**43**
SP1-1	7/25/2002	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
SP1-1	10/25/2002	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
SP1-1	4/29/2003	0.21 U	0.12 U	0.12 U	2.2	0.8	0.11 U	0.12 U	0.12 U	**31**
SP1-1	10/22/2003	0.091 U	0.12 U	0.12 U	0.17 J	0.14 U	0.11 U	0.12 U	0.12 U	0.22 U
SP1-1	4/21/2004	0.2 J	0.12 U	0.12 U	0.16 J	0.36 J	0.11 U	0.12 U	0.12 U	1.1
SP1-1	10/14/2004	0.26 J	0.12 U	0.12 U	0.14 J	0.18 J	0.11 U	0.12 U	0.12 U	0.22 U
SP1-1	4/14/2005	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
SP1-1	10/13/2005	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
SP1-1	7/12/2006	0.13 J	0.5 U	0.2 U	0.17 J	0.5 U	0.5 U	0.5 U	0.5 U	0.06 J
SP1-1	10/17/2006	0.14 J	0.5 U	0.3 U	0.16 J	0.5 U	0.5 U	0.5 U	0.5 U	0.2 U
SP1-1	6/15/2007	0.11 J	0.5 U	0.5 U	0.14 J	0.5 U	0.5 U	0.5 U	0.5 U	0.05 J
SP1-1	5/8/2008	0.12 J	0.14 J	0.2 U	0.2 J	0.14 J	0.5 U	0.5 U	0.5 U	0.13 J
SP1-1	6/24/2009	0.5 U	0.08 J	0.2 U	0.32 J	0.5 U	0.5 U	0.5 U	0.5 U	0.2 U
SP1-1	6/16/2010	0.09 J	0.09 J	0.5 U	0.4 J	0.14 J	0.5 U	0.5 U	0.14 J	0.31 J
SP1-1	7/19/2011	0.1 J	0.5 U	0.5 U	0.27 J	0.13 J	0.5 U	0.5 U	0.5 U	0.11 J
SP1-1	6/25/2014	0.5 U	0.5 U	0.5 U	0.34 J	0.12 J	0.5 UJ	0.5 U	0.5 U	0.24 J
SP1-1	6/18/2019	0.06 J	0.2 U	0.2 U	0.1 J	0.2 U	0.5 U	0.2 U	0.2 UM	0.086

Table C-5. OU 1 Chlorinated VOC Surface and Seep Water Sampling Results through June 2019

Location ID	Sampling Date	1,1-DCA	1,2-DCA	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride
Remediation Goals		NE	59	1.9	NE	33,000	4.2	41,700	56	2.9
MA09	9/5/1995	1 U	1 UJ	1 U	4	1 UJ	1 U	1 U	1 U	1.3
MA09	12/5/1995	1 U	1 U	1 U	14	1 U	1 U	1 U	1 U	**5.4**
MA09	3/14/1996	0.29 J	0.5 U	0.5 U	11	0.5 U	0.5 U	0.5 U	1.2	**8**
MA09	7/2/1996	0.5 U	0.5 U	0.5 U	0.79	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MA09	3/3/1998	0.5 U	0.5 U	0.5 U	1.5	0.5 U	0.5 U	0.5 U	0.5 U	0.3 J
MA09	6/6/2000	0.5 U	0.5 U	0.5 U	3	0.5 U	0.5 U	0.5 U	0.63	0.64
MA09	6/22/2001	1.2	0.12 U	0.12 U	37	0.51	0.11 U	0.12 U	4.7	**8.3**
MA09	6/27/2002	0.13 J	0.12 U	0.12 U	6.3	0.14 U	0.11 U	0.12 U	0.82	1.4
MA09	4/29/2003	0.27 U	0.12 U	0.12 U	18	0.24 U	0.11 U	0.12 U	3.5	**4.9**
MA09	4/21/2004	0.22 J	0.12 U	0.12 U	15	0.21 J	0.11 U	0.12 U	3.2	1.9
MA09	4/14/2005	0.2 J	0.2 U	0.2 U	14 J	0.2 J	0.2 U	0.2 U	3.1 J	2.5 J
MA09	7/12/2006	0.5 U	0.5 U	0.2 U	2.3	0.5 U	0.5 U	0.5 U	0.5 U	0.3
MA09	6/15/2007	0.5 U	0.5 U	0.5 U	10	0.5 U	0.5 U	0.5 U	1.6	1.8
MA09	5/9/2008	0.5 U	0.5 U	0.2 U	6.3	0.09 J	0.5 U	0.5 U	1.3	1.2
MA09	6/24/2009	0.5 U	0.5 U	0.2 U	12	0.11 J	0.5 U	0.5 U	2.3	1.6
MA09	6/16/2010	0.11 J	0.5 U	0.5 U	23	0.21 J	0.5 U	0.5 U	2.9	2.5
MA09	7/19/2011	0.5 U	0.5 U	0.5 U	0.88 J	0.5 J	0.5 U	0.5 U	0.13 J	0.11 J
MA09	6/13/2012	0.08 J	0.5 U	0.5 U	29	0.24 J	0.5 U	0.5 U	3.7	2.7
MA09	6/19/2013	0.5 U	0.5 U	0.5 U	9.7	0.1 J	0.5 U	0.5 U	1.7	0.49 J
MA09	6/18/2014	0.5 U	0.5 U	0.5 U	12	0.12 J	0.5 U	0.5 U	2.2	0.95
MA09	6/24/2015	0.5 U	0.5 U	0.5 U	0.74	0.5 U	0.5 U	0.5 U	0.1 J	0.5 U
MA09	6/23/2016	0.5 U	0.5 U	0.5 U	2.5	0.5 U	0.5 U	0.5 U	0.56	0.34 J
MA09	6/19/2017	0.5 U	0.5 U	0.5 U	0.16 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MA09	6/18/2019	0.2 UJ	0.2 U	0.2 UM	0.55	0.2 U	0.5 U	0.2 U	0.2 U	0.1 M
Tide Flats										
TF19	9/5/1995	1 U	1 U	1 U	4	1 U	1 U	1 U	1 U	0.92 J
TF19	12/4/1995	1 U	1 U	1 U	8.7	1 U	1 U	1 U	1 U	**3.1**
TF19	3/12/1996	0.43 J	0.5 U	0.5 U	19	0.26 J	0.5 U	0.5 U	1.3	**19**
TF19	7/1/1996	0.5 U	0.5 U	0.5 U	5.9	0.5 U	0.5 U	0.5 U	0.7	2.4
TF19	9/10/1996	0.5 U	0.5 U	0.5 U	1.4	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TF19	3/3/1998	0.5 J	0.5 U	0.5 U	16	0.31 J	0.5 U	0.5 U	2.6	**6.1**
TF19	6/6/2000	0.4 J	0.5 U	0.5 U	12	0.2 J	0.5 U	0.5 U	2.3	**3.1**
TF19	6/22/2001	0.55	0.12 U	0.12 U	18	0.22 J	0.11 U	0.12 U	2.1	**3.2**
TF19	6/19/2002	0.22 J	0.12 U	0.12 U	8.5	0.14 U	0.11 U	0.12 U	1.3	1.9
TF19	4/29/2003	0.43 U	0.12 U	0.12 U	26	0.29 U	0.11 U	0.12 U	4.9	**6.1**
TF19	4/23/2004	0.13 J	0.12 U	0.12 U	9	0.17 J	0.11 U	0.12 U	1.6	1.1
TF19	4/14/2005	0.2 U	0.2 U	0.2 U	11	0.2 U	0.2 U	0.2 U	2.4	1.8
TF19	7/12/2006	0.5 U	0.5 U	0.2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 U
TF19	6/15/2007	0.5 U	0.5 U	0.5 U	6.5	0.5 U	0.5 U	0.5 U	0.98	1
TF19	5/9/2008	0.5 U	0.5 U	0.2 U	0.18 J	0.5 U	0.5 U	0.5 U	0.5 U	0.2 U
TF19	6/25/2009	0.5 U	0.5 U	0.2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 U
TF19	6/17/2010	0.5 U	0.5 U	0.5 U	3.9	0.5 U	0.5 U	0.5 U	0.58	0.42 J
TF19	7/19/2011	0.5 U	0.5 U	0.5 U	0.27 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TF19	6/18/2014	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TF19	6/20/2019	0.2 U	0.2 U	0.2 U	0.83	0.2 U	0.5 U	0.2 U	0.2 U	0.02 U

Table C-5. OU 1 Chlorinated VOC Surface and Seep Water Sampling Results through June 2019

Location ID	Sampling Date	1,1-DCA	1,2-DCA	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	1,1,1-TCA	TCE	Vinyl Chloride
Remediation Goals		NE	59	1.9	NE	33,000	4.2	41,700	56	2.9
Dogfish Bay										
DB14	9/5/1995	1 U	1 UJ	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U
DB14	12/4/1995	1 U	1 U	1 U	1.9	1 U	1 U	1 U	1 U	1 U
DB14	3/13/1996	0.5 U	0.5 U	0.5 U	0.35 J	0.5 U	0.5 U	0.5 U	0.5 U	0.25 J
DB14	7/1/1996	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
DB14	9/10/1996	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
DB14	3/3/1998	0.5 U	0.5 U	0.5 U	1.5	0.5 U	0.5 U	0.5 U	0.5 U	0.58
DB14	6/6/2000	0.5 U	0.5 U	0.5 U	0.59	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
DB14	6/22/2001	0.091 U	0.12 U	0.12 U	0.7	0.14 U	0.11 U	0.12 U	0.12 U	0.22 U
DB14	6/19/2002	0.091 U	0.12 U	0.12 U	0.53	0.14 U	0.11 U	0.12 U	0.12 U	0.22 U
DB14	4/29/2003	0.091 U	0.12 U	0.12 U	1.8	0.14 U	0.11 U	0.12 U	0.35 U	0.38 U
DB14	4/23/2004	0.091 U	0.12 U	0.12 U	0.63	0.14 U	0.11 U	0.12 U	0.12 J	0.22 U
DB14	4/14/2005	0.2 U	0.2 U	0.2 U	0.6	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
DB14	7/12/2006	0.5 U	0.5 U	0.2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 U
DB14	6/15/2007	0.5 U	0.5 U	0.5 U	1.1	0.5 U	0.5 U	0.5 U	0.18 J	0.16 J
DB14	5/9/2008	0.5 U	0.5 U	0.2 U	0.13 J	0.5 U	0.5 U	0.5 U	0.5 U	0.2 U
DB14	6/25/2009	0.5 U	0.5 U	0.2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 U
DB14	6/17/2010	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
DB14	7/19/2011	0.5 U	0.5 U	0.5 U	0.07 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
DB14	6/18/2014	0.5 U	0.5 U	0.5 U	0.07 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
DB14	6/18/2019	0.2 U	0.2 UM	0.2 UM	0.2 UM	0.2 UM	0.5 UM	0.2 U	0.2 U	0.02 U

Notes:

All concentrations are in µg/L.

Bold indicates detected value is equal to or exceeds surface water remediation goal.

Yellow highlighting indicates samples collected during this FYR period.

D – the reported result is from a dilution

DCA – dichloroethane

DCE – dichloroethene

J – estimated result

M – manual integrated compound

µg/L – micrograms per liter

NE – not established

PCE – tetrachloroethene

TCA – trichloroethane

TCE – trichloroethene

U – not detected at value shown

U[1] – not detected at value shown and value exceeds remediation goal

UJ – not detected at the estimated value shown

Table C-6. OU 1 Total PCBs (Aroclors) in Seep SP1-1 Water through June 2019

Sampling Date	Program	Total PCBs (µg/L)
Total PCBs Remediation Goal		**0.044**
Spring 1990	RI	1.8
Fall 1991	RI	1.5
September 5, 1995	Post-RI	0.16
December 5, 1995	–	0.15
March 13, 1996	Post-RI	0.2
July 2, 1996	Post-RI	0.24 J
October 10, 1996	Post-RI	0.13
June 7, 2000	Post-RA/LTM	0.42
June 17, 2002	Post-RA/LTM	0.45
April 21, 2004	Post-RA/LTM	0.42
July 12, 2006	Post-RA/LTM	0.29
May 8, 2008	Post-RA/LTM	0.27
June 16, 2010	Post-RA/LTM	0.28
June 25, 2014	Post-RA/LTM	0.696
June 20, 2017	Post-RA/LTM	0.010 U
June 18, 2019	Post-RA/LTM	0.572 J

Notes:

µg/L – micrograms per liter

U – not detected at value shown

RI – remedial investigation

RA – remedial action

LTM – long-term monitoring

Table C-7. OU 1 PCB Congeners Seep Water Results, June 2019

Congener	SP1-1		SP1-1 (DUP)	
	AREA-1-19-220		AREA-1-19-221	
PCB-1	16,000		15,000	
PCB-2	900		740	
PCB-3	7,000	J	5,900	J
PCB-4	210,000	D M J1	170,000	D
PCB-5	1,200	U M	900	U M
PCB-6	160,000	D M	110,000	D M
PCB-7	2,500	M	1,700	M
PCB-8	180,000	D M	120,000	D M
PCB-9	3,900	M	2,700	M
PCB-10	5,900		4,400	
PCB-11	4,700	M	3,700	M
PCB-12/13	18,000	M	13,000	M
PCB-14	1,100	U	850	U
PCB-15	100,000	D J1	64,000	D
PCB-16	77,000	D	45,000	D
PCB-17	100,000	D	62,000	D
PCB-18/30	230,000	D	130,000	D
PCB-19	67,000	D J1	39,000	D
PCB-20/28	170,000	D	96,000	D M
PCB-21/33	31,000		20,000	M
PCB-22	38,000	D	22,000	D M
PCB-23	900	U	660	U
PCB-24	190	U	190	U
PCB-25	63,000	D	35,000	D M
PCB-26/29	100,000	D	58,000	D
PCB-27	62,000	D	36,000	D
PCB-31	150,000	D	83,000	D M
PCB-32	63,000	D	36,000	D
PCB-34	2,300	M	1,500	M
PCB-35	960	M	700	U
PCB-36	810	U	590	U
PCB-37	19,000	D J1	13,000	M
PCB-38	900	U	660	U
PCB-39	920	U	670	U
PCB-40/71	46,000	D M	22,000	M
PCB-41	34,000	D	18,000	
PCB-42	5,000	M	2,700	M
PCB-43	120,000	D	71,000	D
PCB-44/47/65	25,000	D M	14,000	M
PCB-45	18,000	D	11,000	
PCB-46	12,000		6,500	
PCB-48	110,000	D	67,000	D
PCB-49/69	65,000	D	34,000	
PCB-50/53	9,300	M	4,600	M
PCB-51	210,000	D M	120,000	D M
PCB-52	1,100	J	730	J
PCB-54	190	U M	190	U M
PCB-55	11,000		6,600	
PCB-56	1,000	M	490	M

Table C-7. OU 1 PCB Congeners Seep Water Results, June 2019

Congener	SP1-1	SP1-1 (DUP)
	AREA-1-19-220	AREA-1-19-221
PCB-57	420 M	190 M
PCB-58	20,000	10,000
PCB-59/62/75	2,100	1,300 M
PCB-60	53,000	28,000
PCB-61/70/74/76	2,300 M	1,200 M
PCB-63	35,000 D M	16,000 M
PCB-64	44,000 D	19,000
PCB-66	3,400 M	1,600 M
PCB-67	1,600 M	750 M
PCB-68	2,300 M	1,100 M
PCB-72	1,400 U	830 U
PCB-73	3,500 J M	2,000 J
PCB-77	200 U	190 U
PCB-78	570 M	320 M
PCB-79	330	190
PCB-80	310 U M	160 U M
PCB-81	4,800	3,000
PCB-82	5,400 M	2,700 M
PCB-83	43,000 D	16,000
PCB-84	7,600	4,800
PCB-85/116/117	37,000	23,000
PCB-86/87/97/108/119/125	18,000	8,200
PCB-88/91	970 U	580 U
PCB-89	87,000 D	42,000 M
PCB-90/101/113	16,000	9,800 M
PCB-92	1,900 M	850 M
PCB-93/100	2,000 M	910 M
PCB-94	110,000 D M	66,000 D M
PCB-95	2,200	1,100
PCB-96	4,400 M	1,900 M
PCB-98/102	44,000 D M	25,000 D M
PCB-99	1,700 M	780 M
PCB-103	20 J	12 J
PCB-104	12,000 M	7,000 M
PCB-105	680 U	410 U
PCB-106	1,100 M	650 M
PCB-107/124	3,400 M	2,100 M
PCB-109	87,000 D	50,000 D
PCB-110/115	760 U	460 U
PCB-111	610 U M	360 U M
PCB-112	940 U	540 U
PCB-114	47,000 D M J1	27,000 D M
PCB-118	640 U	380 U
PCB-120	650 U	390 U
PCB-121	960 U	580 U
PCB-122	960 U	560 U
PCB-123	1,100 U	650 U
PCB-126	800 U	480 U
PCB-127	5,900	3,200

Table C-7. OU 1 PCB Congeners Seep Water Results, June 2019

	SP1-1	SP1-1 (DUP)
Congener	AREA-1-19-220	AREA-1-19-221
PCB-128/166	46,000	24,000
PCB-129/138/163	3,100	1,600
PCB-130	510 M	290 M
PCB-131	16,000 M	8,400 M
PCB-132	720 M	370 M
PCB-133	3,400 M	1,800 M
PCB-134/143	15,000 M	7,700 M
PCB-135/151	7,500	3,900
PCB-136	1,800	930
PCB-137	770 M	400 M
PCB-139/140	6,300	3,100
PCB-141	250 U	200 U
PCB-142	1,600	800 M
PCB-144	190 U	190 U
PCB-145	6,700	3,400
PCB-146	37,000 M	18,000 M
PCB-147/149	220 U	190 U
PCB-148	190 U	190 U
PCB-150	190 U	190 U
PCB-152	36,000	19,000
PCB-153/168	970 M	500 M
PCB-154	190 U	190 U
PCB-155	3,900 J	2,300 J
PCB-156/157	4,000	2,000
PCB-158	150 J	91 J
PCB-159	200 U M	190 U M
PCB-160	190 U M	190 U M
PCB-161	140 J M	91 J M
PCB-162	2,800	1,500
PCB-164	200 U	190 U
PCB-165	1,800 J	990 J
PCB-167	43 U	28 U
PCB-169	7,300	4,300
PCB-170	2,000	1,200
PCB-171/173	1,100	620
PCB-172	5,600	3,200
PCB-174	340	160 J
PCB-175	930 M	460
PCB-176	3,500	2,000
PCB-177	1,500	750
PCB-178	2,700	1,300 M
PCB-179	14,000	8,000
PCB-180/193	190 U	190 U
PCB-181	88 J M	36 J M
PCB-182	3,600 M	2,200 M
PCB-183	14 J M	6 J M
PCB-184	540 M	220 M
PCB-185	190 U	190 U
PCB-186	8,100 M	3,900 M

Table C-7. OU 1 PCB Congeners Seep Water Results, June 2019

Congener	SP1-1	SP1-1 (DUP)
	AREA-1-19-220	AREA-1-19-221
PCB-187	23 J	14 J M
PCB-188	310	160 M
PCB-189	1,300 M	740
PCB-190	270	170 J
PCB-191	190 U	190 U
PCB-192	2,000	1,100
PCB-194	840	430
PCB-195	1,300	680
PCB-196	75 J	43 J M
PCB-197	2,200	1,200
PCB-198/199	290	150 J M
PCB-200	290	160 J
PCB-201	420	260
PCB-202	1,400	800
PCB-203	190 U	190 U
PCB-204	150 J	70 J
PCB-205	690 J	440 J
PCB-206	76 J	50 J
PCB-207	200	130 J
PCB-208	470	270
PCB-209	2,700 U	1,600 U
Total PCB Congeners (pg/L)	3,519,276	2,080,293
Total PCB Congeners (µg/L)	**3.5193**	**2.0803**
Cleanup Goal (µg/L)	**0.044**	**0.044**

Notes:

All concentrations are in picograms per gram (pg/L), except where noted.

Bold indicates detected concentration exceeds MTCA Method B risk based cleanup level of 0.044 µg/L for total PCBs.

D – the reported from a diluted analysis

J – analyte positively identified, but result is estimated

J1 – the quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria.

M – a manual integration was performed by the laboratory analyst

PCB – polychlorinated biphenyl

q – the reported concentration is the estimated maximum possible concentration for this analyte.

The measured ion ratio does not meet qualitative identification criteria and indicates a possible interference.

Table C-8. OU 1 PCB Aroclors Sediment Results, June 2019

Location ID	Sample ID	Sampling Date	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	Total PCBs
SP1-1	AREA-1-19-250	6/18/2019	14 J	22 UM	22 UM	22 UM	22 UM	22 UM	34.67	**48.67 J**
SP1-1 (DUP)	AREA-1-19-251	6/18/2019	12 J	16.5 UM	16.5 UM	16.5 UM	16.5 UM	16.5 UM	24	**36 J**
MA09	AREA-1-19-252	6/18/2019	6.77 UM J1	6.77 UM	6.77 UM	6.77 UM	6.77 UM	1.15 J	6.77 UM	1.15 J
MA14	AREA-1-19-253	6/18/2019	7.17 UM	7.17 U	7.17 UM	7.17 UM	7.17 UM	1.2 J	7.17 UM	1.2 J
TF21	AREA-1-19-254	6/20/2019	5.58 UM	5.58 U	5.58 UM	5.58 UM	5.58 UM	5.58 U	5.58 UM	5.58 UM
Sediment Quality Standard (mg/kg OC)			**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**12**

Notes:

All concentrations are in milligrams per kilogram and have been normalized for organic carbon (mg/kg OC).

Bold indicates detected concentration is equal to or exceeds the SQS of 12 mg/kg for total PCBs in sediment.

D – the report results is from a diluted analysis

DUP – field duplicate sample

GW – groundwater

J – analyte positively identified, but result is estimated

J1 – the quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria

P – the relative percent difference is greater than 40 percent between the results on the two analytical columns

PCBs – polychlorinated biphenyls

SQS – sediment quality standard

U – the analyte was not detected at or above the indicated practical quantitation limit

UJ – analyte not detected, but the reported quantitation/detection limit is estimated

Table C-9. OU 1 PCB Congeners Sediment Results, June 2019

	SP1-1	SP1-1 (DUP)	MA09	MA14	TF21
Congener	AREA-1-19-250	AREA-1-19-251	AREA-1-19-252	AREA-1-19-253	AREA-1-19-254
PCB-1	550 M	360 M	6.2 J	3.9 J M	7.4 J
PCB-2	100	73 M	43	39 M	83
PCB-3	430	310 M	4.2 J	4.1 J	7.7 J
PCB-4	13,000 D M	13,000 D M	24 M	16 J M	61 M
PCB-5	110 U	110 U	20 U	20 U	20 U
PCB-6	11,000 D M	9,900 D M	23 M	18 J M	43 M
PCB-7	140 M	130 M	20 U	20 U	20 U
PCB-8	13,000 D M	11,000 D M	35 M	29 M	58 M
PCB-9	240 M	200 M	20 U	20 U	20 U
PCB-10	340	380	20 U	20 U	20 U
PCB-11	410 M	370 M	19 J M	23 J M	28 M
PCB-12/13	1,600 M	1,300 M	13 J M	9 J M	9 J M
PCB-14	100 U	100 U	20 U	20 U	20 U
PCB-15	8,300 D	7,400 D M	64 M	58 M	53 M
PCB-16	4,900 D	4,400 D	20	15 J	20
PCB-17	6,700 D	6,000 D	30	18 J	34
PCB-18/30	15,000 D	14,000 D	53	35 J	49
PCB-19	3,600 D	3,800 D	9.5 J	6.7 J M	13 J
PCB-20/28	11,000 D	9,200 D M	110 q	100	94
PCB-21/33	2,400 D M	1,900 M	21 J q	25 J	22 J
PCB-22	2,400 D	1,900 D M	19 J	20	14 J M
PCB-23	100 U	100 U	20 U	20 U	20 U
PCB-24	20 U	20 U	20 U	20 U	20 U
PCB-25	3,400 D	3,000 D M	28 q	20 M	19 J
PCB-26/29	5,800 D	5,000 D	66 q	42 M	35 J
PCB-27	4,300 D	4,400 D	19 J	11 J	21
PCB-31	9,900 D	8,000 D M	100	89	67
PCB-32	4,000 D	3,700 D	18 J	12 J	21
PCB-34	140 M	120 M	20 U	20 U	20 U
PCB-35	110 U	110 U	20 U	2.5 J M	2.3 J M
PCB-36	92 U	94 U M	3.4 J q	20 U	20 U
PCB-37	1,900	1,400 M	29	37	26 M
PCB-38	100 U	100 U	20 U	20 U	20 U
PCB-39	100 U	110 U	20 U	20 U	20 U
PCB-40/71	2,800	2,700	36 J	26 J M	16 J M
PCB-41	170 U	290 U	20 U	20 U	20 U
PCB-42	2,400 D	2,000 D	19 J	16 J	11 J
PCB-43	320 M	340 M	2.8 J M	2.2 J M	20 U
PCB-44/47/65	8,300 D	7,200 D	98	78	50 J
PCB-45	1,900 M	1,800 M	10 J M	7.5 J M	6.7 J M
PCB-46	1,200	1,200	5.3 J	3.6 J	3.6 J
PCB-48	740	730	7.6 J	7 J	4.7 J
PCB-49/69	7,600 D	6,700 D	110	72	59
PCB-50/53	4,000	4,200 D	25 J	14 J	17 J
PCB-51	500 M	440 M	3.2 J M	1.7 J M	2.8 J M
PCB-52	15,000 D	13,000 D M	230 M	190 M	110 M
PCB-54	90	80 M q	0.74 J M	0.71 J M	20 U
PCB-55	31 U M	22 U M	20 U M	20 U M	20 U M
PCB-56	1,100 M	870 M	19 J	27	14 J M
PCB-57	35 M	36 M	20 U	20 U	20 U
PCB-58	31 U	230 M	6 J M	20 U M	1.2 J M
PCB-59/62/75	1,200	1,300	11 J	7.9 J	5.6 J
PCB-60	350 M	260 M	9.2 J	14 J	8.3 J M
PCB-61/70/74/76	4,200 M	3,000 M	85 M	150 M	49 J M q
PCB-63	120 M	100 M	2.1 J M	2.5 J M	1.3 J
PCB-64	2,000	1,900	22	28 M	11 J
PCB-66	3,900 D	3,000 D	79 M	90 M	47 M
PCB-67	180 M	27 M	1.8 J M	2 J M	0.72 J q
PCB-68	75 M	68 M	1.6 J	1.7 J M	1.1 J
PCB-72	120	100 M	2.3 J	2.3 J	1.3 J
PCB-73	91 U	150 U	20 U	20 U	20 U
PCB-77	660	390 M	22	24	20
PCB-78	39 U	28 U	20 U	20 U	20 U
PCB-79	300	100 M	4.9 J	4.5 J M	1.7 J M
PCB-80	100 M	93 M	3.2 J	3.2 J M	0.89 J
PCB-81	45 U M	31 U M	2 U	2 U M	2 U
PCB-82	1,200	770	46	42	9.7 J
PCB-83	660 M	560 M	20 M	15 J M	6.6 J M

Table C-9. OU 1 PCB Congeners Sediment Results, June 2019

	SP1-1	SP1-1 (DUP)	MA09	MA14	TF21
Congener	AREA-1-19-250	AREA-1-19-251	AREA-1-19-252	AREA-1-19-253	AREA-1-19-254
PCB-84	4,600 D	2,700 D	84 M	74 M	16 J M
PCB-85/116/117	2,000	1,400	97	110	33 J
PCB-86/87/97/108/119/125	8,500 M	6,000 M	320 M	330 M	79 J M
PCB-88/91	2,000 M	1,400 M	45 M	52 M	13 J M
PCB-89	230 U	160 U	20 U	20 U	20 U
PCB-90/101/113	18,000 D	10,000 D	530	520	160
PCB-92	3,500 D	2,100 D	100	100	28
PCB-93/100	240 U	230 M	40 U	40 U	40 U
PCB-94	270 U	190 U	20 U	20 U	20 U
PCB-95	16,000 D M	9,400 D M	220 M	260 M	50 M
PCB-96	120	62 M	1.6 J	1.2 J	0.73 J M
PCB-98/102	460 M	360 M	7.4 J M	8 J M	3 J M
PCB-99	5,600 D M	3,900 D M	260 M	260 M	100 M
PCB-103	220 U	150 U	20 U	20 U	20 U
PCB-104	4 J	2 J M	0.25 J	0.24 J M	20 U
PCB-105	4,100 D	2,200 D	220 J J1	270	100
PCB-106	160 U	110 U	20 U	20 U	20 U
PCB-107/124	400	250	9.6 J	21 J	5.2 J
PCB-109	1,200 M	710 M	38 M	50 M	20 M
PCB-110/115	17,000 D	9,900 D	590	680	160
PCB-111	180 U	120 U	20 U	20 U	20 U
PCB-112	140 U M	99 U M	20 U M	20 U M	20 U M
PCB-114	190 U	130 U	7.9 M	11 M	3.3 M
PCB-118	13,000 D B	7,200 B D	590 J J1 B M	690 B	270 B
PCB-120	150 U	100 U	20 U	20 U	20 U
PCB-121	160 U	110 U	20 U	20 U	20 U
PCB-122	230 U	160 U	9.1 J M	11 J M	3.5 J M
PCB-123	200 U	140 M	7.6 M	10 M	4.5 M
PCB-126	500 M	210 M	4.3 U	6.2 U	2.4 U
PCB-127	190 U	130 U	20 U	20 U	20 U
PCB-128/166	4,500 D	2,200	130	150	51
PCB-129/138/163	47,000 D	21,000 D	730	850	310
PCB-130	2,700 D	1,400	45	60	20
PCB-131	290 M	140 M	7.2 J	7.3 J	2 J M
PCB-132	11,000 D	4,900 D	160	180	47 M
PCB-133	510	280 M	6.8 J	9 J	4 J M
PCB-134/143	1,400 M	830 M	28 J M	29 J M	8.5 J M
PCB-135/151	12,000 D	5,600 D	110 M	130	44 M
PCB-136	3,800 D M	1,800 M	48 M	45	16 J
PCB-137	840	530 M	37	46	12 J
PCB-139/140	500 M	270 M	13 J	12 J	4.1 J M
PCB-141	8,600 D	3,600 D	66	84	23
PCB-142	160 U	81 U	20 U	20 U	20 U
PCB-144	1,600 M	800 M	17 J	17 J M	5.8 J
PCB-145	97 U	50 U	20 U	20 U	20 U
PCB-146	6,400 D	2,900 D	67	83	38
PCB-147/149	28,000 D	13,000 D	320	370	130 M
PCB-148	140 U	73 U	20 U	20 U	20 U
PCB-150	100 U	53 U	20 U	20 U	20 U
PCB-152	91 U	47 U	20 U	20 U	20 U
PCB-153/168	43,000 D	19,000 D	440	470	230
PCB-154	650 M	350 M	6.6 J M	5.6 J M	4.2 J
PCB-155	120 U	69 U	20 U	20 U	20 U
PCB-156/157	4,100 D	2,300	90	120	37
PCB-158	4,200 D	1,900	72	76	25
PCB-159	360	170	1.1 J	1.8 J M	0.89 J
PCB-160	130 U M	66 U M	20 U M	20 U M	20 U M
PCB-161	99 U M	51 U M	20 U M	20 U M	20 U M
PCB-162	240 M	120 M	2.5 J M	4.3 J M	1.3 J M
PCB-164	2,800 D	53 U	32	43	12 J
PCB-165	120 U	64 U	20 U	20 U	20 U
PCB-167	2,200 D	1,200	32	42	14
PCB-169	77 M	37 U	2 U	2 U	2 U
PCB-170	19,000 D	7,100 D	47	79	40
PCB-171/173	4,800 D	2,200 M	18 J	28 J	16 J
PCB-172	2,900 D	1,300	7.6 J	13 J	7.1 J
PCB-174	13,000 D	5,200 D	32	61 M	32 M
PCB-175	610	220	2.2 J	2.7 J	2.9 J M

Table C-9. OU 1 PCB Congeners Sediment Results, June 2019

Congener	SP1-1 AREA-1-19-250	SP1-1 (DUP) AREA-1-19-251	MA09 AREA-1-19-252	MA14 AREA-1-19-253	TF21 AREA-1-19-254
PCB-176	1,500	530	5.1 J	7.2 J	5 J
PCB-177	7,900 D	3,200 D	26	44	27
PCB-178	2,900 D	1,000	11 J	15 J	12 J
PCB-179	5,100 D	1,600	13 J M	21	15 J
PCB-180/193	39,000 D	14,000 D	83 M	140 M	91
PCB-181	120 U	51 U	1.1 J	1.7 J M	20 U
PCB-182	110 M	33 M	0.5 J M	0.29 J M q	0.5 J M
PCB-183	11,000 D M	3,800 D M	32 M	40 M	31 M
PCB-184	20	8 J	0.086 J M q	20 U	0.23 J M
PCB-185	950 M	590 M	1.8 J M	2.9 J M	2.4 J M
PCB-186	20 U	20 U	20 U	20 U	20 U
PCB-187	17,000 D M	6,000 D M	51 M	77 M	67 M
PCB-188	51	25	0.5 J M	0.47 J M	0.93 J
PCB-189	800 M	300 M	3.2 M	4.8	2.6 M
PCB-190	3,500 D	1,400	10 J M	16 J M	7.8 J
PCB-191	750	310	2.4 J M	3.1 J M	1.6 J
PCB-192	99 U	41 U	20 U	20 U	20 U
PCB-194	5,900 D	2,600 D	14 J	27	25
PCB-195	2,300 D	1,600	5 J	10 J	8.7 J
PCB-196	4,200 D	1,000	7.2 J	11 J	15 J
PCB-197	210	51	0.71 J	0.81 J M q	1.5 J M
PCB-198/199	6,900 D	1,600	15 J	28 J	31 J
PCB-200	660	200	1.4 J	2.4 J M	2.1 J M
PCB-201	920	240	2.9 J	4.1 J	5.9 J
PCB-202	1,600	620	5.6 J	10 J	11 J
PCB-203	4,500 D	1,100 M	9 J	15 J	14 J
PCB-204	20 U	20 U	20 U	20 U	20 U
PCB-205	410	160	0.79 J	1.5 J	1.2 J M
PCB-206	1,800 D	930	15 J	32	25
PCB-207	280	110	2.1 J	3.6 J M	4.3 J
PCB-208	550	230	6.1 J	14 J	13 J
PCB-209	370	340	25	46	50
Total PCB Congeners (pg/g)	630,842	366,488	7,696	8,522	3,906
Total PCB Congeners (mg/kg)	0.6308	0.3665	0.0077	0.0085	0.0039
Total Organic Carbon	1.50%	2.00%	0.96%	0.92%	1.20%
Total PCB congeners (mg/kg OC)	**42.0561**	**18.3244**	0.8017	0.9263	0.3255
Cleanup Goal (mg/kg)	**12**	**12**	**12**	**12**	**12**

Notes:

All concentrations are in picograms per gram (pg/g), except where noted.

Bold indicates detected concentration exceeds the RG of 12 mg/kg for total PCBs.

B – the analyte was detected above one-half the reporting limit in an associated blank.

D – the reported from a diluted analysis

J – analyte positively identified, but result is estimated

J1 – the quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria.

M – a manual integration was performed by the laboratory analyst

PCB – polychlorinated biphenyl

q – the reported concentration is the estimated maximum possible concentration for this analyte.

The measured ion ratio does not meet qualitative identification criteria and indicates a possible interference.

APPENDIX D
OU 1 DATA COLLECTED DURING FYR PERIOD

Table D-1. OU 1 2014 cVOC Concentrations in Groundwater

Location	Date	PCE (µg/L)	TCE (µg/L)	1,1-DCE (µg/L)	cis- 1,2-DCE (µg/L)	trans- 1,2-DCE (µg/L)	Vinyl Chloride (µg/L)	1,1,1-TCA (µg/L)	1,1-DCA (µg/L)	1,2-DCA (µg/L)	cVOCs (µg/L)
Remediation Goal		**5**	**5**	**0.5**	**70**	**100**	**0.5**	**200**	**800**	**5**	**NE**
MW1-4	6/23/2014	10 U	6,100	4.2 J	3,500	27	110	10 U	10 U	10 U	9,741
MW1-5	6/23/2014	0.5 U	0.24 J	0.5 U	0.85	0.2 J	17	0.5 U	0.78	0.5 U	19
MW1-16	6/23/2014	0.5 U	0.11 J	0.5 U	0.63	0.39 J	0.29 J	0.5 U	2.5	0.5 U	3.9
MW1-17	6/18/2014	0.5 U	0.5 U	1.5	360	0.31 J	62	0.5 U	0.5 U	0.5 U	424
P1-6	6/23/2014	10 U	10 U	10 U	3,420	60.7	3,800	10 U	172	20 U	7,453
P1-7	6/23/2014	100 U	33,800	100 U	55,700	305	6,850	100 U	100 U	200 U	96,655
P1-8	6/23/2014	1 U	1 U	1 U	18.7	1 U	88	1 U	1 U	2 U	107
P1-9	6/23/2014	1 U	906	1.7	1,740	17.8	356	1 U	1 U	2 U	3,022
P1-10	6/23/2014	10 U	287	10 U	1,040	17.7	1,150	10 U	10 U	20 U	2,495
S-2	9/4/2014	0.1 U	0.1	0.1 U	1.1	0.1 U	2.1	0.1 U	0.6	NA	3.9
S-2B	9/4/2014	1.0 U	1.0 U	1.0 U	1.0 U	1.9	16	1.0 U	10.3	NA	28.2
S-3	9/4/2014	0.1 U	0.1 U	0.1 U	0.2	0.1	0.4	0.1 U	0.1	NA	0.8
S-3B	9/4/2014	0.1 U	0.1 U	0.1 U	1.1	0.1 U	0.2 U	0.1 U	0.1	NA	1.2
S-4	9/4/2014	100 U	100 U	100 U	46,000	302	13,200	100 U	100 U	NA	59,500
S-4B	9/4/2014	1.0 U	1.0 U	1.0 U	416	1.5	191	1.0 U	1.0 U	NA	608
S-5	9/4/2014	1.0 U	6.5	1.3	1350	4.7	43.7	1.0 U	1.0 U	NA	1400
S-5B	9/4/2014	0.1 U	0.1 U	0.1 U	0.4	0.1 U	1.5	0.1 U	0.1 U	NA	2
S-6	9/4/2014	0.1 U	0.6	0.1 U	3.1	0.1	1.9	0.1 U	0.1 U	NA	5.7

Notes:
cVOCs - sum of detected chlorinated volatile organic chemicals, including seven chemicals in table and PCE and 1,1,1-TCA
DCA - dichloroethane
DCE - dichloroethene
J - estimated
µg/L - microgram per liter
NA - not analyzed
NE - not established
PCE - tetrachloroethene
TCA - trichloroethane
TCE - trichloroethene
U - non-detect

Table D-2. OU 1 2017 Target cVOCs in Auger Boring Soil Samples (µg/kg)

	Location Name	MW1-42	MW1-43	MW1-44	MW1-45	MW1-46		MW1-47
	Sample Name	CL-B76-S-19.0-171006	CL-B77-S-18.0-171006	CL-B75-S-26.0-171005	CL-B74-S-18.5-171005	CL-B78-S-28.5-171007	FD-171007-01	CL-B79-S-21.5-171009
	Sample Type	N	N	N	N	P	FD	N
Analyte Name	**PAL**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
1,1,1-Trichloroethane	1490	23 U	21 U	22 U	23 U	18 U	63 U	21 U
1,1-Dichloroethane	40.7	23 U	21 U	22 U	23 U	18 U	63 U	21 U
1,1-Dichloroethene	45.7	23 U	21 U	39 J	23 U	18 U	63 U	**56**
1,2-Dichloroethane	23.1	39 U	37 U	38 U	40 U	32 U	110 U	37 U
Chloroethane	40.7	110 U	110 U	110 U	110 U	92 U	320 U	100 U
Cis-1,2-Dichloroethene	78.1	**110**	**4,000**	**6,600**	23 U	**3,500**	**11,000**	**36,000** J
Tetrachloroethene	49.9	39 U	37 U	38 U	40 U	32 U	110 U	37 U
Trans-1,2-Dichloroethene	518	190	150	**60** J	68 U	53 J	240 J	390
Trichloroethene	25.2	**73**	37 U	38 U	40 U	**200**	**150** J	**54**
Vinyl Chloride	1.67	230 U	**150** J	**130** J	230 U	**630**	**450** J	**2,400** J

Table D-2. OU 1 2017 Target cVOCs in Auger Boring Soil Samples (μg/kg)

	Location Name	MW1-48	MW1-49	MW1-50	MW1-51	MW1-52	MW1-53	MW1-54
	Sample Name	CL-B83-S-18.5-171012	SP-B80-S-7.5-171010	SP-B73-S-9.0-171004	SP-B71-S-13.5-171002	SP-B72-S-12.0-171003	SP-B82-S-10.0-171011	SP-B81-S-38.5-171011
	Sample Type	N	N	N	N	N	N	N
Analyte Name	**PAL**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
1,1,1-Trichloroethane	1490	29 U	22 U	20 U	24 UJ	23 U	21 U	20 U
1,1-Dichloroethane	40.7	29 U	22 U	20 U	**140** J	23 U	21 U	20 U
1,1-Dichloroethene	45.7	29 U	22 U	20 U	45 J	23 U	21 U	20 U
1,2-Dichloroethane	23.1	<u>50</u> U	<u>38</u> U	<u>36</u> U	<u>41</u> UJ	<u>40</u> U	<u>37</u> U	<u>36</u> U
Chloroethane	40.7	<u>140</u> U	<u>110</u> U	<u>100</u> U	<u>120</u> UJ	<u>110</u> U	<u>110</u> U	<u>100</u> U
Cis-1,2-Dichloroethene	78.1	**440**	**620**	**730**	**4,000** J	**3,700**	**5,300**	**93**
Tetrachloroethene	49.9	50 U	38 U	36 U	41 UJ	40 U	37 U	36 U
Trans-1,2-Dichloroethene	518	86 U	65 U	61 U	220 J	86 J	310	61 U
Trichloroethene	25.2	**52** J	**2,200**	**3,500**	**1,600** J	**52** J	**3,000**	<u>36</u> U
Vinyl Chloride	1.67	**440**	<u>220</u> U	<u>200</u> U H	**980** J	**260** J	**530**	<u>200</u> U

Table D-2. OU 1 2017 Target cVOCs in Auger Boring Soil Samples (μg/kg)

	Location Name	MW1-55	MW1-56	MW1-56	MW1-56	MW1-57		MW1-57
	Sample Name	SP-B86-S-35.0-171016	SP-B87-S-29.0-171017	SP-B87-S-37.5-171017	SP-B87-S-9.0-171017	FD-171018-01	SP-B88-S-9.0-171018	SP-B88-S-31.0-171018
	Sample Type	N	N	N	N	FD	P	N
Analyte Name	PAL	Result	Result	Result	Result	Result	Result	Result
1,1,1-Trichloroethane	1490	14 U	27 U	21 U	22 U	19 UJ	21 UJ	27 U
1,1-Dichloroethane	40.7	14 U	27 U	21 U	22 U	19 UJ	21 UJ	27 U
1,1-Dichloroethene	45.7	14 U	27 U	21 U	22 U	**350** J	**540** J	27 U
1,2-Dichloroethane	23.1	24 U	47 U	38 U	39 U	34 UJ	37 UJ	47 U
Chloroethane	40.7	69 U	130 U	110 U	110 U	96 UJ	110 UJ	130 U
Cis-1,2-Dichloroethene	78.1	**290**	**5,200**	**80** J	22 U	**240,000** J	**350,000** J	**760**
Tetrachloroethene	49.9	24 U	47 U	38 U	39 U	**2,000** J	**4,200** J	47 U
Trans-1,2-Dichloroethene	518	41 U	80 U	64 U	66 U	**3,500** J	**5,600** J	61 J
Trichloroethene	25.2	**520**	**420** J	**120** J	39 U M	**1,800,000** J	**3,500,000** J	**59** J
Vinyl Chloride	1.67	140 UJ	270 UJ	210 UJ	220 UJ	**5,000** J	**4,200** J	**100** J

Table D-2. OU 1 2017 Target cVOCs in Auger Boring Soil Samples (µg/kg)

	Location Name	MW1-58	MW1-58	MW1-58	MW1-60
	Sample Name	SP-B89-S-24.0-171101	SP-B89-S-34.0-171101	SP-B89-S-6.5-171101	SP-B84-S-20.0-171012
	Sample Type	N	N	N	N
Analyte Name	PAL	Result	Result	Result	Result
1,1,1-Trichloroethane	1490	10 U	21 U	26 U	23 U
1,1-Dichloroethane	40.7	10 U	21 U	26 U	23 U
1,1-Dichloroethene	45.7	10 U	21 U	26 U	23 U
1,2-Dichloroethane	23.1	18 U	36 U	46 U	<u>41</u> U
Chloroethane	40.7	<u>51</u> U	<u>100</u> U	<u>130</u> U	<u>120</u> U
Cis-1,2-Dichloroethene	78.1	**400**	68 J M	**8,500**	23 U
Tetrachloroethene	49.9	18 U Q	36 U Q	46 U Q	41 U
Trans-1,2-Dichloroethene	518	31 U	62 U	**92** J	70 U
Trichloroethene	25.2	18 J	**30** J	<u>46</u> U	<u>41</u> U
Vinyl Chloride	1.67	<u>100</u> U	<u>210</u> U	**9,800**	<u>230</u> UJ

Samples analyzed using EPA Method 8260C
Underlined values represent analytes not detected at or above the stated limit, which exceeds the PAL
Bolded values indicate that the reported concentration exceeds the PAL.
FD - Field Duplicate
P – Parent sample of field duplicate
N – Sample is not part of a duplicate pair.
PAL - Project Action Limit
U - The analyte was not detected at or above the stated limit. (sometimes validators will elevate the limit due to the "B" qualifier using the 5x/10x rule so this definition is different than the lab description).
J - The reported value is an estimated concentration.
U H - The analyte was not detected at or above the stated limit. (sometimes validators will elevate the limit due to the "B" qualifier using the 5x/10x rule so this definition is different than the lab description). / Sample was prepped or analyzed beyond the specified holding time.
U M - The analyte was not detected at or above the stated limit. (sometimes validators will elevate the limit due to the "B" qualifier using the 5x/10x rule so this definition is different than the lab description). / A matrix effect was present.
UJ - The analyte was not detected at or above the stated sample quantitation limit, which is an estimated value.
µg/kg – micrograms per kilogram

Table D-3. OU 1 2017 Target cVOCs in Direct Push Soil Samples (µg/kg)

	Location Name	CL-B02			CL-B03			CL-B04	
	Sample Name	CL-B02-S-14.0-170711	CL-B02-S-20.0-170711	CL-B02-S-29.0-170711	CL-B03-S-18.0-170712	CL-B03-S-19.4-170712	CL-B03-S-37.0-170712	CL-B04-S-11.5-170712	CL-B04-S-19.5-170712
	Sample Type	N	N	N	N	N	N	N	N
Analyte	PAL (µg/kg)	Result	Result	Result	Result	Result	Result	Result	Result
1,1,1-Trichloroethane	1,490	0.88 UJ	0.88 UJ	0.97 UJ	0.92 UJ	0.89 UJ	1.1 UJ	0.9 UJ	0.88 UJ
1,1-Dichloroethane	40.7	0.44 U	0.44 U	0.48 U	0.46 U	0.44 U	0.54 U	0.45 U M	0.44 U
1,1-Dichloroethene	45.7	5.2	1 J	0.97 U M	0.92 U M	4.8	1.1 U	0.9 U	2.9 J
1,2-Dichloroethane	23.1	0.44 UJ	0.44 UJ	0.48 UJ	0.46 UJ	0.44 UJ	0.54 UJ	0.45 UJ	0.44 UJ
Chloroethane	40.7	0.44 UJ	0.44 UJ	0.48 UJ	0.46 UJ	0.44 UJ	0.54 UJ	0.45 UJ	0.44 UJ
Cis-1,2-Dichloroethene	78.1	**1,300** J Q	**450** J Q	46 Q	46 Q	**9,000**	13 Q	8.1 Q	**5,600**
Tetrachloroethene	49.9	0.88 U	0.88 U	0.97 U M	0.92 U	0.89 U	1.1 U	0.9 U	0.88 U
Trans-1,2-Dichloroethene	518	2 J	32 J	0.78 J	0.83 J	2 J	1.1 UJ	0.9 UJ	48 J
Trichloroethene	25.2	**7,400** J	**5,200** J	**3,600** J	**3,900**	**83** Q	**92** Q	**51** Q	**3,800** J
Vinyl Chloride	1.67	**44** J	**6.5** J	1.3 J	**3.8** J	**25** J	1.1 UJ	0.9 UJ	**5** J

Table D-3. OU 1 2017 Target cVOCs in Direct Push Soil Samples (μg/kg)

	Location Name	CL-B04	CL-B05	CL-B06a		CL-B07			CL-B08
	Sample Name	CL-B04-S-29.0-170712	CL-B05-S-18.3-170712	CL-B06a-S-16.0-170713	CL-B06a-S-33.0-170713	CL-B07-S-20.0-170713	CL-B07-S-28.5-170713	CL-B07-S-4.0-170713	CL-B08-S-17.5-170713
	Sample Type	N	N	N	N	N	N	N	N
Analyte	PAL (μg/kg)	Result	Result	Result	Result	Result	Result	Result	Result
1,1,1-Trichloroethane	1,490	1.2 UJ	0.98 U	0.85 U	0.9 U	0.82 U	0.85 U	0.76 U	0.87 U
1,1-Dichloroethane	40.7	0.59 U	0.98 U	0.85 U	0.9 U	0.82 U	0.85 U	0.76 U	0.87 U
1,1-Dichloroethene	45.7	13	0.98 U	0.85 U	0.9 U	4.8	3.1	0.76 U	2.2 J
1,2-Dichloroethane	23.1	0.59 UJ	0.98 U	0.85 U	0.9 U	0.82 U	0.85 U	0.76 U	0.87 U
Chloroethane	40.7	0.59 UJ	4.9 U	4.3 U	4.5 U	4.1 U	4.2 U	3.8 U	4.3 U
Cis-1,2-Dichloroethene	78.1	**6,600**	**110**	2	**88** J	**2,100**	**2,600**	0.76 U	**3,800** J
Tetrachloroethene	49.9	1.2 U	0.98 U	0.85 U	0.9 U	0.82 U	0.85 U	0.76 U	0.87 U
Trans-1,2-Dichloroethene	518	35 J	2.7	0.85 U	23 J	6.9	1.4	0.76 U	1.7 J
Trichloroethene	25.2	**6,900** J	**2,900**	0.85 U	0.9 U	0.82 U	0.85 U	0.76 U	0.87 U
Vinyl Chloride	1.67	**77** J	0.98 U	0.85 U	**25** J	**14**	**22**	0.76 U	**5.3** J

Table D-3. OU 1 2017 Target cVOCs in Direct Push Soil Samples (μg/kg)

	Location Name	CL-B08	CL-B09	CL-B10		CL-B11	CL-B12		
	Sample Name	CL-B08-S-27.0-170713	CL-B09-S-13.0-170713	CL-B10-S-10.0-170714	CL-B10-S-21.0-170714	CL-B11-S-7.0-170714	CL-B12-S-17.5-170714	CL-B12-S-20.5-170714	CL-B12-S-31.5-170714
	Sample Type	N	N	N	N	N	N	N	P
Analyte	**PAL (μg/kg)**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
1,1,1-Trichloroethane	1,490	0.79 U	1 U	0.75 U	0.84 U	1.1 U	0.95 U	0.88 U	1.6 U
1,1-Dichloroethane	40.7	0.79 U	1 U	0.75 U	0.84 U	1.1 U	0.95 U	0.88 U	1.6 U
1,1-Dichloroethene	45.7	1.3 J	1 U	0.75 U	0.84 U	1.1 U	19	1.8	24
1,2-Dichloroethane	23.1	0.79 U	1 U	0.75 U	0.84 U	1.1 U	0.95 U	0.88 U	1.6 U
Chloroethane	40.7	3.9 U	5.1 U	3.8 U	4.2 U	5.3 U	4.8 U	4.4 U	7.9 U
Cis-1,2-Dichloroethene	78.1	**470** J	3.5 J	2.7 J	1.2	1.7	**9,500**	**690**	**2,000**
Tetrachloroethene	49.9	0.79 U	1 U	0.75 U	0.84 U	1.1 U	0.95 U	0.88 U	1.6 U
Trans-1,2-Dichloroethene	518	39 J	3.3 J	0.75 U	0.84 U	1.1 U	19	81	25
Trichloroethene	25.2	4.8 J	1.8 J	1.3 J	0.85	1.1 U	1.7	**1,900**	**5,500**
Vinyl Chloride	1.67	**42** J	**2.1** J	0.75 U	0.84 U	1.1 U	**36**	**5.6**	**27**

Table D-3. OU 1 2017 Target cVOCs in Direct Push Soil Samples (μg/kg)

	Location Name	CL-B12	CL-B13	CL-B14b					CL-B15
	Sample Name	FD-170714-01	CL-B13-S-11.5-170717	CL-B14b-S-18.0-170717	CL-B14b-S-21.0-170717	CL-B14b-S-4.0-170717	CL-B14b-S-9.0-170717	FD-170717-01	CL-B15-S-23.0-170717
	Sample Type	FD	N	N	N	N	P	FD	N
Analyte	PAL (μg/kg)	Result	Result	Result	Result	Result	Result	Result	Result
1,1,1-Trichloroethane	1,490	1.5 U	0.98 U	110 U	0.86 U	0.87 U	1.2 U	1.7 U	0.93 U
1,1-Dichloroethane	40.7	1.5 U	0.98 U	110 U	0.86 U	0.87 U	1.2 U	2.5	0.93 U
1,1-Dichloroethene	45.7	15	0.98 U	**120**	16	0.87 U	1.2 U	1.7 U	0.93 U
1,2-Dichloroethane	23.1	1.5 U	0.98 U	110 U	0.86 U	0.87 U	1.2 U	1.7 U	0.93 U
Chloroethane	40.7	7.7 U	4.9 U	560 U	4.3 U	4.4 U	6.2 U	8.7 U	4.6 U
Cis-1,2-Dichloroethene	78.1	**1,900**	11	**42,000** J	**31,000**	5.1	32	74	10
Tetrachloroethene	49.9	1.5 U	0.98 U	110 U	0.86 U	0.87 U	1.2 U	1.7 U	0.93 U
Trans-1,2-Dichloroethene	518	18	0.98 U	**770**	130	0.87 U	1.2 U	1.7 U	0.93 U
Trichloroethene	25.2	**5,000**	0.98 U	110 U	2.5	1.5	1.7	2.6	0.93 U
Vinyl Chloride	1.67	**17**	**6.7**	**10,000**	**5,100**	1.1	**11**	**18**	**3.4**

Table D-3. OU 1 2017 Target cVOCs in Direct Push Soil Samples (µg/kg)

	Location Name	CL-B16	CL-B17	CL-B18a					CL-B19
	Sample Name	CL-B16-S-12.5-170718	CL-B17-S-20.0-170718	CL-B18a-S-14.5-170718	CL-B18a-S-18.0-170718	CL-B18a-S-21.5-170718	CL-B18a-S-22.3-170718	CL-B18a-S-33.0-170718	CL-B19-S-23.0-170719
	Sample Type	N	N	N	N	N	N	N	N
Analyte	**PAL (µg/kg)**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
1,1,1-Trichloroethane	1,490	**2,000**	0.83 U	1.3 U	0.9 U	0.99 U	110 U	0.85 U	0.422 UJ
1,1-Dichloroethane	40.7	**2,100**	1.6	1.3 U	0.9 U	0.99 U	<u>110</u> U	0.85 U	0.422 UJ
1,1-Dichloroethene	45.7	**110**	0.83 U	1.3 U	0.9 U	4.2	<u>110</u> U	0.85 U	0.422 UJ
1,2-Dichloroethane	23.1	**25**	0.83 U	1.3 U	0.9 U	0.99 U	<u>110</u> U	0.85 U	0.422 UJ
Chloroethane	40.7	**120**	4.1 U	6.5 U	4.5 U	4.9 U	<u>530</u> U	4.2 U	0.422 UJ
Cis-1,2-Dichloroethene	78.1	45	28	19	15	**27,000**	**47,000**	**1,600**	1.51 J
Tetrachloroethene	49.9	1.1 U	0.83 U	1.3 U	0.9 U	0.99 U	<u>110</u> U	0.85 U	0.422 UJ
Trans-1,2-Dichloroethene	518	1.1 U	0.83 U	1.3 U	0.9 U	37	**550**	4.6	0.422 UJ
Trichloroethene	25.2	19	0.83 U	1.3 U	0.9 U	**9,000**	**6,000**	1.3	0.422 UJ
Vinyl Chloride	1.67	**8.7**	**2.4**	**5.7**	0.9 U	**76**	**3,100**	**26**	1.19 J

Table D-3. OU 1 2017 Target cVOCs in Direct Push Soil Samples (μg/kg)

	Location Name	CL-B19	CL-B20			CL-B21		CL-B22	CL-B23
	Sample Name	CL-B19-S-38.0-170719	CL-B20-S-25.0-170719	CL-B20-S-28.3-170719	CL-B20-S-31.5-170719	CL-B21-S-12.0-170720	CL-B21-S-21.5-170720	CL-B22-S-18.5-170720	CL-B23-S-13.5-170720
	Sample Type	N	N	N	N	N	N	N	N
Analyte	**PAL (μg/kg)**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
1,1,1-Trichloroethane	1,490	0.402 UJ	0.381 UJ	0.397 UJ	0.479 UJ	0.521 U	0.452 U	0.467 U	0.536 U
1,1-Dichloroethane	40.7	0.402 UJ	0.381 UJ	0.397 UJ	0.479 UJ	0.521 U	0.594 J	0.467 U	0.536 U
1,1-Dichloroethene	45.7	0.402 UJ	0.343 J	1.64 J	0.479 UJ	0.521 U	0.452 U	0.467 U	6.05
1,2-Dichloroethane	23.1	0.402 UJ	0.381 UJ	0.397 UJ	0.479 UJ	0.446 J	0.452 U	0.467 U	0.536 U
Chloroethane	40.7	0.402 UJ	0.381 UJ	0.397 UJ	0.479 UJ	9.32	0.452 U	0.467 U	0.536 U
Cis-1,2-Dichloroethene	78.1	16.9 J	**282** J	**1,040** J	**261** J	3.33	2.26	4.11	**1,590** E
Tetrachloroethene	49.9	0.402 UJ	0.381 UJ	0.397 UJ	0.479 UJ	0.521 U	0.452 U	2.75	0.536 U
Trans-1,2-Dichloroethene	518	2.38 J	3.3 J	16.9 J	3.08 J	0.521 U	0.452 U	3.33	2.16
Trichloroethene	25.2	0.947 J	0.229 J	0.474 J	0.267 J	0.521 U	0.441 J	**72.2**	0.536 U
Vinyl Chloride	1.67	1.49 J	**6.81** J	**57.1** J	**9.87** J	**1.7**	0.945	**1.91**	**54.9**

Table D-3. OU 1 2017 Target cVOCs in Direct Push Soil Samples (µg/kg)

	Location Name	CL-B23	CL-B24	CL-B25		CL-B26a			
	Sample Name	CL-B23-S-18.0-170720	CL-B24-S-15.5-170720	CL-B25-S-14.0-170720	CL-B25-S-29.0-170720	CL-26a-S-19.0-170721	CL-26a-S-26.0-170721	FD-170721-01	CL-26a-S-9.0-170721
	Sample Type	N	N	N	N	N	P	FD	N
Analyte	PAL (µg/kg)	Result	Result	Result	Result	Result	Result	Result	Result
1,1,1-Trichloroethane	1,490	0.38 UJ	0.431 U	0.448 U	0.447 U	0.44 U	0.489 U	0.485 U	0.755 U
1,1-Dichloroethane	40.7	0.38 UJ	0.431 U	0.448 U	0.447 U	0.44 U	0.489 U	0.485 U	0.755 U
1,1-Dichloroethene	45.7	0.598 J	0.431 U	0.448 U	1.6	0.796 J	0.372 J	0.418 J	0.755 U
1,2-Dichloroethane	23.1	0.38 UJ	0.431 U	0.26 J	0.403 J	0.309 J	0.705 J	0.485 U	0.603 J
Chloroethane	40.7	0.38 UJ	0.234 J	0.233 J	0.242 J	0.248 J	0.45 J	0.485 U	0.755 U
Cis-1,2-Dichloroethene	78.1	**244** J	13.4	1.03 J	**198** E	**421** E	**139** E	**151** E	1.4 J
Tetrachloroethene	49.9	0.38 UJ	0.431 U	0.448 U	0.447 U	0.44 U	0.489 U	0.485 U	0.755 U
Trans-1,2-Dichloroethene	518	0.258 J	0.753 J	3.09	21.2	6.36	31.8 J	30	0.755 U
Trichloroethene	25.2	0.38 UJ	0.431 U	0.448 U	0.447 U	2.8	13.8	20.5	0.755 U
Vinyl Chloride	1.67	**7.59** J	**4.46**	**11.9** J	**16**	**3.17**	**35.3**	**30.2**	0.755 U

Table D-3. OU 1 2017 Target cVOCs in Direct Push Soil Samples (μg/kg)

	Location Name	CL-B27	CL-B28	CL-B29a		CL-B30a		CL-B31	
	Sample Name	CL-B27-S-10.0-170721	CL-B28-S-9.0-170721	CL-B29a-S-2.0-170724	CL-B29a-S-21.0-170724	CL-B30a-S-10.5-170724	CL-B30a-S-21.0-170724	CL-B31-S-11.5-170724	CL-B31-S-19.0-170724
	Sample Type	N	N	N	N	N	N	N	N
Analyte	**PAL (μg/kg)**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
1,1,1-Trichloroethane	1,490	0.425 U	0.594 U	0.591 U	0.453 U	1 UJ	0.427 U	0.697 U	0.41 U
1,1-Dichloroethane	40.7	0.425 U	0.594 U	0.591 U	1.36	0.7 J	0.427 U	0.697 U	0.41 U
1,1-Dichloroethene	45.7	0.425 U	0.594 U	0.591 U	0.254 J	1 UJ	0.427 U	0.697 U	0.383 J
1,2-Dichloroethane	23.1	0.425 U	0.594 U	0.591 U	0.499 J	1 UJ	0.427 U	0.697 U	0.41 U
Chloroethane	40.7	0.307 J	0.43 J	0.591 U	0.453 U	1 UJ	0.427 U	0.697 U	0.41 U
Cis-1,2-Dichloroethene	78.1	0.502 J	0.967 J	0.681 J	2.73	1.72 J	0.292 J	0.967 J	**196** J
Tetrachloroethene	49.9	0.425 U	0.594 U	0.591 U	0.816 J	1 UJ	0.427 U	0.697 U	0.41 U
Trans-1,2-Dichloroethene	518	0.425 U	0.594 U	0.591 U	2.33	0.7 J	0.427 U	0.697 U	10.5
Trichloroethene	25.2	0.213 J	0.594 U	0.591 U	10.3	0.96 J	0.427 U	0.697 U	1.28
Vinyl Chloride	1.67	0.307 J	0.597 J	0.411 J	1.64	1 UJ	0.427 U	0.477 J	**8.75**

Table D-3. OU 1 2017 Target cVOCs in Direct Push Soil Samples (μg/kg)

	Location Name	CL-B32	CL-B33	CL-B34	CL-B35		CL-B36	CL-B37	CL-B38c
	Sample Name	CL-B32-S-15.0-170724	CL-B33-S-3.5-170724	CL-B34-S-18.0-170725	CL-B35-S-18.0-170725	CL-B35-S-20.5-170725	CL-B36-S-15.5-170725	CL-B37-S-15.0-170726	CL-B38C-S-4.0-170726
	Sample Type	N	N	N	N	N	N	N	N
Analyte	PAL (μg/kg)	Result	Result	Result	Result	Result	Result	Result	Result
1,1,1-Trichloroethane	1,490	0.514 U	0.412 U	0.502 U	0.563 U	0.481 U	0.435 U	0.95 U	68 UJ
1,1-Dichloroethane	40.7	0.514 U	0.412 U	0.502 U	0.563 U	0.481 U	0.435 U	0.48 U	68 UJ
1,1-Dichloroethene	45.7	3.4	0.412 U	1.96	3.1	0.481 U	0.313 J	6.3	68 UJ
1,2-Dichloroethane	23.1	0.514 U	0.412 U	0.502 U	0.563 U	0.481 U	0.435 U	0.48 U	120 UJ
Chloroethane	40.7	0.514 U	0.412 U	0.502 U	0.563 U	0.481 U	0.435 U	0.43 J	340 UJ
Cis-1,2-Dichloroethene	78.1	814 J	0.579 J	489 E	**721** E	**89.7**	**87.6**	**2,100** J	68 UJ
Tetrachloroethene	49.9	0.514 U	0.412 U	0.502 U	0.563 U	0.481 U	0.435 U	0.95 U	120 UJ
Trans-1,2-Dichloroethene	518	27.4	0.412 U	49.1	1.23	0.481 U	1.05	99	210 UJ
Trichloroethene	25.2	0.514 U	0.412 U	1.64	0.563 U	0.481 U	0.435 U	**11,000** J	**93** J
Vinyl Chloride	1.67	**143** J	0.223 J	**12.8**	**22**	**74.7**	**3.39**	**23**	680 UJ

Table D-3. OU 1 2017 Target cVOCs in Direct Push Soil Samples (µg/kg)

	Location Name	CL-B39	SP-B01			SP-B01B	SP-B40	
	Sample Name	CL-B39-S-7.0-170726	SP-B01-S-13.5-170711	SP-B01-S-17.5-170711	SP-B01-S-28.0-170711	SP-B01b-S-8.0-170807	SP-B40-S-13.0-170726	SP-B40-S-20.0-170726
	Sample Type	N	N	N	N	N	N	N
Analyte	PAL (µg/kg)	Result	Result	Result	Result	Result	Result	Result
1,1,1-Trichloroethane	1,490	0.95 U	140 J	26 U	0.87 UJ	5,400 U	26 UJ	0.91 U
1,1-Dichloroethane	40.7	0.48 U	20 U	26 U	0.43 U	5,400 U	26 UJ	0.49 J
1,1-Dichloroethene	45.7	0.95 U	**2,300**	160	0.87 U	**25,600**	26 UJ	0.91 U
1,2-Dichloroethane	23.1	0.48 U	34 U	46 U	0.43 UJ	5,400 U	46 UJ	0.46 U
Chloroethane	40.7	1.7 J	98 U	130 U	0.43 UJ	5,400 U	**180** J	2.7
Cis-1,2-Dichloroethene	78.1	1.2 J	**1,100,000**	**160,000**	63 Q	**5,660,000** E	**2,000** J	5.7
Tetrachloroethene	49.9	0.95 U	**17,000**	**2,200**	0.82 J	**69,100**	46 UJ	0.91 U
Trans-1,2-Dichloroethene	518	0.95 U	**19,000**	**1,800**	0.99 J	**55,900**	79 UJ	0.91 U
Trichloroethene	25.2	0.95 U	**83,000,000** B	**1,600,000** J	**7,500** B	**59,000,000** E	46 UJ	0.63 J
Vinyl Chloride	1.67	**1.7** J	200 U	260 U	0.58 J	**360,000**	260 UJ	**3.4**

Table D-3. OU 1 2017 Target cVOCs in Direct Push Soil Samples (μg/kg)

	Location Name	SP-B40	SP-B41	SP-B42			SP-B43		SP-B44
	Sample Name	SP-B40-S-7.0-170726	SP-B41-S-8.0-170726	SP-B42-S-16.0-170727	SP-B42-S-20.0-170727	SP-B42-S-7.5-170727	SP-B43-S-10.0-170727	SP-B43-S-12.0-170727	SP-B44-S-10.5-170727
	Sample Type	N	N	N	N	N	N	N	N
Analyte	PAL (μg/kg)	Result	Result	Result	Result	Result	Result	Result	Result
1,1,1-Trichloroethane	1,490	140 J	0.86 U	0.98 U	0.92 U	1.1 U	0.9 U	1.4 U	0.91 U
1,1-Dichloroethane	40.7	26 UJ	3.5	0.81 J	0.46 U	0.67 J	1.1	0.65 J	0.35 J
1,1-Dichloroethene	45.7	7.9 J	0.86 U	2.1 J	0.92 U	2.8 J	4.3 J	1.5 J	1.1 J
1,2-Dichloroethane	23.1	0.54 U	0.43 U	0.49 U	0.46 U	0.54 U	0.45 U	0.72 U	0.45 U
Chloroethane	40.7	**340** J	12	4	0.64 J	3.4	0.74 J	3.8	1.6 J
Cis-1,2-Dichloroethene	78.1	26 J	3.5	**6,800** H	2.4 J	**8,300** J	**9,800** J	**2,900** J	**2,300** J
Tetrachloroethene	49.9	44 J	0.86 U	0.98 U	0.92 U	1.6 J	0.9 U	1.4 U	0.91 U
Trans-1,2-Dichloroethene	518	1.1 U	0.66 J	9.4	0.92 U	30	29	6.5	6.3
Trichloroethene	25.2	**110** J	0.75 J	**6,300** J	2.4 J	**14,000** J	**5,300** J	**2,800** J	**1,800** J
Vinyl Chloride	1.67	**3.3** J	**2.7**	**31**	0.99 J	**56**	**1,600** J	**48**	**84**

Table D-3. OU 1 2017 Target cVOCs in Direct Push Soil Samples (µg/kg)

	Location Name	SP-B45		SP-B46	SP-B47	SP-B48b		SP-B50	
	Sample Name	SP-B45-S-13.5-170727	SP-B45-S-18.0-170727	SP-B46-S-13.0-170728	SP-B47-S-14.0-170728	SP-B48b-S-11.0-170728	SP-B48b-S-6.0-170728	SP-B50-S-12.0-170731	SP-B50-S-16.5-170731
	Sample Type	N	N	N	N	N	N	N	N
Analyte	PAL (µg/kg)	Result	Result	Result	Result	Result	Result	Result	Result
1,1,1-Trichloroethane	1,490	0.99 U	1.1 U	0.88 U	0.82 U	1 U	0.93 U	0.92 U	0.88 U
1,1-Dichloroethane	40.7	0.5 J	0.61 J	2.6	2.6	0.77 J M	3.5	0.21 J M	0.44 U
1,1-Dichloroethene	45.7	0.55 J	1.1 U	0.88 U	0.82 U	1.7 J	5	2.7 J	0.88 U
1,2-Dichloroethane	23.1	0.49 U	0.57 U	0.44 U	0.41 U	0.52 U	0.25 J	0.46 U	0.13 J
Chloroethane	40.7	3.3	3.8	120 U	37 J	0.52 U Q	0.46 U Q	0.46 UJ	0.44 UJ
Cis-1,2-Dichloroethene	78.1	**2,400** J	**2,600** J	65	33	**11,000** J	**18,000** J	**1,400** J	**1,500** J
Tetrachloroethene	49.9	0.99 U	1.1 U	0.88 U	0.82 U	1 U	0.93 U	0.92 U	0.88 U
Trans-1,2-Dichloroethene	518	7.1	6	4.1	4.1	20	74	6.9	1.8
Trichloroethene	25.2	6.7	9.1	0.88 U	0.82 U	15	0.93 U M	**100**	**46**
Vinyl Chloride	1.67	**45**	**24**	**860**	**100**	**4,400** J	**9,100** J	**130**	**15**

Table D-3. OU 1 2017 Target cVOCs in Direct Push Soil Samples (µg/kg)

	Location Name	SP-B51		SP-B52	SP-B53				SP-B54
	Sample Name	SP-B51-S-13.0-170731	SP-B51-S-17.0-170731	SP-B52-S-12.0-170731	SP-B53-S-10.0-170731	SP-B53-S-24.0-170731	SP-B53-S-32.0-170731	SP-B53-S-33.5-170731	SP-B54-S-17.0-170801
	Sample Type	N	N	N	N	N	N	N	N
Analyte	**PAL (µg/kg)**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
1,1,1-Trichloroethane	1,490	0.94 U	0.97 U	0.96 U	0.91 U	0.94 U M	0.73 U	0.99 U	0.98 UJ
1,1-Dichloroethane	40.7	0.47 U	0.49 U	0.48 U	0.46 U	0.47 U	0.36 U	0.5 U	0.49 UJ
1,1-Dichloroethene	45.7	0.94 U	0.97 U	0.93 J	0.91 U	1.4 J	0.73 U	0.82 J M	0.98 UJ
1,2-Dichloroethane	23.1	0.47 U	0.49 U	0.14 J	0.46 U	0.47 U	0.36 U	0.5 U M	0.49 UJ
Chloroethane	40.7	0.47 UJ	0.49 UJ	0.48 UJ	0.46 UJ	0.47 UJ	0.36 UJ	0.5 UJ	0.49 UJ
Cis-1,2-Dichloroethene	78.1	42	2.8	**480** J	55 J	140 J	61 J	**140** J	9 U
Tetrachloroethene	49.9	0.94 U	0.97 U	0.96 U	0.91 U	11	0.73 U	0.99 U M	0.98 UJ
Trans-1,2-Dichloroethene	518	0.94 U	0.97 U	8.1	0.91 U	18	0.73 U M	1.6 J	0.71 J
Trichloroethene	25.2	20	1.2 J	**1,300** J	**200** J	**1,400** J	**450** J	**1,200** J	2.4 J
Vinyl Chloride	1.67	**2.7**	**4.3**	**15**	0.63 J M	**3.3** M	0.89 J	**2.7**	0.88 J

Table D-3. OU 1 2017 Target cVOCs in Direct Push Soil Samples (μg/kg)

	Location Name	**SP-B54**		**SP-B55**			**SP-B56**		**SP-B57**
	Sample Name	**SP-B54-S-35.0-170801**	**SP-B54-S-7.0-170801**	**FD-170801-01**	**SP-B55-S-9.0-170801**	**SP-B55-S-33.0-170801**	**SP-B56-S-10.0-170801**	**SP-B56-S-27.0-170801**	**SP-B57-S-10.0-170802**
	Sample Type	**N**	**N**	**FD**	**P**	**N**	**N**	**N**	**N**
Analyte	**PAL (μg/kg)**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
1,1,1-Trichloroethane	1,490	15 U	2,400 U	140 U	130 U	0.95 U Q	140 U	140 U	0.94 U H
1,1-Dichloroethane	40.7	15 U	2,400 U	140 UJ	130 UJ	0.48 U Q	140 UJ	140 UJ	0.26 J H
1,1-Dichloroethene	45.7	15 U	**9,800** M	19	5.3	0.95 U	1.8 J	9	0.94 UJ
1,2-Dichloroethane	23.1	26 U	4,200 U	240 U	220 U	0.48 U Q	240 U	250 U	0.16 J
Chloroethane	40.7	74 UJ	12,000 UJ	0.52 UJ	0.48 UJ	0.48 UJ	0.54 UJ	0.52 UJ	0.47 U H
Cis-1,2-Dichloroethene	78.1	58 J	**3,600,000** H	**10,000**	**11,000**	75 B	**3,500**	**5,000**	1.9 U
Tetrachloroethene	49.9	26 U	**4,200** U	1 UJ	0.95 UJ	0.95 U Q	5.2 J	1 UJ	0.94 U H
Trans-1,2-Dichloroethene	518	44 U	**59,000**	31	16	1.2 J	100 J	60	0.5 J H
Trichloroethene	25.2	26 U	**7,200**	**2,400**	**1,600**	18 Q	240 U	**2,800**	0.32 J H
Vinyl Chloride	1.67	150 U	**610,000**	**150**	**58**	**13**	**6,600**	**130**	**18** H

Table D-3. OU 1 2017 Target cVOCs in Direct Push Soil Samples (µg/kg)

	Location Name	SP-B57	SP-B58			SP-B59		
	Sample Name	SP-B57-S-29.0-170802	SP-B58-S-21.0-170802	SP-B58-S-37.0-170802	SP-B58-S-39.5-170802	SP-B59-S-21.0-170802	SP-B59-S-29.8-170802	SP-B59-S-5.0-170802
	Sample Type	N	N	N	N	N	N	N
Analyte	**PAL (µg/kg)**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
1,1,1-Trichloroethane	1,490	0.86 U H	1 U	0.78 U	1.9 U	0.86 U	0.9 U	1 UJ
1,1-Dichloroethane	40.7	0.43 U H	0.51 U	0.39 U	0.97 U	0.43 U	0.45 U	0.5 UJ
1,1-Dichloroethene	45.7	0.72 J	1 UJ	0.91 J	1.9 U	0.86 U	0.9 U	1 UJ
1,2-Dichloroethane	23.1	0.43 UJ	0.51 UJ	0.39 UJ	0.97 UJ	0.43 UJ	0.45 UJ	0.5 UJ
Chloroethane	40.7	0.43 U H	0.51 U	0.39 U	0.97 U	0.43 U	0.45 U	0.5 UJ
Cis-1,2-Dichloroethene	78.1	49 H	7.4	**950** J	5.1	0.6 U	1.1 U	2.6 J
Tetrachloroethene	49.9	0.86 U H	1 U	1.3 J	1.9 U	0.86 U	0.9 U	31 J
Trans-1,2-Dichloroethene	518	2.1 H	1 U	3.6	1.9 U	0.86 U	0.9 U	8 J
Trichloroethene	25.2	0.44 J H	4.3	**2,100** J	2.5 J	1.6 J	6.9	2.1 J
Vinyl Chloride	1.67	**4.8** H	1.4 J M	**10** J	1 J	0.37 J	0.9 UJ	**1.7** J

Table D-3. OU 1 2017 Target cVOCs in Direct Push Soil Samples (μg/kg)

	Location Name	SP-B60			SP-B61		SP-B62		
	Sample Name	SP-B60-S-17.0-170802	SP-B60-S-23.5-170802	SP-B60-S-7.5-170802	SP-B61-S-18.0-170803	SP-B61-S-23.5-170803	SP-B62-S-16.0-170803	SP-B62-S-24.0-170803	SP-B62-S-26.0-170804
	Sample Type	N	N	N	N	N	N	N	N
Analyte	PAL (μg/kg)	Result	Result	Result	Result	Result	Result	Result	Result
1,1,1-Trichloroethane	1,490	0.92 U	0.8 U	1.4 U	21 U R	18 U R	20 U R	17 U R	0.415 U
1,1-Dichloroethane	40.7	0.46 U	0.4 U	0.72 U	21 U R	18 U R	20 U R	17 U R	0.415 U
1,1-Dichloroethene	45.7	0.92 U	0.8 U	1.4 U	21 U R	18 U R	20 U R	17 U R	0.415 U
1,2-Dichloroethane	23.1	0.46 U Q	0.4 U Q	0.72 UJ	**38** U R	**31** U R	35 U R	**29** U R	0.415 U
Chloroethane	40.7	0.46 U	0.4 U	0.72 U	**110** U R	**89** U R	**100** U R	**84** U R	0.415 U
Cis-1,2-Dichloroethene	78.1	1.5 J	1.1 J	1.6 U	**160** J	18 U R	**260** J	17 U R	1.08
Tetrachloroethene	49.9	0.92 U	0.8 U	1.4 U	38 U R	31 U R	35 U R	29 U R	0.415 U
Trans-1,2-Dichloroethene	518	0.92 U	0.8 U	1.4 U M	36 J	53 U R	96 J	50 U R	0.415 U
Trichloroethene	25.2	1.6 J	6.5	1.4 J	**35** J	**180** J	**780** J	**230** J	2.16
Vinyl Chloride	1.67	0.92 U Q	0.37 J M Q	0.79 J	**210** U R	**180** U R	**200** U R	**170** U R	0.415 U

Table D-3. OU 1 2017 Target cVOCs in Direct Push Soil Samples (µg/kg)

Location Name		SP-B62	SP-B63		SP-B64	SP-B65C	SP-B66	
Sample Name		SP-B62-S-7.0-170803	SP-B63-S-18.5-170804	SP-B63-S-24.0-170804	SP-B64-S-12.0-170804	SP-B65c-S-8.0-170806	SP-B66-S-10.5-170806	SP-B66-S-9.0-170806
Sample Type		N	N	N	N	N	N	N
Analyte	PAL (µg/kg)	Result	Result	Result	Result	Result	Result	Result
1,1,1-Trichloroethane	1,490	3.3 U	0.468 U	0.444 U	0.538 U	0.544 U	0.457 U	0.473 U
1,1-Dichloroethane	40.7	0.87 J	0.468 U	0.444 U	0.538 U	0.544 U	0.457 U	0.473 U
1,1-Dichloroethene	45.7	3.3 U	0.468 U	0.573 J	0.538 U	0.294 J	0.457 U	0.473 U
1,2-Dichloroethane	23.1	0.99 J	0.468 U	0.444 U	0.538 U	0.544 U	0.457 U	0.473 U
Chloroethane	40.7	1.6 U	0.468 U	0.444 U	0.538 U	0.544 U	0.229 J	0.473 U
Cis-1,2-Dichloroethene	78.1	68	9.63	**321** E	**199** E	**319** E	**180** E	**84**
Tetrachloroethene	49.9	3.3 U	0.468 U	0.37 J	0.538 U	0.544 U	0.457 U	0.473 U
Trans-1,2-Dichloroethene	518	7.4	0.468 U	2.4	1.7	3.72	1.58	0.95
Trichloroethene	25.2	2.4 J	12.2	**1,700** E	**513** E	**540** E	20.2	21.4
Vinyl Chloride	1.67	**8.3** J	0.586 J	**2.08**	**1.91**	**3.86**	**13.9**	**6.31**

Table D-3. OU 1 2017 Target cVOCs in Direct Push Soil Samples (μg/kg)

	Location Name	**SP-B67**		**SP-B68**			**SP-B69**		
	Sample Name	**SP-B67-S-12.5-170806**	**SP-B67-S-24.0-170806**	**SP-B68-S-0.5-170806**	**SP-B68-S-12.5-170806**	**SP-B68-S-9.5-170806**	**FD-0-170806-02**	**SP-B69-S-11.5-170806**	**SP-B69-S-15.0-170806**
	Sample Type	**N**	**N**	**N**	**N**	**N**	**FD**	**P**	**N**
Analyte	**PAL (μg/kg)**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
1,1,1-Trichloroethane	1,490	0.473 U	0.523 U	0.777 U	0.468 U	0.504 U	0.478 U	0.526 U	0.549 U
1,1-Dichloroethane	40.7	0.473 U	0.523 U	0.777 U	0.468 U	32.4	0.478 U	0.526 U	0.549 U
1,1-Dichloroethene	45.7	0.473 U	0.523 U	0.777 U	0.468 U	0.504 U	0.487 J	0.326 J	0.549 U
1,2-Dichloroethane	23.1	0.473 U	0.523 U	0.777 U	0.468 U	0.302 J	0.478 U	0.526 U	0.549 U
Chloroethane	40.7	0.958	0.523 U	0.777 U	0.468 U	**90.8**	10	8.38	2.29
Cis-1,2-Dichloroethene	78.1	32.5	3.36	7.19	**111** E	5.45	**395** E	**396** E	**168** E
Tetrachloroethene	49.9	0.473 U	0.523 U	0.777 U	0.468 U	0.504 U	0.478 U	0.526 U	0.549 U
Trans-1,2-Dichloroethene	518	1.13	0.523 U	0.777 U	2.21	3.47	5.67	5.57	2.93
Trichloroethene	25.2	18.5	9.78	21	10.9	11.9	**129** E	11.5	16.3
Vinyl Chloride	1.67	**23.2**	**3.17**	**4.68**	**39.5**	**3.46**	**69.3**	**66.9**	**18.2**

Samples analyzed using EPA Method 8260C

FD - Field Duplicate

PAL - Project Action Limit

μg/kg – micrograms per kilogram

J - The reported value is an estimated concentration.

B - The analyte was found in an associated blank, as well as in the sample.

M - A matrix effect was present.

H - Sample was prepped or analyzed beyond the specified holding time.

Q - One or more quality control criteria failed.

E - The reported value exceeded the instrument calibration range, so the concentration is estimated.

P – Parent sample of field duplicate.

N – Sample is not part of a duplicate pair.

U - The analyte was not detected at or above the stated limit. (sometimes validators will elevate the limit due to the "B" qualifier using the 5x/10x rule, so this definition is different than the lab description).

UJ - The analyte was not detected at the stated sample quantitation limit, which is an estimated value.

J H - The reported value is an estimated concentration. / Sample was prepped or analyzed beyond the specified holding time.

U R - The reported value is unusable, rejected. Analyte may or may not be present.

U H - The analyte was not detected at or above the stated limit. (sometimes validators will elevate the limit due to the "B" qualifier using the 5x/10x rule, so this definition is different than the lab description). / Sample was prepped or analyzed beyond the specified holding time.

U M - The analyte was not detected at or above the stated limit. (sometimes validators will elevate the limit due to the "B" qualifier using the 5x/10x rule, so this definition is different than the lab description). / A matrix effect was present.

Underlined values represent analytes not detected at or above the stated limit, which exceeds the PAL.

Bolded values indicate that the reported concentration exceeds the PAL.

Table D-4. OU 1 2017 SVOCs in Soil (µg/kg)

Analyte Name	Screening Level (µg/kg)	Screening Level Source	CL-B18a		CL-B21		SP-B01B		SP-B62	
			CL-B18a-S-18.0-170718		CL-B21-S-12.0-170720		SP-B01b-S-8.0-170807		SP-B62-S-7.0-170803	
			N		N		N		N	
			Result		Result		Result		Result	
1,2,4-Trichlorobenzene	29.4	A	19	U	19	U	190	U J	2,300	U J
1,2-Dichlorobenzene	399.4	A	38	U	38	U	370	U J	4,600	U J
1,3-Dichlorobenzene	NA	NE	19	U	19	U	190	U J	2,300	U J
1,4-Dichlorobenzene	67.7	A	19	U	19	U	190	U J	2,300	U J
1-Methylnaphthalene	34,483	B	2,000		20	J	190	U J	8,600	
2,2'-Oxybis(1-Chloropropane)	14,286	B	150	U	150	U	1,500	U J	18,000	U J
2,4,5-Trichlorophenol	1,507	A	150	U	150	U	1,500	U J	18,000	U J
2,4,6-Trichlorophenol	2.66	A	150	U	150	U	1,500	U J	18,000	U J
2,4-Dichlorophenol	10.4	A	38	U	38	U	370	U J	4,600	U J
2,4-Dimethylphenol	79.3	A	38	U	38	U	370	U J	4,600	U J
2,4-Dinitrophenol	9.17	A	510	U	500	U	5,000	U J	61,000	U J
2,4-Dinitrotoluene	0.11	A	150	U	150	U	1,500	U J	18,000	U
2,6-Dinitrotoluene	0.021	A	150	U	150	U	1,500	U J	18,000	U
2-Chloronaphthalene	6,400,000	C	19	U	19	U	190	U J	2,300	U
2-Chlorophenol	27	A	150	U	150	U	1,500	U J	18,000	U J
2-Methylnaphthalene	320,000	C	2,900		15	J	370	U J	10,000	
2-Methylphenol	151.1	A	150	U	150	U	1,500	U J	18,000	U J
2-Nitroaniline	800,000	C	64	U	63	U	620	U J	7,700	U
2-Nitrophenol	NA	NE	150	U	150	U	1,500	U J	18,000	U J
3,3-Dichlorobenzidine	0.197	A	310	U Q	300	U Q	3,000	U J	37,000	U
3- And 4-Methylphenol	4,000,000	C	24	J	38	U	370	U J	4,600	U J
3-Nitroaniline	NA	NE	150	U	150	U	1,500	U J	18,000	U
4,6-Dinitro-2-Methylphenol	NA	NE	310	U Q	300	U Q	3,000	U J	37,000	U J
4-Bromophenyl-Phenylether	NA	NE	150	U	150	U	1,500	U J	18,000	U
4-Chloro-3-Methylphenol	NA	NE	150	U	150	U	1,500	U J	18,000	U J
4-Chloroaniline	0.0772	A	1,300	U	1,300	U	12,000	U J	150,000	U J
4-Chlorophenyl-Phenylether	NA	NE	150	U	150	U	1,500	U J	18,000	U
4-Nitroaniline	NA	NE	64	U	63	U	620	U J	7,700	U
4-Nitrophenol	NA	NE	1,000	U	1,000	U	10,000	U J	120,000	U J
Acenaphthene	4,977	A	4,700		17	J	190	U J	**8,900**	
Acenaphthylene	NA	NE	110		19	U	190	U J	2,300	U
Anthracene	114,142	A	3,600		19	U	190	U J	8,400	

Table D-4. OU 1 2017 SVOCs in Soil (µg/kg)

Analyte Name	Screening Level (µg/kg)	Screening Level Source	CL-B18a		CL-B21		SP-B01B		SP-B62	
			CL-B18a-S-18.0-170718		CL-B21-S-12.0-170720		SP-B01b-S-8.0-170807		SP-B62-S-7.0-170803	
			N		N		N		N	
			Result		Result		Result		Result	
Benzo[A]Anthracene	42.89	A	**7,500**		19	U	**75**	J	**8,500**	
Benzo[A]Pyrene	116.3	A	**3,400**		38	U	370	U J	**5,100**	J
Benzo[B]Fluoranthene	147.5	A	**6,400**		19	U	190	U J	**4,600**	
Benzo[G,H,I]Perylene	NA	NE	590		38	U	370	U J	4,600	UJ
Benzo[K]Fluoranthene	1,475	A	**2,400**	M	38	U	370	U J	4,600	U M
Benzoic Acid	18,385	A	2,600	U M	2,500	U	25,000	U J	310,000	U J
Benzyl Alcohol	8,000,000	C	150	U	150	U	1,500	U J	18,000	U J
Bis(2-Chloroethoxy)Methane	NA	NE	150	U	150	U	1,500	U J	18,000	U J
Bis(2-Chloroethyl)Ether	0.0144	A	150	U	150	U	1,500	U J	18,000	U J
Bis(2-Ethylhexyl)Phthalate	668.5	A	510	U	500	U	5,000	U J	61,000	U
Butylbenzylphthalate	646	A	150	U Q	150	U Q	1,500	U J	18,000	UJ
Carbazole	NA	NE	1,300		150	U	1,500	U J	18,000	U J
Chrysene	4,774	A	**7,200**		38	U	370	U J	**12,000**	
Di-N-Butylphthalate	2,966	A	150	U	150	U	1,500	U J	18,000	U
Di-N-Octylphthalate	13,312,046	A	770	U	760	U	7,500	U J	92,000	U
Dibenz[A,H]Anthracene	21.4	A	**220**		38	U	370	U J	4,600	UJ
Dibenzofuran	80,000	C	3,600		150	U	1,500	U J	18,000	U
Diethylphthalate	4,719	A	510	U	500	U	5,000	U J	61,000	U
Dimethyl Phthalate	NA	NE	150	U	150	U	1,500	U J	18,000	U
Fluoranthene	31,605	A	**42,000**		19	U	130	J	14,000	
Fluorene	5,116	A	**5,500**		12	J	190	U J	**12,000**	
Hexachlorobenzene	43.9	A	19	U	19	U	190	U J	2,300	U
Hexachlorobutadiene	30.3	A	38	U	38	U	370	U J	4,600	U J
Hexachlorocyclopentadiene	9,613.76	A	64	U	63	U	620	U J	7,700	U J
Hexachloroethane	2.26	A	150	U	150	U	1,500	U J	18,000	U J
Indeno[1,2,3-Cd]Pyrene	416	A	**960**		19	U	190	U J	2,300	U J
Isophorone	15.4	A	150	U	150	U	1,500	U J	18,000	U J
N-Nitrosodimethylamine	19.6	B	1,300	U	1,300	U	12,000	U J	150,000	U J
N-Nitrosodinpropylamine	3.88E-03	A	150	U	150	U	1,500	U J	18,000	U J
N-Nitrosodiphenylamine	28.2	A	38	U	38	U	370	U J	4,600	U
Naphthalene	236.4	A	**1,700**		19	U	190	U J	**21,000**	J
Nitrobenzene	6.49	A	150	U	150	U	1,500	U J	18,000	U J
Pentachlorophenol	0.879	A	310	U	300	U	3,000	U J	37,000	U J
Phenanthrene	NA	NE	34,000		38	U	370	U J	46,000	J
Phenol	757.12	A	71	J	150	U	520	J	18,000	U J
Pyrene	32,774	A	28,000		38	U	370	U J	19,000	J

Notes:

Samples analyzed using EPA Method 8270D.

Screening levels based on the lowest MTCA Method B value shown in Ecology's July 2015 CLARC table. Values used as presented by Ecology without recalculation.

A - Screening level source is "Protective of Groundwater Saturated".

B - Screening level source is "Method B Cancer".

C - Screening level source is "Method B Non Cancer".

N – Sample is not part of a duplicate pair.

Underlined values represent analytes not detected at or above the stated limit, which exceeds the PAL.

Bolded values indicate that the reported concentration exceeds the PAL.

NE - Not established.

U - The analyte was not detected at or above the stated limit. (Sometimes validators will elevate the limit due to the "B" qualifier using the 5x/10x rule so this definition is different than the lab description).

J - The reported value is an estimated concentration.

U J - The analyte was not detected at the stated sample quantitation limit, which is an estimated value.

Q - One or more quality control criteria failed.

M - A matrix effect was present.

U M - The analyte was not detected at or above the stated limit. (sometimes validators will elevate the limit due to the "B" qualifier using the 5x/10x rule so this definition is different than the lab description). / A matrix effect was present.

µg/kg – micrograms per kilogram

Table D-5. OU 1 2017 TPH Results in Soil Samples (mg/kg)

		Location Name	CL-B18a	CL-B21	SP-B01	SP-B62
		Sample Name	CL-B18a-S-18.0-170718	CL-B21-S-12.0-170720	SP-B01-S-17.5-170711	SP-B62-S-7.0-170803
		Sample Type	N	N	N	N
Method	**Analyte**	**Screening Level [a]**	**Result**	**Result**	**Result**	**Result**
NWTPH-HCID	TPH-Diesel range C12-C24	NE	300 J	140	4,200 J	80,000 J
NWTPH-HCID	TPH-Motor Oil C24-C36	NE	140 J	310	6,600 J	330,000 J
NWTPH-HCID	TPH-Total Unknown Gasoline Range Organics	NE	28 UJ	27 U	13,000 J	390,000 J
NWTPH-Dx	TPH-Diesel range	2000	950 J	260	**6,900** J	**69,000** J
NWTPH-Dx	TPH-Motor Oil C24-C36	2000	660 J	800	**12,000** J	**240,000** J
NWTPH-Gx	TPH-Total Gasoline Range Organics	100	NA	NA	**6,500** J	**13,000**

Notes:

Samples analyzed using EPA Method NWTPH-HCID, NWTPH-Dx, NWTPH-Gx

EPA Method NWTPH-HCID is a screening method for TPH

N – Sample is not part of a duplicate pair.

U - The analyte was analyzed but not detected at or above the stated limit. (sometimes validators will elevate the limit due to the "B" qualifier using the 5x/10x rule so this definition is different than the lab description).

J - The reported value is an estimated concentration.

UJ - The analyte was analyzed but not detected. the sample quantitation limit is an estimated value.

NA - not analyzed

NE - not established

[a] MTCA Method A Soil Cleanup Levels used as screening levels for reference

Bolded values indicate that the reported concentration exceeds the PAL.

mg/kg - milligrams per kilogram

Table D-6. OU 1 2017 VOCs in Soil Samples (µg/kg)

		Location Name:	CL-B02			CL-B03			CL-B04			SP-B01			SP-B62
		Sample Name	CL-B02-S-14.0-170711	CL-B02-S-20.0-170711	CL-B02-S-29.0-170711	CL-B03-S-18.0-170712	CL-B03-S-19.4-170712	CL-B03-S-37.0-170712	CL-B04-S-11.5-170712	CL-B04-S-19.5-170712	CL-B04-S-29.0-170712	SP-B01-S-13.5-170711	SP-B01-S-17.5-170711	SP-B01-S-28.0-170711	SP-B62-S-7.0-170803
		Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N
Analyte	**PAL or Screening level**	**Source**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
1,1,1,2-Tetrachloroethane	38,500	B	0.44 U	0.44 U	0.48 U	0.46 U	0.44 U	0.54 U	0.45 U	0.44 U	0.59 U	210	78 U	0.43 U	1.6 U Q
1,1,1-Trichloroethane	1,490	SAP	0.88 UJ	0.88 UJ	0.97 UJ	0.92 UJ	0.89 UJ	1.1 UJ	0.9 UJ	0.88 UJ	1.2 UJ	140 J	26 U	0.87 UJ	3.3 U
1,1,2,2-Tetrachloroethane	0.08	A	1.8 U	1.8 U	1.9 U	1.8 U	1.8 U	2.2 U	1.8 U	1.8 U	2.4 U	9.8 U	13 U	1.7 U	6.6 U
1,1,2-Trichloroethane	1.81	A	0.44 U	0.44 U	0.48 U	0.46 U	0.44 U	0.54 U	0.45 U	0.44 U	0.59 U	20 U M	26 U	0.43 U	1.6 U
1,1-Dichloroethane	40.7	SAP	0.44 U	0.44 U	0.48 U	0.46 U	0.44 U	0.54 U	0.45 U M	0.44 U	0.59 U	20 U	26 U	0.43 U	0.87 J
1,1-Dichloroethene	45.7	SAP	5.2	1 J	0.97 U M	0.92 U M	4.8	1.1 U	0.9 U	2.9 J	13	**2,300**	**160**	0.87 U	3.3 U
1,1-Dichloropropene	NE	NA	0.88 UJ	0.88 UJ	0.97 UJ	0.92 UJ	0.89 UJ	1.1 UJ	0.9 UJ	0.88 UJ	1.2 UJ	34 U	46 U	0.87 UJ	3.3 U
1,2,3-Trichlorobenzene	21	D	1.8 U	1.8 U	1.9 U	1.8 U	1.8 U	2.2 U	1.8 U	1.8 U	2.4 U	59 U	78 U	1.7 U	6.6 U M Q
1,2,3-Trichloropropane	33	B	0.88 U	0.88 U	0.97 U	0.92 U	0.89 U	1.1 U	0.9 U	0.88 U	1.2 U	59 U	78 U	0.87 U	**40**
1,2,4-Trichlorobenzene	29.4	A	0.88 U	0.88 U	0.97 U	0.92 U	0.89 U	1.1 U	0.9 U	0.88 U	1.2 U	98 U	130 U	0.87 U	3.3 U M Q
1,2,4-Trimethylbenzene	NE	NA	5.9	2.7	1.6 J	1.3 J	0.89 J	1.1 J	0.59 J	0.72 J	0.71 J	140,000	97,000	28	370,000 J
1,2-Dibromo-3-Chloropropane	1,250	B	3.5 U M	3.5 U	3.9 U	3.7 U M	3.5 U	4.3 U	3.6 U	3.5 U	4.7 U	**3,500**	520 U M	3.5 U	13 U Q
1,2-Dibromoethane	NE	NA	0.44 U	0.44 U	0.48 U	0.46 U	0.44 U	0.54 U	0.45 U	0.44 U	0.59 U	20 U Q	26 U Q	0.43 U	1.6 U
1,2-Dichlorobenzene	399	A	0.88 U M	0.88 U M	0.97 U M	0.92 U M	0.89 U	1.1 U M	0.9 U	0.88 U	1.2 U	20 U	26 U	0.87 U M	3.3 U
1,2-Dichloroethane	23.1	SAP	0.44 UJ	0.44 UJ	0.48 UJ	0.46 UJ	0.44 UJ	0.54 UJ	0.45 UJ	0.44 UJ	0.59 UJ	34 U	46 U	0.43 UJ	0.99 J
1,2-Dichloropropane	1.67	A	0.88 UJ	0.88 UJ	0.97 UJ	0.92 UJ	0.89 UJ	1.1 UJ	0.9 UJ	0.88 UJ	1.2 UJ	19 U Q M	25 U Q	0.87 UJ	3.3 UJ
1,3,5-Trimethylbenzene	800,000	C	1.2 J	0.53 J	0.29 J	0.25 J	0.16 J	0.21 J	0.45 U	0.44 U	0.59 U	45,000	27,000	6.9	140,000 J
1,3-Dichlorobenzene	NE	NA	0.88 U	0.88 U M	0.97 U M	0.92 U M	0.89 U M	1.1 U	0.9 U M	0.88 U	1.2 U M	34 U	46 U	0.87 U M	3.3 U M
1,3-Dichloropropane	NE	NA	0.44 U	0.44 U	0.48 U	0.46 U	0.44 U	0.54 U	0.45 U	0.44 U	0.59 U	34 U Q M	46 U Q	0.43 U	1.6 U
1,4-Dichlorobenzene	67.7	A	0.44 U M	0.44 U M	0.48 U M	0.46 U M	0.44 U M	0.54 U M	0.45 U M	0.44 U	0.59 U M	59 U Q M	78 U Q	0.43 U M	1.6 U
2,2-Dichloropropane	NE	NA	1.8 U	1.8 U	1.9 U	1.8 U	1.8 U	2.2 U	1.8 U	1.8 U	2.4 U	59 U	78 U	1.7 U	6.6 U
2-Chlorotoluene	NE	NA	0.44 U	0.44 U	0.48 U	0.46 U	0.44 U	0.54 U	0.45 U	0.44 U	0.59 U	34 U Q	46 U Q	0.43 U M	1.6 U
4-Chlorotoluene	NE	NA	0.44 U M	0.44 U M	0.48 U	0.46 U	0.44 U	0.54 U	0.45 U	0.44 U	0.59 U	740	78 U Q M	0.43 U M	3,000 J
4-Isopropyltoluene	NE	NA	0.61 J	0.88 U	0.97 U	0.92 U	0.89 U	1.1 U M	0.9 U	0.88 U M	1.2 U	20,000	12,000	3.1	62,000 H
Benzene	1.74	A	0.88 U Q	0.88 U Q	0.97 U Q	0.92 U Q	0.89 U Q	1.1 U M Q	0.9 U Q	0.88 U Q	1.2 U Q	**390** J	46 U M	0.87 U Q	**11**
Bromobenzene	NE	NA	3.5 U	3.5 U	3.9 U	3.7 U	3.5 U	4.3 U	3.6 U	3.5 U	4.7 U	98 U Q	130 U Q	3.5 U	13 U
Bromochloromethane	NE	NA	0.44 U Q	0.44 U Q	0.48 U Q	0.46 U Q	0.44 U Q	0.54 U Q	0.45 U Q	0.44 U Q	0.59 U Q	34 U	46 U	0.43 U Q	1.6 U
Bromodichloromethane	2.6	A	0.44 U M Q	0.44 U M Q	0.48 U M Q	0.46 U Q	0.44 U M Q	0.54 U M Q	0.45 U M Q	0.44 U M Q	0.59 U M Q	**54,000** M	26 U M	0.43 U M Q	1.6 U
Bromoform	22.9	A	0.88 U	0.88 U	0.97 U	0.92 U	0.89 U	1.1 U	0.9 U	0.88 U	1.2 U	200 U	260 U	0.87 U	3.3 U
Bromomethane	3.31	A	0.44 UJ	0.44 UJ	0.48 UJ	0.46 UJ	0.44 UJ	0.54 UJ	0.45 UJ	0.44 UJ	0.59 UJ	59 U	78 U	0.43 UJ	1.6 U
Carbon Tetrachloride	2.19	A	0.88 U Q	0.88 U Q	0.97 U Q	0.92 U Q	0.89 U Q	1.1 U Q	0.9 U Q	0.88 U Q	1.2 U Q	20 U	26 U	0.87 U Q	3.3 U Q
Chlorobenzene	51.1	A	0.88 U	0.88 U	0.97 U	0.92 U	0.89 U	1.1 U	0.9 U	0.88 U	1.2 U	**970**	78 U Q	0.87 U M	**100**
Chloroethane	40.7	SAP	0.44 UJ	0.44 UJ	0.48 UJ	0.46 UJ	0.44 UJ	0.54 UJ	0.45 UJ	0.44 UJ	0.59 UJ	98 U	130 U	0.43 UJ	1.6 U
Chloroform	4.8	A	0.88 UJ	0.88 UJ	0.97 UJ	0.92 UJ	0.89 UJ	1.1 UJ	0.9 UJ	0.88 UJ	1.2 UJ	20 U	26 U	0.87 UJ	3.3 U
Chloromethane	NE	NA	0.44 U	0.44 U	0.48 U	0.46 U	0.44 U	0.54 U	0.45 U	0.44 U	0.59 U	59 U	78 U	0.43 U	1.6 UJ
Cis-1,2-Dichloroethene	78.1	SAP	**1,300** J Q	**450** J Q	46 Q	46 Q	**9,000**	13 Q	8.1 Q	**5,600**	**6,600**	**1,100,000**	**160,000**	63 Q	68
Cis-1,3-Dichloropropene	0.14	A	0.44 U	0.44 U	0.48 U	0.46 U	0.44 U	0.54 U	0.45 U	0.44 U	0.59 U	20 U Q	26 U Q	0.43 U	1.6 U
Dibromochloromethane	1.82	A	0.88 U	0.88 U	0.97 U	0.92 U	0.89 U	1.1 U	0.9 U	0.88 U	1.2 U	59 U	78 U	0.87 U	3.3 U
Dibromomethane	NE	NA	0.44 UJ	0.44 UJ	0.48 UJ	0.46 UJ	0.44 UJ	0.54 UJ	0.45 UJ	0.44 UJ	0.59 UJ	34 U M	46 U	0.43 UJ	1.6 U
Dichlorodifluoromethane	16,000,000	C	0.88 UJ	0.88 UJ	0.97 UJ	0.92 UJ	0.89 UJ	1.1 UJ	0.9 UJ	0.88 UJ	1.2 UJ	200 UJ	260 UJ	0.87 UJ	3.3 U
Ethylbenzene	343	A	0.88 U	0.88 U	0.97 U M	0.92 U M	0.89 U M	1.1 U	0.9 U	0.88 U	1.2 U	**4,100**	**2,900** J	0.71 J	**400**
Hexachlorobutadiene	30.3	A	1.8 U	1.8 U	1.9 U	1.8 U	1.8 U	2.2 U	1.8 U	1.8 U	2.4 U	98 U	130 U	1.7 U	6.6 U
Isopropylbenzene	NE	NA	0.44 U M	0.44 U M	0.48 U	0.46 U	0.44 U	0.54 U	0.45 U	0.44 U	0.59 U	9,300	5,500	1.3 J	39,000 J
M- and P-Xylene[1]	772	A	0.58 J	0.41 J	0.27 J	0.46 U	0.44 U M	0.54 U	0.23 J	0.44 U	0.59 U	**14,000**	**11,000**	2.9	**40,000** J
Methyl Tert-Butyl Ether	7.23	A	0.88 UJ	0.88 UJ	0.97 UJ	0.92 UJ	0.89 UJ	1.1 UJ	0.9 UJ	0.88 UJ	1.2 UJ	34 U	46 U	0.87 UJ	3.3 U
Methylene Chloride	1.48	A	3.9 U	4.7 U	4.5 U	**5.4** J	**3.7** J	**4.2** J	3.3 U	5.4 U	4.3 U	390 U	520 U	4.2 U	**5.1** J
N-Butylbenzene	4,000,000	C	2.4	0.44 U M	0.59 J	0.46 U M	0.44 U M	0.35 J	0.45 U	0.22 J	0.59 U	21,000	12,000	13	68,000 J
Naphthalene	236	A	1.8 J	3.5 U	3.9 U	3.7 U	3.5 U	4.3 U	3.6 U	3.5 U	4.7 U M	**460**	**7,300**	6.2 J	**6,700** J
O-Xylene	844	A	0.29 J	0.88 U	0.97 U M	0.92 U	0.89 U	1.1 U	0.9 U	0.88 U	1.2 U	**10,000**	**7,400**	1.7	**21,000** J
Propylbenzene	8,000,000	C	0.72 J	0.37 J	0.97 U	0.92 U M	0.89 U	1.1 U	0.9 U	0.88 U	1.2 U	22,000	14,000	3.8	73,000 J

Table D-6. OU 1 2017 VOCs in Soil Samples (µg/kg)

		Location Name:	CL-B02			CL-B03			CL-B04			SP-B01			SP-B62
		Sample Name	CL-B02-S-14.0-170711	CL-B02-S-20.0-170711	CL-B02-S-29.0-170711	CL-B03-S-18.0-170712	CL-B03-S-19.4-170712	CL-B03-S-37.0-170712	CL-B04-S-11.5-170712	CL-B04-S-19.5-170712	CL-B04-S-29.0-170712	SP-B01-S-13.5-170711	SP-B01-S-17.5-170711	SP-B01-S-28.0-170711	SP-B62-S-7.0-170803
		Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N
Analyte	**PAL or Screening level**	**Source**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
Sec-Butylbenzene	8,000,000	C	0.32 J	0.44 U	0.48 U	0.46 U	0.44 U	0.54 U M	0.45 U M	0.44 U	0.59 U M	14,000	8,200	3.5	66,000 J
Styrene	120	A	0.44 U	0.44 U	0.48 U	0.46 U	0.44 U	0.54 U	0.45 U	0.44 U	0.59 U	34 U M	46 U M	0.43 U M	1.6 U M
Tert-Butylbenzene	8,000,000	A	0.44 U M	0.44 U	0.48 U	0.46 U	0.44 U	0.54 U	0.45 U	0.44 U	0.59 U	900	2,500 U	0.43 U M	62
Tetrachloroethene	49.9	SAP	0.88 U	0.88 U	0.97 U M	0.92 U	0.89 U	1.1 U	0.9 U	0.88 U	1.2 U	**17,000**	**2,200**	0.82 J	3.3 U
Toluene	273	A	0.3 J	0.27 J	0.35 J	0.28 J	0.89 U	1.1 U	0.27 J	0.28 J	1.2 U	2,800	14,000 U	0.37 J	120
Trans-1,2-Dichloroethene	518	SAP	2 J	32 J	0.78 J	0.83 J	2 J	1.1 UJ	0.9 UJ	48 J	35 J	**19,000**	**1,800**	0.99 J	7.4
Trans-1,3-Dichloropropene	0.137	A	3.5 U	3.5 U	3.9 U	3.7 U	3.5 U	4.3 U	3.6 U	3.5 U	4.7 U	34 U Q	46 U Q	3.5 U	13 U
Trichloroethene	25.2	SAP	**7,400** J	**5,200** J	**3,600** J	**3,900**	**83** Q	**92** Q	**51** Q	**3,800** J	**6,900** J	**83,000,000** B	**1,600,000** J	**7,500** B	2.4 J
Trichlorofluoromethane	24,000,000	C	0.88 UJ	0.88 UJ	0.97 UJ	0.92 UJ	0.89 UJ	1.1 UJ	0.9 UJ	0.88 UJ	1.2 UJ	200 U	260 U	0.87 UJ	3.3 U
Vinyl Chloride	1.67	SAP	**44** J	**6.5** J	1.3 J	**3.8** J	**25** J	1.1 UJ	0.9 UJ	**5** J	**77** J	200 U	260 U	0.58 J	**8.3** J

Notes:

Samples analyzed using EPA Method 8260C.

[1]The lowest MTCA Method B value for M-Xylene was chosen to represent M- and P-Xylene, as the M-Xylene value was the lower of the two analytes.

Screening levels based either on the lowest MTCA Method B value show in Ecology's July 2015 CLARC table or the project SAP. Values used as presented by Ecology without recalculation.

A - Screening level source is "Protective of Groundwater Saturated".

B - Screening level source is "Method B Cancer".

C - Screening level source is "Method B Non Cancer".

D - Screening level source is "Protective of Groundwater Vadose at 25 degC"

SAP - The screening level source is the SAP for this project: "Sampling and Analysis Plan Operable Unit 1 Site Recharacterization, June 29, 2017."

NA - Not applicable; NE - Not established.

N – Sample is not part of a field duplicate pair

PAL - Project Action Limit

U - The analyte was analyzed but not detected at or above the stated limit. (sometimes validators will elevate the limit due to the "B" qual using the 5x/10x rule so this definition is different than the lab description).

J - The reported value is an estimated concentration.

E - The reported value exceeded the instrument calibration range, estimated concentration.

UJ - The analyte was analyzed but not detected. the sample quantitation limit is an estimated value.

B - The analyte was found in an associated blank, as well as in the sample.

H - Sample was prepped or analyzed beyond the specified holding time.

J H - The reported value is an estimated concentration./Sample was prepped or analyzed beyond the specified holding time.

M - A matrix effect was present.

Q - One or more quality control criteria failed.

U H - The analyte was analyzed but not detected at or above the stated limit. (sometimes validators will elevate the limit due to the "B" qual using the 5x/10x rule so this definition is different than the lab description)./Sample was prepped or analyzed beyond the specified holding time.

U M - The analyte was analyzed but not detected at or above the stated limit. (sometimes validators will elevate the limit due to the "B" qual using the 5x/10x rule so this definition is different than the lab description)./A matrix effect was present.

Underlined values represent analytes not detected at or above the stated limit, which exceeds the PAL.

Bolded values indicate that the reported concentration exceeds the PAL.

Table D-7. OU 1 2017 PCBs in Soil Samples (mg/kg)

	Location Name	CL-B18a	CL-B21	SP-B01	SP-B62
	Sample Name	CL-B18a-S-18.0-170718	CL-B21-S-12.0-170720	SP-B01-S-17.5-170711	SP-B62-S-7.0-170803
	Sample Type	N	N	N	N
Analyte Name	PAL* (mg/kg)	Result	Result	Result	Result
Aroclor-1016	0.5	0.029 U	0.025 U	0.023 U J	0.31 U J
Aroclor-1221	0.5	0.014 U	0.012 U	0.012 U	0.15 U J
Aroclor-1232	0.5	0.014 U	0.012 U	0.012 U	0.15 U J
Aroclor-1242	0.5	0.005 U	0.0043 U	0.0041 U	0.054 U J
Aroclor-1248	0.5	0.014 U	0.012 U	0.012 U	0.15 U J
Aroclor-1254	0.5	0.053	0.0062 U	**1.1**	0.32 J
Aroclor-1260	0.5	0.01 U	0.0087 U	0.34 J	0.11 U J

Notes:

* WAC 173-340-747; Soil Method B cleanup level

Bold indicates exceedance of PAL.

Samples analyzed using EPA Method 8082 A

mg/kg - milligram per kilogram

U - The compound was analyzed for, but was not detected ("nondetect") at or above the LOD.

J - The result is an estimated concentration that is less than the LOQ, but greater than or equal to the DL.

U J - The analyte was not detected at the stated sample quantitation limit, which is an estimated value

N – Sample is not part of a field duplicate pair

Table D-8. OU 1 2017 cVOCs in Grab Groundwater Samples (μg/L)

Location Name		CL-B02	CL-B03	CL-B04	CL-B05	CL-B06a	CL-B07	CL-B08
Sample Name		CL-B02-GW-20.0-170711	CL-B03-GW-22.0-170712	CL-B04-GW-20.0-170712	CL-B05-GW-19.0-170712	CL-B06a-GW-16.0-170713	CL-B07-GW-29.0-170713	CL-B08-GW-18.0-170713
Sample Type		N	N	N	N	N	N	N
ANALYTE_NAME	PAL	Result	Result	Result	Result	Result	Result	Result
1,1,1-Trichloroethane	200	100 UJ	2.5 UJ	2.5 UJ	0.05 UJ	0.05 UJ	0.05 UJ	0.05 UJ
1,1-Dichloroethane	7.7	50 UJ	2.5 UJ	2.5 UJ	0.15 J	0.054 J	0.069 J	2 J
1,1-Dichloroethene	7	200 UJ	**15** J	**12** J	0.73 J	0.05 UJ	3.3 J	5.1 J
1,2-Dichloroethane	0.48	**53** J	2.5 UJ	2.5 UJ	0.05 UJ	0.05 UJ	0.05 UJ	0.05 UJ
Chloroethane	7.7	350 UJ	10 UJ	10 UJ	0.63 J	0.2 UJ	0.2 UJ	0.2 UJ
Cis-1,2-Dichloroethene	16	**3,900** J	**4,500** J	**4,400** J	**150** J	**33** J	**250** J	**270** J
Tetrachloroethene	5	100 UJ	10 UJ	3.5 J	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ
Trans-1,2-Dichloroethene	100	**160** J	71 J	97 J	2.9 J	1 J	3.1 J	**110** J
Trichloroethene	0.54	**22** J	**60** J	**6.4** J	**160** J	0.5 J	0.18 J	0.1 J
Vinyl Chloride	0.029	**270** J	**210** J	**1,300** J	**43** J	**100** J	**120** J	**740** J

Table D-8. OU 1 2017 cVOCs in Grab Groundwater Samples (μg/L)

	Location Name	CL-B09	CL-B10	CL-B11	CL-B12	CL-B13	CL-B14B	
	Sample Name	CL-B09-GW-14.0-170713	CL-B10-GW-12.0-170714	CL-B11-GW-12.0-170714	CL-B12-GW-21.0-170714	CL-B13-GW-12.0-170717	CL-B14b-GW-22.0-170717	FD-170717-02
	Sample Type	N	N	N	N	N	P	FD
ANALYTE_NAME	PAL	Result	Result	Result	Result	Result	Result	Result
1,1,1-Trichloroethane	200	0.05 UJ	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
1,1-Dichloroethane	7.7	0.083 J	0.19 J	0.3	0.19 J	0.86	0.05 U M	0.05 U M
1,1-Dichloroethene	7	0.05 UJ	0.05 U M	0.05 U M	2.2	0.05 U M	**210** H	**210** H
1,2-Dichloroethane	0.48	0.05 UJ	0.065 J	0.026 J	0.05 U	0.05 U M	0.05 U	0.05 U M
Chloroethane	7.7	0.2 UJ	0.2 U M	**11** M	0.83	0.92 M	0.2 U M	0.2 U
Cis-1,2-Dichloroethene	16	2.8 J	**16**	0.97	**210** J	0.28	**50,000** J	**46,000** J
Tetrachloroethene	5	0.2 UJ	0.2 U M	0.2 U M	0.2 U	0.2 U M	0.2 U M	0.2 U M
Trans-1,2-Dichloroethene	100	0.17 J	0.25	0.05 U	61 J	0.05 U M	**1,300** J	**1,300** J
Trichloroethene	0.54	0.1 J	**6.1**	0.099 J	**150** J	0.087 U	**610** J	**610** J
Vinyl Chloride	0.029	**3.5** J	**3.2** M	**0.72** M	**22**	0.015 U M	**22,000** J	**20,000** J

Table D-8. OU 1 2017 cVOCs in Grab Groundwater Samples (µg/L)

	Location Name	CL-B15	CL-B16	CL-B17	CL-B18a	CL-B18a		CL-B19
	Sample Name	CL-B15-GW-23.0-170717	CL-B16-GW-13.0-170718	CL-B17-GW-19.5-170718	CL-B18a-GW-14.5-170718	CL-B18a-GW-33.0-170719	CL-B18b-GW-20.0-170807	CL-B19-GW-23.0-170719
	Sample Type	N	N	N	N	N	N	N
ANALYTE_NAME	**PAL**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
1,1,1-Trichloroethane	200	0.05 U	37	0.05 U M	0.05 U	0.05 U	500 U	0.05 U
1,1-Dichloroethane	7.7	0.05 U M	**550**	0.11 J M	0.58	0.05 U M	250 U	0.23
1,1-Dichloroethene	7	0.05 U M	**37**	0.05 U M	0.05 U M	10	1,000 U M	0.05 U M
1,2-Dichloroethane	0.48	0.05 U	**38**	0.031 J	0.053 J	0.05 U	500 U	0.05 U
Chloroethane	7.7	0.46 J M	**5,300** M	0.2 U M	2.3 M	0.2 U M	1,800 U	0.2 U M
Cis-1,2-Dichloroethene	16	14 J	**1,100** J	**36** J	**24**	**5,700** J	**22,000**	0.55 J
Tetrachloroethene	5	0.2 U M	0.23 J	0.2 U M	0.2 U M	0.2 U M	500 U	0.2 U M
Trans-1,2-Dichloroethene	100	0.28	25 U M	0.61	0.66	1,000 U R	1,000 U M	0.099 J
Trichloroethene	0.54	0.13 U	**27** J	0.26	0.38	**6.7**	**1,100** J	0.23 J
Vinyl Chloride	0.029	**2.5**	**180** B M	**0.69** B M	**3.9** M	**1,300** J	**2,200** J	**1** J

Table D-8. OU 1 2017 cVOCs in Grab Groundwater Samples (µg/L)

	Location Name	CL-B20		CL-B21	CL-B22	CL-B23		CL-B24
	Sample Name	CL-B20-GW-26.5-170719	CL-B20-GW-32.0-170719	CL-B21-GW-12.5-170720	CL-B22-GW-19.0-170720	CL-B23-GW-14.0-170720	CL-B23-GW-18.0-170720	CL-B24-GW-16.0-170720
	Sample Type	N	N	N	N	N	N	N
ANALYTE_NAME	PAL	Result	Result	Result	Result	Result	Result	Result
1,1,1-Trichloroethane	200	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
1,1-Dichloroethane	7.7	3.7	0.39	0.14 J	0.47	0.077 J	0.05 U M	0.37
1,1-Dichloroethene	7	3.4	**26**	0.05 U M	5.7	1	2.6	0.7
1,2-Dichloroethane	0.48	0.056 J	0.026 J	**4**	**1.1**	0.05 U M	0.05 U	0.05 U M
Chloroethane	7.7	**18**	0.2 U M	1,800 U R	1,800 U R	0.2 U M	0.2 U M	0.2 U M
Cis-1,2-Dichloroethene	16	**1,400** J	**14,000** J	250 U R	**26** B	**410** J	**1,100** J	**230** J
Tetrachloroethene	5	0.2 U M	0.2 U M	0.2 U M	**9**	0.2 U M	0.39 J	0.2 U M
Trans-1,2-Dichloroethene	100	20	**1,000** U R	1.1	45	1.5	31	17
Trichloroethene	0.54	**0.71**	**1.7**	0.05 U	**200** J	0.14 J	**1.3**	0.068 J
Vinyl Chloride	0.029	**290** J	**3,800** J	0.015 UJ	**21** J	**150** J	250 U R	**350** J

Table D-8. OU 1 2017 cVOCs in Grab Groundwater Samples (µg/L)

	Location Name	CL-B25	CL-B26a	CL-B27	CL-B28		CL-B29a	CL-B30a
	Sample Name	CL-B25-GW-29.0-170720	CL-B26a-GW-10.0-170721	CL-B27-GW-12.0-170721	CL-B28-GW-10.0-170721	FD-170721-02	CL-B29a-GW-21.0-170724	CL-B30a-GW-21.0-170724
	Sample Type	N	N	N	N	FD	N	N
ANALYTE_NAME	PAL	Result	Result	Result	Result	Result	Result	Result
1,1,1-Trichloroethane	200	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
1,1-Dichloroethane	7.7	0.15 J	0.05 U M	0.11 J	0.05 U M	0.05 U M	**29.5** J	0.05 U
1,1-Dichloroethene	7	3.1	0.05 U M	0.05 U M	0.05 U M	0.05 U M	4.39	0.05 U
1,2-Dichloroethane	0.48	0.05 U M	0.05 U	0.05 U	0.05 U	0.05 U	**4.49**	**0.87**
Chloroethane	7.7	0.2 U M	0.2 U M	0.2 U M	0.2 U M	0.2 U M	0.5 UJ	0.5 UJ
Cis-1,2-Dichloroethene	16	**590** J	250 U H	250 U H	250 U H	250 U H	**108** J	0.05 U
Tetrachloroethene	5	0.2 U M	0.2 U M	0.2 U M	0.2 U M	0.2 U M	1.92	0.192 J
Trans-1,2-Dichloroethene	100	9.3	0.05 U	0.33	0.05 U	0.05 U	37.7 J	0.189 J
Trichloroethene	0.54	0.18 J	0.068 J	**0.81**	0.036 J	0.05 U M	**122** J	0.467 U
Vinyl Chloride	0.029	**250** U R	0.015 U M	0.015 U M	0.015 U M	0.015 U M	**253** J	**0.434**

Table D-8. OU 1 2017 cVOCs in Grab Groundwater Samples (μg/L)

	Location Name	CL-B31	CL-B32	CL-B33	CL-B34	CL-B35	CL-B36a	CL-B37
	Sample Name	CL-B31-GW-12.0-170724	CL-B32-GW-16.0-170724	CL-B33-GW-13.0-170724	CL-B34-GW-20.0-170725	CL-B35-GW-21.0-170725	CL-B36a-GW-17.0-170725	CL-B37-GW-15.0-170726
	Sample Type	N	N	N	N	N	N	N
ANALYTE_NAME	**PAL**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
1,1,1-Trichloroethane	200	0.05 U	0.05 UJ	0.05 UJ	0.05 U	0.05 U	0.05 U	0.164 J
1,1-Dichloroethane	7.7	0.05 U	0.259 J	0.145 J	1.88	0.05 U	1.25	0.117 J
1,1-Dichloroethene	7	0.05 U	1.76 J	0.05 UJ	3.15	**23.7** D	**23.7** D	0.946 J
1,2-Dichloroethane	0.48	0.05 U	0.05 UJ	0.05 UJ	0.05 U	0.05 U	0.05 U	0.0163 J
Chloroethane	7.7	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	6.46 J
Cis-1,2-Dichloroethene	16	0.05 U	**505** J	1.21 J	**698** D	**4,520** D	**4,790** D	**52.2** J
Tetrachloroethene	5	0.177 J	0.172 J	0.2 UJ	0.171 J	0.17 J	0.172 J	0.2 UJ
Trans-1,2-Dichloroethene	100	0.05 U	51.8 J	0.667 J	**336** D	98 D	**122** D	12.4 J
Trichloroethene	0.54	0.05 U	<u>2.82</u> U	**1.39** J	<u>1.87</u> U	**1.32** U	<u>17</u> U	**7.1** J
Vinyl Chloride	0.029	0.015 U	**188** J	0.015 UJ	0.015 U	**1,040** D	**2,030** D	**46.1** J

Table D-8. OU 1 2017 cVOCs in Grab Groundwater Samples (μg/L)

	Location Name	**CL-B39**	**SP-B01**		**SP-B01a**	**SP-B01B**		
	Sample Name	**CL-B39-GW-10.0-170726**	**SP-B01-GW-13.5-170711**	**SP-B01-GW-17.5-170711**	**SP-B01a-GW-28.0-170711**	**FD-0170807-01**	**SP-B01b-GW-10.0-170807**	**SP-B01b-GW-15.0-170809**
	Sample Type	**N**	**N**	**N**	**N**	**FD**	**P**	**N**
ANALYTE_NAME	**PAL**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
1,1,1-Trichloroethane	200	0.164 J	1 U	1 UJ	25 UJ	500 U	500 U	500 U
1,1-Dichloroethane	7.7	0.204 J	0.63 J	0.5 UJ	13 UJ	250 U	250 U	250 U
1,1-Dichloroethene	7	0.0156 J	**88** J	**80** J	50 UJ	1,000 U M	1,000 U	1,000 U
1,2-Dichloroethane	0.48	0.0179 J	1 U	1 UJ	25 UJ	500 U	500 U	500 U
Chloroethane	7.7	0.408 J	3.5 U	3.5 UJ	88 UJ	1,800 U	1,800 U	1,800 U
Cis-1,2-Dichloroethene	16	0.569 J	**150,000** J	**130,000** J	**360** J	**100,000**	**350,000**	**120,000**
Tetrachloroethene	5	0.2 UJ	**25** J	**43** J	25 UJ	500 U	500 U	500 U
Trans-1,2-Dichloroethene	100	0.595 J	**4,100** J	**3,700** J	23 J	**1,100** J	**2,300**	**1,100** J
Trichloroethene	0.54	0.182 J	**150,000** H	**360,000** H	**500** J	**320,000**	**260,000**	**310,000**
Vinyl Chloride	0.029	**1.71** J	**7,900** J	**2,900** J	**320** J	**4,300** J M	**32,000**	**4,800** J

Table D-8. OU 1 2017 cVOCs in Grab Groundwater Samples (µg/L)

	Location Name	**SP-B40**		**SP-B41**	**SP-B42**		**SP-B43a**	**SP-B44**
	Sample Name	**SP-B40-GW-11.0-170726**	**SP-B40-GW-16.0-170726**	**SP-B41-GW-10.0-170726**	**SP-B42-GW-10.0-170727**	**SP-B42-GW-18.0-170727**	**SP-B43a-GW-13.0-170807**	**SP-B44-GW-12.0-170727**
	Sample Type	**N**	**N**	**N**	**N**	**N**	**N**	**N**
ANALYTE_NAME	**PAL**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
1,1,1-Trichloroethane	200	**5,810** J	**255** J	3.8 J	0.921 J	0.489 J	<u>500</u> U	1.24 J
1,1-Dichloroethane	7.7	**17,600** J	**302** J	**8.43** J	1.41 J	0.572 J	<u>250</u> U	4.82 J
1,1-Dichloroethene	7	**305** J	5.64 J	1 UJ	**12.2** J	3.87 J	<u>1,000</u> U M	**53.1** J
1,2-Dichloroethane	0.48	**5.12** J	<u>1</u> UJ	<u>1</u> UJ	0.0376 J	0.0312 J	<u>500</u> U	0.198 J
Chloroethane	7.7	**30,600** J	**2,580** J	**26.5** J	**91.9** J	**105** J	<u>1,800</u> U M	**2,450** J
Cis-1,2-Dichloroethene	16	**456** J	**3,570** J	**18.6** J	**4,270** J	**2,340** J	**27,000**	**11,900** J
Tetrachloroethene	5	0.2 UJ	0.2 UJ	4 UJ	0.55 J	0.0159 J	<u>500</u> U	0.0687 J
Trans-1,2-Dichloroethene	100	83.8 J	**103** J	4.32 J	62.4 J	36.9 J	<u>1,000</u> U	**148** J
Trichloroethene	0.54	**195** J	**380** J	**9.54** J	**4,670** J	**1,200** J	**10,000**	**5,330** J
Vinyl Chloride	0.029	**571** J	**3,800** J	**41.9** J	**498** J	**339** J	**4,200** J	**4,200** J

Table D-8. OU 1 2017 cVOCs in Grab Groundwater Samples (μg/L)

	Location Name	SP-B45	SP-B46	SP-B47	SP-B48b	SP-B49		SP-B50
	Sample Name	SP-B45-GW-18.0-170727	SP-B46-GW-15.0-170728	SP-B47-GW-15.0-170728	SP-B48b-GW-10.0-170728	SP-B49-GW-10.0-170728	SP-B49-GW-20.0-170728	SP-B50-GW-14.0-170731
	Sample Type	N	N	N	N	N	N	N
ANALYTE_NAME	**PAL**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
1,1,1-Trichloroethane	200	0.058 J	0.057 J	0.13 J	0.042 J	0.05 U	0.05 U M	0.05 U M
1,1-Dichloroethane	7.7	1.8	**31**	**33**	**13** J	**17**	0.056 J	1.2
1,1-Dichloroethene	7	**13**	0.58	0.44	**25** J	**69**	5 U	**34**
1,2-Dichloroethane	0.48	0.2	0.11 J	0.097 J	0.33 J	0.05 U	0.05 U M	0.29
Chloroethane	7.7	**15**	1,800 U R	1,800 U R	3,500 U R	100 UJ	0.19 J	0.3 J
Cis-1,2-Dichloroethene	16	**8,300** J	**360** J	**200** J	**12,000** J	**77,000** J	**470** J	**9,300** J
Tetrachloroethene	5	0.2 U M	0.2 U M	0.2 U	0.091 J	**5.3**	0.11 J	0.08 J
Trans-1,2-Dichloroethene	100	94 J	29	40	**130**	**720**	9.5 J	**110**
Trichloroethene	0.54	**47**	**1.4**	**1.7**	**1,700** J	**63,000** J	**480** J	**2,600** J
Vinyl Chloride	0.029	**1,200** J	**2,500** B	**1,800** B	**3,100** B	**5,600** B	**250** U R	**1,100**

Table D-8. OU 1 2017 cVOCs in Grab Groundwater Samples (µg/L)

Location Name		SP-B51	SP-B52		SP-B53		SP-B54	
Sample Name		SP-B51-GW-14.0-170731	SP-B52-GW-11.0-170731	SP-B52-GW-20.0-170731	SP-B53-GW-23.0-170731	SP-B53-GW-33.0-170731	SP-B54-GW-35.0-170801	SP-B54-GW-7.0-170801
Sample Type		N	N	N	N	N	N	N
ANALYTE_NAME	**PAL**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
1,1,1-Trichloroethane	200	0.034 J	0.17 J	0.05 U M	50 U M	0.05 U M	2.5 U M	2.5 U M
1,1-Dichloroethane	7.7	0.05 U	2.3	0.068 J	50 U	0.074 J	2.5 U	2.5 U M
1,1-Dichloroethene	7	0.45	**25**	0.53	50 U M	2.5 U	2.5 U M	**64**
1,2-Dichloroethane	0.48	0.05 U M	0.039 J	0.05 U M	50 U M	0.05 U M	2.5 U M	2.5 U M
Chloroethane	7.7	0.2 U M	4.3	0.22 J	200 U M	0.2 U M	10 U M	10 U M
Cis-1,2-Dichloroethene	16	**190** B	**21,000** B	**630** B	**63,000** J	**270** B	**7,700** H B	**59,000** J
Tetrachloroethene	5	0.2 U M	2.8	0.096 J M	200 U M	0.34 J	10 U M	10 U M
Trans-1,2-Dichloroethene	100	1.7 J	**200**	8.6 J	**700**	7.5 J	60	**900**
Trichloroethene	0.54	**250** U R	**26,000** J	**590** J	**540,000** J	**1,900** J	**270** J	**250** J
Vinyl Chloride	0.029	**10**	**1,300**	**26** M	15 U M	**27**	**440** B	**14,000** B

Table D-8. OU 1 2017 cVOCs in Grab Groundwater Samples (µg/L)

	Location Name	SP-B55		SP-B56			SP-B57	
	Sample Name	SP-B55-GW-10.0-170801	SP-B55-GW-33.0-170801	FD-170801-02	SP-B56-GW-10.0-170801	SP-B56-GW-27.0-170801	SP-B57-GW-10.0-170802	SP-B57-GW-29.0-170802
	Sample Type	N	N	FD	P	N	N	N
ANALYTE_NAME	PAL	Result	Result	Result	Result	Result	Result	Result
1,1,1-Trichloroethane	200	2.5 U M	2.5 U M	0.05 U	0.05 U	0.05 U M	0.05 U M	0.05 U M
1,1-Dichloroethane	7.7	2.5 U	2.5 U	0.34	0.16 J	0.05 U M	0.37	0.11 J
1,1-Dichloroethene	7	**150**	2.5 U M	**18**	**17**	**18**	2.8	**32**
1,2-Dichloroethane	0.48	2.5 U M	2.5 U M	0.05 U	**0.72**	0.05 U	0.37	0.05 U M
Chloroethane	7.7	10 U M	10 U M	0.2 U	0.2 U	0.2 U	0.2 U Q	0.2 U Q
Cis-1,2-Dichloroethene	16	**43,000** B J	**3,800** B	**31,000** J	**29,000** J	**15,000** B	**6,600** B	**1,700** B
Tetrachloroethene	5	10 U M	10 U M	0.2 U M	0.2 U	0.2 U M	0.2 U	0.2 U M
Trans-1,2-Dichloroethene	100	**290**	52	**370**	**330**	**130**	**120**	61
Trichloroethene	0.54	**20,000** B	**520** J	6.8 U	5.9 U	**250** J	**250** J	**250** J
Vinyl Chloride	0.029	**2,600** B J	**660**	0.015 U	0.015 U M	**1,900** B	**15,000** B	**280** B

Table D-8. OU 1 2017 cVOCs in Grab Groundwater Samples (μg/L)

Location Name		SP-B58	SP-B59	SP-B60		SP-B61	SP-B62	SP-B63
Sample Name		SP-B58-GW-39.0-170802	SP-B59-GW-30.0-170802	SP-B60-GW-24.0-170802	SP-B60-GW-9.0-170802	SP-B61-GW-25.0-170803	SP-B62-GW-26.0-170804	SP-B63-GW-24.0-170804
Sample Type		N	N	N	N	N	N	N
ANALYTE_NAME	PAL	Result	Result	Result	Result	Result	Result	Result
1,1,1-Trichloroethane	200	0.05 U M	0.05 U M	0.05 U M	0.05 U M	0.05 U M	0.05 U M	0.05 U M
1,1-Dichloroethane	7.7	0.05 U M	0.05 U	0.05 U	0.05 U	0.05 U M	0.12 J	0.05 U
1,1-Dichloroethene	7	**13** U	0.26	0.082 J	0.05 U	0.11 M	0.05 U	0.28
1,2-Dichloroethane	0.48	0.03 J	0.05 U M	0.05 U	0.05 U M	0.05 U M	0.05 U M	0.05 U M
Chloroethane	7.7	0.2 U M Q	0.2 U M Q	0.2 U M Q	0.2 U M Q	0.2 U M	0.2 U M	0.2 U M
Cis-1,2-Dichloroethene	16	**8,500** J	250 U R	**250** UJ	250 UJ	7.5 B	5.5 B	**100** J
Tetrachloroethene	5	0.31 J	0.2 U M	0.2 U M	0.2 U M	0.2 U M	0.2 U M	0.14 J M
Trans-1,2-Dichloroethene	100	**130** J	2.9	0.98	1,000 UJ	0.93	2.3	2.2
Trichloroethene	0.54	**1,400** J	250 U R	250 UJ	250 UJ	250 UJ	250 UJ	**710** J
Vinyl Chloride	0.029	**1,100** J	**9.5** B	250 UJ	250 UJ	250 UJ	250 UJ	250 UJ

Table D-8. OU 1 2017 cVOCs in Grab Groundwater Samples (µg/L)

Location Name		SP-B64	SP-B65C	SP-B66	SP-B67	SP-B68		SP-B69
Sample Name		SP-B64-GW-10.0-170804	SP-B65c-GW-9.0-170806	SP-B66-GW-10.0-170806	SP-B67-GW-14.0-170806	FD-170806-01	SP-B68-GW-13.0-170806	SP-B69-GW-12.0-170806
Sample Type		N	N	N	N	FD	P	N
ANALYTE_NAME	**PAL**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
1,1,1-Trichloroethane	200	0.07 J	500 U	500 U	500 U	500 U	500 U	500 U
1,1-Dichloroethane	7.7	0.26 J	250 U	250 U	250 U	250 U M	250 U M	250 U
1,1-Dichloroethene	7	6.6 J	1,000 U M	1,000 U M	1,000 U	1,000 U	1,000 U	1,000 U M
1,2-Dichloroethane	0.48	0.05 U M	500 U	500 U	500 U	500 U	500 U	500 U
Chloroethane	7.7	0.28 J	1,800 U	1,800 U M	1,800 U M	1,800 U	1,800 U M	**2,700**
Cis-1,2-Dichloroethene	16	**6,500** J	**260** J	**22,000**	**2,200**	**2,400**	**2,900**	**1,500**
Tetrachloroethene	5	2 J	500 U M	500 U	500 U	500 U	500 U	500 U
Trans-1,2-Dichloroethene	100	64	1,000 U M	1,000 U	1,000 U M	1,000 U	1,000 U	1,000 U
Trichloroethene	0.54	**15,000** J	**710** J	250 U M	250 U	250 U	250 U	250 U M
Vinyl Chloride	0.029	**84** J	250 UJ	**14,000** J	**9,800** J	**7,200** J	**6,600** J	**1,100** J

Notes:

Samples analyzed using EPA Method 8260C

FD - Field Duplicate

P – Parent sample of field duplicate

N – Sample is not part pof a field duplicate pair

PAL - Project Action Limit

D - The reported value is from a dilution.

JD - The reported value is an estimated concentration. / The reported value is from a dilution.

U - The analyte was not detected at or above the stated limit. (sometimes validators will elevate the limit due to the "B" qualifier using the 5x/10x rule so this definition is different than the lab description).

J - The reported value is an estimated concentration.

UJ - The analyte was not detected at or above the sample quantitation limit, which is an estimated value.

B - The analyte was found in an associated blank, as well as in the sample.

B J - The analyte was found in an associated blank, as well as in the sample. / Sample was prepped or analyzed beyond the specified holding time.

H - Sample was prepped or analyzed beyond the specified holding time.

M - A matrix effect was present.

U R - The reported value is unusable, rejected. Analyte may or may not be present.

U H - The analyte was not detected at or above the stated limit. (Sometimes validators will elevate the limit due to the "B" qualifier using the 5x/10x rule so this definition is different than the lab description). / Sample was prepped or analyzed beyond the specified holding time.

U M - The analyte was not detected at or above the stated limit. (sometimes validators will elevate the limit due to the "B" qualifier using the 5x/10x rule so this definition is different than the lab description). / A matrix effect was present.

Underlined values represent analytes not detected at or above the stated limit, which exceeds the PAL.

Bolded values indicate that the reported concentration exceeds the PAL

Table D-9. OU 1 2017 cVOCs in Groundwater Monitoring Wells (µg/L)

Location Name		IW1-S	MW1-17	MW1-42	MW1-43	MW1-44	MW1-45
Sample Name		IW1-S-171026	CL-MW1-17-GW-170720	MW1-42-171023	MW1-43-171023	MW1-44-171023	MW1-45-171023
	Sample type	N	N	N	N	N	N
Analyte	PAL (µg/L)	Result	Result	Result	Result	Result	Result
1,1,1-Trichloroethane	200	0.5 U	0.05 U	1 U	5 U	25 U	1 U
1,1-Dichloroethane	7.7	0.5 U	0.05 U M	5.09 D	5 U	25 U	1 U
1,1-Dichloroethene	7	0.5 U	2.5	0.613 JD	3.76 JD	**26.5** JD	0.931 JD
1,2-Dichloroethane	0.48	0.5 U	0.05 U	1 U	5 U	25 U	1 U
Chloroethane	7.7		1,800 U R				
Cis-1,2-Dichloroethene	16	1.32 U	**680** J	**53.6** D	**982** D	**5,250** D	**187** D
Tetrachloroethene	5	0.5 U	0.2 U M	1 U	5 U	25 U	1 U
Trans-1,2-Dichloroethene	100	0.5 U	0.82	38.7 D	92.1 D	20.8 JD	1 U
Trichloroethene	0.54	**46.6**	250 U R	**1.18** JD	5 U	25 U	1 U
Vinyl Chloride	0.029	0.5 U	250 U R	**46.9** D	**452** D	**723** D	**83.7** D

Table D-9. OU 1 2017 cVOCs in Groundwater Monitoring Wells (µg/L)

Location Name		MW1-46		MW1-47	MW1-48	MW1-49	MW1-50
Sample Name		FD-171023-01	MW1-46-171023	MW1-47-171023	MW1-48-171024	MW1-49-171024	MW1-50-171024
	Sample type	FD	P	N	N	N	N
Analyte	PAL (µg/L)	Result	Result	Result	Result	Result	Result
1,1,1-Trichloroethane	200	50 U	50 U	100 U	2.5 U	25 U	5 U
1,1-Dichloroethane	7.7	<u>50</u> U	<u>50</u> U	<u>100</u> U	2.5 U	<u>25</u> U	5 U
1,1-Dichloroethene	7	<u>50</u> U	<u>50</u> U	<u>100</u> U	2.5 U	<u>25</u> U	5 U
1,2-Dichloroethane	0.48	<u>50</u> U	<u>50</u> U	<u>100</u> U	<u>2.5</u> U	<u>25</u> U	<u>5</u> U
Chloroethane	7.7						
Cis-1,2-Dichloroethene	16	**8,600** D	**8,500** D	**20,900** D	**438** D	**2,830** D	**855** D
Tetrachloroethene	5	<u>50</u> U	<u>50</u> U	<u>100</u> U	2.5 U	<u>25</u> U	<u>5</u> U
Trans-1,2-Dichloroethene	100	82 JD	**101** D	**189** JD	4.08 JD	27.9 JD	6.76 JD
Trichloroethene	0.54	<u>50</u> U	<u>50</u> U	**86.4** JD	**111** D	**1,040** D	**856** D
Vinyl Chloride	0.029	**2,070** D	**2,050** D	**3,400** D	**98.2** D	**280** D	**54.2** D

Table D-9. OU 1 2017 cVOCs in Groundwater Monitoring Wells (µg/L)

Location Name		MW1-51	MW1-52	MW1-53		MW1-54	MW1-55
Sample Name		MW1-51-171024	MW1-52-171024	FD-171026-01	MW1-53-171026	MW1-54-171024	MW1-55-171024
	Sample type	N	N	FD	P	N	N
Analyte	PAL (µg/L)	Result	Result	Result	Result	Result	Result
1,1,1-Trichloroethane	200	0.5 U	1 U	5 U	5 U	0.5 U	2.5 U
1,1-Dichloroethane	7.7	0.357 J	1 U	5 U	5 U	0.5 U	2.5 U
1,1-Dichloroethene	7	0.5 U	0.671 JD	5 U	5 U	0.5 U	1.62 JD
1,2-Dichloroethane	0.48	0.5 U	1 U	5 U	5 U	0.5 U	2.5 U
Chloroethane	7.7						
Cis-1,2-Dichloroethene	16	**23.8**	**156** D	**803** D	**773** D	1.76	**492** D
Tetrachloroethene	5	0.5 U	1 U	5 U	5 U	0.5 U	2.5 U
Trans-1,2-Dichloroethene	100	0.5 U	0.64 JD	31.1 D	29.4 D	0.5 U	5.46 D
Trichloroethene	0.54	0.5 U	**4.37** D	**220** D	**216** D	**2.86**	**357** D
Vinyl Chloride	0.029	**25.3**	**45.2** D	**192** D	**189** D	**0.464** J	**75.2** D

Table D-9. OU 1 2017 cVOCs in Groundwater Monitoring Wells (µg/L)

Location Name		MW1-56		MW1-57		
Sample Name		MW1-56-12.0-171025	MW1-56-24.0-171025	MW1-57-10.0-171025	MW1-57-16.0-171025	MW1-57-34.0-171025[a]
	Sample type	N	N	N	N	N
Analyte	**PAL (µg/L)**	**Result**	**Result**	**Result**	**Result**	**Result**
1,1,1-Trichloroethane	200	1,000 U	1,250 U	1,250 U	1,000 U	25 U
1,1-Dichloroethane	7.7	1,000 U	1,250 U	1,250 U	1,000 U	25 U
1,1-Dichloroethene	7	1,000 U	1,250 U	1,250 U	1,000 U	25 U
1,2-Dichloroethane	0.48	1,000 U	1,250 U	1,250 U	1,000 U	25 U
Chloroethane	7.7					
Cis-1,2-Dichloroethene	16	**31,000** D	**55,200** D	**94,300** D	**58,800** D	**2,470** D
Tetrachloroethene	5	1,000 U	1,250 U	1,250 U	1,000 U	25 U
Trans-1,2-Dichloroethene	100	1,000 U	1,250 U	**938** JD	**661** JD	49.5 JD
Trichloroethene	0.54	**122,000** D	**332,000** D	**361,000** D	**218,000** D	**9,490** D
Vinyl Chloride	0.029	1,000 U	1,250 U	**4,810** D	1,000 U	**406** D

Table D-9. OU 1 2017 cVOCs in Groundwater Monitoring Wells (μg/L)

Location Name		MW1-58			MW1-60
Sample Name		MW1-58-9.0-171115	MW1-58-19.0-171115	MW1-58-35.0-171115	MW1-60-171026
	Sample type	N	N	N	N
Analyte	PAL (μg/L)	Result	Result	Result	Result
1,1,1-Trichloroethane	200	100 U	5 U	1 U	0.5 U
1,1-Dichloroethane	7.7	100 U	5 U	1 U	0.5 U
1,1-Dichloroethene	7	100 U	5 U	1 U	0.5 U
1,2-Dichloroethane	0.48	100 U	5 U	1 U	0.5 U
Chloroethane	7.7				
Cis-1,2-Dichloroethene	16	**23,600** D	**1,110** D	**79.2** D	0.5 U
Tetrachloroethene	5	100 U	5 U	1 U	0.5 U
Trans-1,2-Dichloroethene	100	**245** D	6.85 JD	1 U	0.5 U
Trichloroethene	0.54	**66.6** JD	**27.6** D	**8.53** D	**15.8**
Vinyl Chloride	0.029	**9,570** D	**106** D	**9.64** D	0.5 U

Notes:

[a] – The sample ID incorrectly indicates the depth of this sample as 34 feet bgs. The actual depth was 31 feet bgs.

Samples analyzed using EPA Method 8260C

FD - Field Duplicate

P – Parent sample of field duplicate

N – Sample is not part of a field duplicate pair

PAL - Project Action Limit

U - The analyte was not detected at or above the stated limit. (sometimes validators will elevate the limit
due to the "B" qualifier using the 5x/10x rule so this definition is different than the lab description).

D - The reported value is from a dilution.

JD - The reported value is an estimated concentration. / The reported value is from a dilution.

U R - The reported value is unusable, rejected. Analyte may or may not be present.

J - The reported value is an estimated concentration.

U M - The analyte was not detected at or above the stated limit. (sometimes validators will elevate the limit
due to the "B" qualifier using the 5x/10x rule so this definition is different than the lab description). / A matrix effect was present.

Underlined values represent analytes not detected at or above the stated limit, which exceeds the PAL.

Bolded values indicate that the reported concentration exceeds the PAL.

Table D-10. OU 1 2017 Groundwater Monitoring Well Results for 1,4-Dioxane (µg/L)

Location Name	Sample Name	Sample Type	PAL	1,4-Dioxane (µg/L)
MW1-43	MW1-43-171023	N	0.44	0.236 U
MW1-46	MW1-46-171023	P	0.44	**4.04**
MW1-46	FD-171023-01	FD	0.44	**3.32**
MW1-47	MW1-47-171023	N	0.44	**2.1**
MW1-48	MW1-48-171024	N	0.44	**4.94**
MW1-50	MW1-50-171024	N	0.44	0.254 U
MW1-52	MW1-52-171024	N	0.44	0.251 U
MW1-56	MW1-56-12.0-171025	N	0.44	0.234 U
MW1-57	MW1-57-10.0-171025	N	0.44	0.246 U
MW1-58	MW1-58-9.0-171115	N	0.44	<u>1.17</u> U
MW1-60	MW1-60-171026	N	0.44	0.239 U

Samples analyzed using EPA Method 8270D.

FD - Field Duplicate

P – Parent sample of field duplicate

N – Sample is not part of a field duplicate pair

PAL - Project Action Limit

U - The analyte was not detected at or above the stated limit. (sometimes validators will elevate the limit due to the "B" qualifier using the 5x/10x rule so this definition is different than the lab description).

Underlined values represent analytes not detected at or above the stated limit, which exceeds the PAL.

Bolded values indicate that the reported concentration exceeds the PAL. µg/L – micrograms per liter

Table D-11. OU 1 2017 Total PCBs in Sediment (µg/kg)

Location Name	Sample Name	Sample type	Total PCBs (Sum of analyte value with ND as null) Result (µg/kg)		Total number of PCBs detections	Total Organic Carbon %	Total PCBs (TOC Normalized)[a] (mg/kg OC)
			Freshwater				**Marine**
		SMS Sediment SCO	**110**				**12**
		SMS Sediment CSL	**2500**				**65**
MA09	SED02-10-170906	N	**830**	B q	169	1.6	**51.9**
MA14 (DUP)	FD-170906-01	FD	33	B q	164	0.53	6.2
MA14	SED01-10-170906	N	24	q B	157	0.51	4.7
MA19	SED04-10-170906	N	9.9	B q	151	0.58	1.7
SP1-1	SED03-10-170906	N	13	B q	157	0.56	2.3
TF-21	SED05-10-170907	N	30	B q	166	0.79	3.8

Notes:

[a] – If percent TOC is between 0.5 and 3.5, then PCB concentrations TOC-normalized with units of mg/kg OC. To calculate TOC-normalized values, the concentration in µg/kg is divided by the decimal fraction TOC times 1,000 µg/mg.

All samples analyzed using analytical method 1668A.

Bolded values exceed the SCO

DUP – Duplicate

FD - Field Duplicate

P – Parent sample of field duplicate

N – Sample is not part of a field duplicate pair

µg/kg - microgram per kilogram

B - The analyte was found in an associated blank, as well as in the sample.

q - One or more quality control criteria failed.

SCO - sediment cleanup objective

CSL – cleanup screening level

Table D-12. OU 1 2017 PCB Aroclor Analysis in Sediment Samples (µg/kg)

		Location Name	MA-09	MA-14	MA-14	MA19	SP1-1	TF-21
		Sample Name	SED02-10-170906	FD-170906-01	SED01-10-170906	SED04-10-170906	SED03-10-170906	SED05-10-170907
		Sample type	N	FD	P	N	N	N
Analyte	Units	ROD RG (mg/kg OC)	Result	Result	Result	Result	Result	Result
AROCLOR-1016	µg/kg	NE	48 U	31 U	31 U	36 U	35 U	39 U J
AROCLOR-1221	µg/kg	NE	75 U	48 U	49 U	57 U	55 U	62 U
AROCLOR-1232	µg/kg	NE	94 U	60 U	62 U	71 U	69 U	77 U
AROCLOR-1242	µg/kg	NE	110 U	71 U	73 U	83 U	81 U	91 U
AROCLOR-1248	µg/kg	NE	75 U	48 U	49 U	57 U	55 U	62 U
AROCLOR-1254	µg/kg	NE	350 J	46 U	47 U	54 U	52 U	59 U
AROCLOR-1260	µg/kg	NE	120 J	33 U Q	33 U Q	38 U Q	37 U Q	42 U Q
AROCLOR-1262	µg/kg	NE	130 U	82 U	84 U	96 U	94 U	100 U
AROCLOR-1268	µg/kg	NE	100 U	65 U	66 U	76 U	74 U	82 U
Total PCB Aroclors	mg/kg OC	12	29.38 J	8.68 U	9.22 U	1.61 U	1.66 U	7.47 U
CARBON	mg/kg	NE	16,000.00	5,300.00 J	5,100.00 J	5,800.00	5,600.00 J	7,900.00 J

Notes:

Samples analyzed for Aroclor analysis by method 8082 A, carbon analysis by 9060.

FD – Field duplicate

P – Parent Sample of field duplicate

N – Sample is not part of a field duplicate pair

U - The analyte was analyzed but not detected at or above LOD. (sometimes validators will elevate the limit due to the "B" qual using the 5x/10x rule so this definition is different than the lab description).

J - The reported value is an estimated concentration.

U J - The analyte was analyzed but not detected. The sample quantitation limit is an estimated value.

Q - One or more quality control criteria failed.

Total PCB (Aroclor) are derived based on the sum of the concentrations of Aroclors® 1016, 1221, 1232, 1242, 1248, 1254 and 1260.

When all chemicals in a group are undetected, only the single highest individual chemical quantitation limit in a group should be reported and appropriately qualified. If some concentrations were detected and others were not, only the detected concentrations are included in the sum.

Table D-13. OU 1 Calculated Total Dissolved PCB* and Diffusive PCB Flux Obtained via Passive Samplers (PEDs)

PED Type	Location	Calculated Water Concentration (ng/L)		Calculated Flux** ($\mu g/m^2/yr$)
PED Frames		**Porewater**	**Surface Water**	
PED-01	TF-21	3.3	0.6	191
PED-02	MA-14	8.9	0.8	574
PED-03	MA-09	14.6	NA	N/A
PED-04	SP1-1	2.2	NA	N/A
PED-05	MA19	3.4	0.6	200
PED-06	*new*	2.6	0.5	148
Piezometers/Wells		**Groundwater**		
PED-07	P1-1	6		NA
PED-08	P1-2	1.1		NA
PED-09	MW1-14	129.2		NA
PED-10	MW1-2	0.9		NA

Notes:
* in PCB summations congeners not detected above the detection limit were counted as zero and within co-eluting congener groups calculations were conducted on the one with the lowest PED-water partition coefficient which results in the highest (more conservative) total PCB estimate (see text for more information)
** positive values of flux indicate transport from porewater to surface water
NA - Not Available – surface water portion of PED damaged during deployment.
$\mu g/m^2/yr$ - micrograms per squared meters per year
ng/L - nanogram per liter

Table D-14. OU 1 2017 cVOCs in Porewater Samples (µg/L)

	Location Name	**PW1-01**	**PW1-02**		**PW1-03**	**PW1-04**	**PW1-05**	**PW1-06**	**PW1-07**	**PW1-08**	**PW1-09**	**PW1-10**
	Sample Name	**PW1-01-170907**	**PW1-02-170907**	**FD-170907-01**	**PW1-03-170907**	**PW1-04-170907**	**PW1-05-170908**	**PW1-06-170908**	**PW1-07-170908**	**PW1-08-170908**	**PW1-09-170908**	**PW1-10-170908**
	Sample Type	**N**	**P**	**FD**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**
Analyte	**PAL**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
cis-1,2-Dichloroethene	16	1 U	**1,000** J	**1,160** D	**26,800** D	**297** D	1 U	1 U	1 U	1 U	1 U	**555** D
Trichloroethene	0.54	<u>1</u> U	**10.9** JD	**34.9** D	**6,520** D	**13.8** D	<u>1</u> U	<u>1</u> U	<u>1</u> U	<u>1</u> U	<u>1</u> U	**15.9** D
Vinyl Chloride	0.029	<u>1</u> U	**408** J	**415** D	**3,570** D	**492** D	<u>1</u> U	<u>1</u> U	<u>1</u> U	<u>1</u> U	<u>1</u> U	**182** D
1,1,1-Trichloroethane	200	1 U	10 U	10 U	125 U	5 U	1 U	1 U	1 U	1 U	1 U	2.5 U
1,1-Dichloroethane	7.7	1 U	<u>10</u> U	<u>10</u> U	<u>125</u> U	5 U	1 U	1 U	1 U	1 U	1 U	2.5 U
1,1-Dichloroethene	7	1 U	<u>10</u> U	<u>10</u> U	**108** JD	5 U	1 U	1 U	1 U	1 U	1 U	1.76 JD
1,2-Dichloroethane	0.48	<u>1</u> U	<u>10</u> U	<u>10</u> U	<u>125</u> U	<u>5</u> U	<u>1</u> U	<u>1</u> U	<u>1</u> U	<u>1</u> U	<u>1</u> U	<u>2.5</u> U
Tetrachloroethene	5	1 U	<u>10</u> U	<u>10</u> U	<u>125</u> U	<u>5</u> U	1 U	1 U	1 U	1 U	1 U	2.5 U
trans-1,2-Dichloroethene	100	1 U	7.25 JD	10.3 JD	**194** JD	5.91 JD	1 U	1 U	1 U	1 U	1 U	3.68 JD

Notes

Samples analyzed using EPA Method 8260C.

FD - Field Duplicate

P – Parent sample of field duplicate

N – Sample is not part of a field duplicate pair

PAL - Project Action Limit

D - The reported value is from a dilution.

JD - The reported value is an estimated concentration./The reported value is from a dilution.

U - The analyte was not detected at or above the stated limit. (sometimes validators will elevate the limit due to the "B" qualifier using the 5x/10x rule so this definition is different than the lab description).

J - The reported value is an estimated concentration.

<u>Underlined</u> values represent analytes not detected at or above the stated limit, which exceeds the PAL.

Bolded values indicate that the reported concentration exceeds the PAL. µg/L - micrograms per liter

Table D-15. OU 1 2017 cVOCs in Surface Water Samples (μg/L)

	Location Name	SW1-01	SW1-02	SW1-03	SW1-04	SW1-05	SW1-06	SW1-06
	Sample Name	SW1-01-171026	SW1-02-171026	SW1-03-171026	SW1-04-171026	SW1-05-171026	SW1-06-171026	FD-171026-02
	Sample Type	N	N	N	N	N	P	FD
Analyte	PAL	Result	Result	Result	Result	Result	Result	Result
cis-1,2-Dichloroethene	600	**10,600** D	**2,500** D	170 D	**744** D	527 D	293 D	319 D
Trichloroethene	0.382	**2,580** D	**305** D	**28.8** D	**115** D	**79.8** D	**44.9** D	**49.1** D
Vinyl Chloride	0.021	**981** D	**399** D	**1.86** JD	**32.5** D	**17.1** D	**5.89** D	**5.54** D
1,1,1-Trichloroethane	47,000	50 U	25 U	1 U	5 U	2.5 U	2.5 U	2.5 U
1,1-Dichloroethane	9.3	<u>50</u> U	<u>25</u> U	1 U	5 U	2.5 U	2.5 U	2.5 U
1,1-Dichloroethene	1,200	50 U	25 U	1 U	5 U	2.5 U	2.5 U	2.5 U
1,2-Dichloroethane	9.3	<u>50</u> U	<u>25</u> U	1 U	5 U	2.5 U	2.5 U	2.5 U
Tetrachloroethene	4.9	<u>50</u> U	<u>25</u> U	1 U	<u>5</u> U	2.5 U	2.5 U	2.5 U
trans-1,2-Dichloroethene	600	47.2 JD	25 U	0.789 JD	3.78 JD	2.8 JD	1.67 JD	1.84 JD

Table D-15. OU 1 2017 cVOCs in Surface Water Samples (µg/L)

	Location Name	SW1-07	SW1-08	SW1-09	SW1-10	SW1-11	SW1-12
	Sample Name	SW1-07-171026	SW1-08-171026	SW1-09-171026	SW1-10-171026	SW1-11-171026	SW1-12-171026
	Sample Type	N	N	N	N	N	N
Analyte	**PAL**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
cis-1,2-Dichloroethene	600	62 D	50.5 D	41.1 D	**6,640** D	246 D	229 D
Trichloroethene	0.382	**10.1** D	**9.18** D	**58.6** D	<u>25</u> U	**10.3** D	**9.33** D
Vinyl Chloride	0.021	**0.606** JD	<u>1</u> U	**9.62** D	**4,330** D	**51.8** D	**45.3** D
1,1,1-Trichloroethane	47,000	1 U	1 U	1 U	25 U	2.5 U	2.5 U
1,1-Dichloroethane	9.3	1 U	1 U	1 U	<u>25</u> U	2.5 U	2.5 U
1,1-Dichloroethene	1,200	1 U	1 U	0.644 JD	13.3 JD	2.5 U	2.5 U
1,2-Dichloroethane	9.3	1 U	1 U	1 U	<u>25</u> U	2.5 U	2.5 U
Tetrachloroethene	4.9	1 U	1 U	1 U	<u>25</u> U	2.5 U	2.5 U
trans-1,2-Dichloroethene	600	1 U	1 U	1 U	53.7 D	1.29 JD	1.42 JD

Notes:

Samples analyzed using EPA Method 8260C.

N – Sample is not part of a field duplicate pair

FD - Duplicate

P – Parent Sample of field duplicate

PAL - Project Action Limit

D - The reported value is from a dilution.

JD - The reported value is an estimated concentration. The reported value is from a dilution.

U - The analyte was not detected at or above the stated limit. (Sometimes validators will elevate the limit due to the "B" qualifier using the 5x/10x rule so this definition is different than the lab description).

Underlined values represent analytes not detected at or above the stated limit, which exceeds the PAL.

Bolded values indicate that the reported concentration exceeds the PAL. µg/L - micrograms per liter

Table D-16. OU 1 2017 cVOCs in Stormwater Samples (µg/L)

	Location Name	08-705-STORMW		MH-STORMW			
	Sample Name	08-705-STORMW-171115		FD-171115-01		MH-STORMW-171115	
	Sample Type	N		FD		P	
Analyte	PAL	Result		Result		Result	
cis-1,2-Dichloroethene	600	1.14	JD	1	U	1	U
Trichloroethene	0.382	<u>1</u>	U	<u>1</u>	U	<u>1</u>	U
Vinyl Chloride	0.021	<u>1</u>	U	<u>1</u>	U	<u>1</u>	U
1,1,1-Trichloroethane	47,000	1	U	1	U	1	U
1,1-Dichloroethane	9.3	1	U	1	U	1	U
1,1-Dichloroethene	1,200	1	U	1	U	1	U
1,2-Dichloroethane	9.3	1	U	1	U	1	U
Tetrachloroethene	4.9	1	U	1	U	1	U
trans-1,2-Dichloroethene	600	1	U	1	U	1	U

Notes:

Samples analyzed using EPA Method 8260C.

FD - Field Duplicate

P – Parent sample of a field duplicate pair

N – Sample is not part of a field duplicate pair

PAL - Project Action Limit

U - The analyte was analyzed but not detected at or above the stated limit. (Sometimes validators will elevate the limit due to the "B" qual using the 5x/10x rule so this definition is different than the lab description).

JD - The reported value is an estimated concentration. The reported value is from a dilution.

µg/L - micrograms per liter

<u>Underlined</u> values represent analytes not detected at or above the stated limit, which exceeds the PAL.

Bolded values indicate that the reported concentration exceeds the PAL.

Table D-17. Summary of Analytical Results for cVOCs, Methane, and Helium in Soil Gas Samples

Sample ID:	**Soil Gas Screening Level**		**SV-01**	**SV-02**	**SV-03**	**SV-04**	**SV-05**	**SV-06**	**SV-11**	**SV-12**		**SV-13**
Sample Date:	**Ecology MTCA**	**EPA[b]**	**8/30/2016**	**8/30/2016**	**8/30/2016**	**8/30/2016**	**8/30/2016**	**8/30/2016**	**9/8/2016**	**9/8/2016**		**9/8/2016**
Other:	**Method B[a]**										**DUP**	
Chlorinated Volatile Organic Compounds (ug/m3)												
1,1-Dichloroethane	52	260	21	3.2 J	2.9 J	3.3 J	0.64 U	25 U	24 U	24 U	39 U	2.3 U
Chloroethane	NE	NE	4.4 J	4.1	3.4 U	3.7 U	0.61 U	24 U	23 U	22 U	38 U	0.98 J
Tetrachloroethene	320	1,600	3.7 U	2.6 U	3.4 U	3.7 U	0.42 J	24 U	23 U	22 U	38 U	6
trans-1,2-Dichloroethene	NE	NE	310	29	5.5	5.4	0.64 U	68	24 U	24 U	39 U	89
1,1-Dichloroethene	3,050	29,000	140	49	7.5	3.9 U	0.66 U	130	24 U	24 U	40 U	39
1,2-Dichloroethane	3.2	16	3.9 U	2.8 U	3.6 U	3.8 U	0.42 J	25 U	24 U	24 U	39 U	2.3 U
1,1,1-Trichloroethane	76,000	730,000	3.8 U	2.7 U	3.5 U	3.7 U	0.63 U	24 U	23 U	23 U	39 U	2.2 U
Trichloroethene	12	100	**120**	**79**	**22**	3.7 U	0.23 J	**210**	23 U	**15 J**	**16 J**	**420**
cis-1,2-Dichloroethene	NE	NE	1,900 D	220	110	23	0.66 U	470	11 J	42	43 J	760 D
Vinyl Chloride	9.3	93	**9,100 D**	**150**	**13**	**150**	0.61 U	**1,400**	23 U	**82**	**89**	**39**
Methane (mg/m^3)	NE	NE	60,000	100,000	36,000	130,000	4.6	150,000	190,000	19,000	19,000	2,200
Helium (ppmv)[c]	NE	NE	NA	NA	NA	NA	NA	NA	92	2,800	5,200	6.7
TWA Helium (ppmv in shroud)[d]	NE	NE	NA	NA	NA	NA	NA	NA	38,000	60,700	70,200	77,000
Helium (% as ratio)[e]	NA		NA	NA	NA	NA	NA	NA	0.24	4.6	7.4	0.0087

Notes:
Bold value indicates that the reported result exceeds the lowest soil gas screening level.
Shaded value indicates the reporting limit exceeds the lowest soil gas screening level.
[a]Model Toxics Control Act (MTCA) Cleanup Regulation, WAC 173-340. MTCA values are from Ecology website CLARC tables dated August 2015. (https://fortress.wa.gov/ecy/clarc/CLARCDataTables.aspx)
[b] United States Environmental Protection Agency (USEPA) Vapor Intrusion Screening Levels (VISLs) from Vapor Intrusion Screening Level Calculator with May 2016 Regional Screening Levels. (https://www.epa.gov/vaporintrusion/vapor-intrusion-screening-levels-visls).
[c] Helium concentration within sampling shroud enclosing the sampling apparatus was measured in field at the time of sampling. Time-weighted average of concentrations throughout the duration of sampling was used comparison to the laboratory results (Appendix H).
[d] Values converted from mg/m^3.
[e] Helium concentration in sample canister expressed as a percentage of the concentration in the sampling shroud at the time of sampling. Leak tests results are considered passing results if the percentage is less than 10 perce

% - percent
D - reported result is from a dilution
EPA - U.S. Environmental Protection Agency
J - estimated value
ug/m^3 - micrograms per cubic meter
mg/m3 - milligrams per cubic meter
MTCA - Model Toxics Control Act
NA - not applicable
NE - not established
ppmv - parts per million by volume
DUP - field duplicate sample
TWA - time-weighted average
U - compound was analyzed for but not detected above the reporting limit shown.
VOC - volatile organic compound

Table D-18. OU 1 2018 Vapor Intrusion Sampling Results – Building 916

				Analyte Name	Tetrachloroethene		Trichloroethene		cis-1,2-Dichloroethene		trans-1,2-Dichloroethene		1,1-Dichloroethene		Vinyl chloride		1,4-Dioxane		Methane[1]
				PAL Air - Indoor (µg/m^3)	**40**		**2**		**NE**		**60**		**200**		**2.8**		**5**		**3,280,164**
				PAL Soil Gas – Sub-slab (µg/m3)	**1330**		**66.7**		**NE**		**2000**		**6670**		**93.3**		**167**		**3,280,164**
Location Name	**Sample Name**	**Sample Type**	**Collect Date**	**Description**	**Result (µg/m^3)**														
March																			
B916-IA-1	OU1-B916-IA-1-180320	P	3/20/2018	Air - Indoor	0.12		0.014	U	0.034	J	0.013	J	0.078		0.02	J	0.049	J	2,200
B916-IA-1	OU1-B916-IA-2-180320	FD	3/20/2018	Air - Indoor	0.099		0.012	U	0.033	J	0.011	U	0.073		0.017	J	0.053	J	2,100
B916-IA-1				Air - Indoor- Corrected	0.077		0		0		0		0.067		0.009	J	0.031	J	200
B916-SS-1	OU1-B916-SS-1-180321	P	3/21/2018	Soil Gas – Sub-slab	0.82	U	0.82	U	0.94	U	1.1	U	1	U	1	U	0.94	U	3,400
B916-SS-1	OU1-B916-SS-2-180321	FD	3/21/2018	Soil Gas – Sub-slab	0.86	U	1	J	0.98	U	1.2	U	1	U	1	U	0.98	U	3,300
OA-4	OU1-OA-4-180320	N	3/20/2018	Air - Outdoor	0.043		0.035		0.043		0.015	J	0.011	J	0.011	J	0.022	J	2,000
July																			
B916-IA-1	OU1-B916-IA-1-180724	P	7/24/2018	Air - Indoor	0.029	J	0.035	U	0.035	U	0.037	U	0.021	J	0.052		0.028	J	2,000
B916-IA-1	OU1-B916-IA-2-180724	FD	7/24/2018	Air - Indoor	0.033	J	0.033	U	0.033	U	0.035	U	0.024	J	0.052		0.034	J	1,800
B916-IA-1				Air - Indoor- Corrected	0		0.033	U	0.033	U	0.035	U	0.024	J	0.052		0.001	J	100
B916-SS-1	OU1-B916-SS-1-180725	P	7/25/2018	Soil Gas – Sub-slab	0.45	J	0.62	U	0.62	U	0.62	U	0.62	U	0.62	U	0.62	U	690
B916-SS-1	OU1-B916-SS-2-180725	FD	7/25/2018	Soil Gas – Sub-slab	0.35	J	0.67	U	0.67	U	0.67	U	0.67	U	0.67	U	0.67	U	800
OA-5	OU1-OA-5-180724	N	7/24/2018	Air - Outdoor	0.064	J	0.033	U	0.033	U	0.035	U	0.033	U	0.033	U	0.033	J	1,900

Notes:

[1] – Because the PAL for methane is based on the lower explosive limit (LEL), no attenuation factor was applied. That is, the PAL for both sub-slab vapor and indoor air was established as 10% LEL.

Bold text indicates a concentration that exceeds the PAL

FD – field duplicate; µg/m^3 – micrograms per cubic meter; N – normal sample, with no paired field duplicate; NE – not established; P – parent sample of field duplicate; PAL – project action limit

Decision rules:

For outdoor air samples with field duplicates, the outdoor sample with the minimum concentration was used to compare to the indoor air sample.

When an analyte is not detected in outdoor air, then the maximum detected indoor air concentration is selected as the indoor air corrected value.

When an analyte is detected in outdoor air but not detected in indoor air and the reporting limit is ***below*** the detected outdoor air concentration, then the corrected indoor value is zero.

When an analyte is detected in outdoor air but not detected in indoor air and the reporting limit is ***above*** the detected outdoor air concentration, then the minimum detection limit in indoor air is selected as the corrected indoor value.

If the indoor air sample concentration is less than outdoor air concentration, then the indoor air corrected is zero (no contribution from SSV or indoor air sources; indoor air value is no different from outdoor air)

If the indoor air sample concentration is greater than outdoor air concentration, the indoor air corrected is calculated as follows: Indoor air – Outdoor air

Table D-19. OU 1 2018 Vapor Intrusion Sampling Results – Building 944

				Analyte Name	Tetrachloroethene	Trichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	1,1-Dichloroethene	Vinyl chloride	1,4-Dioxane	Methane[1]
				PAL Air – Indoor ($\mu g/m^3$)	40	2	NE	60	200	2.8	5	3,280,164
				PAL Soil Gas – Sub-slab ($\mu g/m3$)	1330	66.7	NE	2000	6670	93.3	167	3,280,164
Location Name	Sample Name	Sample Type	Collect Date	Description	Result ($\mu g/m^3$)							
March												
B944-IA-1	OU1-B944-IA-1-180320	P	3/20/2018	Air - Indoor	0.063	0.013 U	0.06	0.011 U	0.013 U	0.012 U	0.2	1,900
B944-IA-1	OU1-B944-IA-2-180320	FD	3/20/2018	Air - Indoor	0.059	0.012 U	0.058	0.011 U	0.013 U	0.011 U	0.023 J	1,900
				Air - Indoor- Corrected	0.02	0	0.017	0	0.013 U	0.011 U	0.178	0
B944-SS-1	OU1-B944-SS-1-180321	P	3/21/2018	Soil Gas – Sub-slab	0.56 U	0.56 U	0.64 U	0.76 U	0.68 U	0.68 U	0.64 U	1,700
B944-SS-1	OU1-B944-SS-2-180321	FD	3/21/2018	Soil Gas – Sub-slab	0.55 U	0.55 U	0.62 U	0.74 U	0.66 U	0.66 U	0.62 U	1,700
OA-4	OU1-OA-4-180320	N	3/20/2018	Air - Outdoor	0.043	0.035	0.043	0.015 J	0.011 J	0.011 J	0.022 J	2,000
July												
B944-IA-1	OU1-B944-IA-1-180724	P	7/24/2018	Air - Indoor	0.075	0.033 U	0.033 U	0.035 U	0.033 U	0.033 U	0.071 J	1,900
B944-IA-1	OU1-B944-IA-2-180724	FD	7/24/2018	Air - Indoor	0.074	0.031 U	0.031 U	0.032 U	0.031 U	0.031 U	0.06 J	1,800
				Air - Indoor- Corrected	0.011	0.031 U	0.031 U	0.032 U	0.031 U	0.031 U	0.038 J	0
B944-SS-1	OU1-B944-SS-1-180725	P	7/25/2018	Soil Gas – Sub-slab	0.27 J	0.67 U	0.67 U	0.67 U	0.67 U	0.67 U	0.6 J	1,500
B944-SS-1	OU1-B944-SS-2-180725	FD	7/25/2018	Soil Gas – Sub-slab	0.63 U	0.63 U	0.63 U	0.63 U	0.63 U	0.63 U	0.63 U	1,400
OA-5	OU1-OA-5-180724	N	7/24/2018	Air - Outdoor	0.064 J	0.033 U	0.033 U	0.035 U	0.033 U	0.033 U	0.033 J	1,900

Notes:

[1] – Because the PAL for methane is based on the lower explosive limit (LEL), no attenuation factor was applied. That is, the PAL for both sub-slab vapor and indoor air was established as 10% LEL.

Bold text indicates a concentration that exceeds the PAL

FD - field duplicate; $\mu g/m^3$ - micrograms per cubic meter; N - normal sample, with no paired field duplicate; NE - not established; P - parent sample of field duplicate; PAL - project action limit

Decision rules:

For outdoor air samples with field duplicates, the outdoor sample with the minimum concentration was used to compare to the indoor air sample.

When an analyte is not detected in outdoor air, then the maximum detected indoor air concentration is selected as the indoor air corrected value.

When an analyte is detected in outdoor air but not detected in indoor air and the reporting limit is ***below*** the detected outdoor air concentration, then the corrected indoor value is zero.

When an analyte is detected in outdoor air but not detected in indoor air and the reporting limit is ***above*** the detected outdoor air concentration, then the minimum detection limit in indoor air is selected as the corrected indoor value.

If the indoor air sample concentration is less than outdoor air concentration, then the indoor air corrected is zero (no contribution from SSV or indoor air sources; indoor air value is no different from outdoor air)

If the indoor air sample concentration is greater than outdoor air concentration, the indoor air corrected is calculated as follows: Indoor air - Outdoor air

Table D-20. OU 1 2018 Vapor Intrusion Sampling Results – Building 945

				Analyte Name	**Tetrachloroethene**	**Trichloroethene**	**cis-1,2-Dichloroethene**	**trans-1,2-Dichloroethene**	**1,1-Dichloroethene**	**Vinyl chloride**	**1,4-Dioxane**	**Methane[1]**
				PAL Air - Indoor (µg/m^3)	**40**	**2**	**NE**	**60**	**200**	**2.8**	**5**	**3,280,164**
				PAL Soil Gas – Sub-slab (µg/m3)	**1330**	**66.7**	**NE**	**2000**	**6670**	**93.3**	**167**	**3,280,164**
Location Name	**Sample Name**	**Sample Type**	**Collect Date**	**Description**	**Result (µg/m^3)**							
March												
B945-IA-1	OU1-B945-IA-1-180320	P	3/20/2018	Air - Indoor	0.074	0.021 J	0.089	0.011 U	0.041	0.011 U	0.02 J	1,900
B945-IA-1	OU1-B945-IA-2-180320	FD	3/20/2018	Air - Indoor	0.069	0.024 J	0.093	0.0092 U	0.043	0.011 J	0.12 J	1,800
				Air - Indoor- Corrected	0.031	0	0.05	0	0.032	0	0.098 J	0
B945-SS-1	OU1-B945-SS-1-180321	P	3/21/2018	Soil Gas – Sub-slab	0.77 U	0.77 U	0.88 U	1 U	0.93 U	0.93 U	0.88 U	1,000
B945-SS-1	OU1-B945-SS-2-180321	FD	3/21/2018	Soil Gas – Sub-slab	0.75 U	0.75 U	0.86 U	1 U	0.91 U	0.91 U	0.86 U	1,000
OA-4	OU1-OA-4-180320	N	3/20/2018	Air - Outdoor	0.043	0.035	0.043	0.015 J	0.011 J	0.011 J	0.022 J	2,000
July												
B945-IA-1	OU1-B945-IA-1-180724	P	7/24/2018	Air - Indoor	0.041	0.033 U	0.033 U	0.035 U	0.073	0.033 U	0.068 J	2,000
B945-IA-1	OU1-B945-IA-2-180724	FD	7/24/2018	Air - Indoor	0.031 J	0.034 U	0.034 U	0.036 U	0.069	0.034 U	0.05 J	2,000
				Air - Indoor- Corrected	0	0.033 U	0.033 U	0.035 U	0.073	0.033 U	0.035 J	100
B945-SS-1	OU1-B945-SS-1-180725	P	7/25/2018	Soil Gas – Sub-slab	0.5 J	0.72 J	0.87 J	0.67 U	0.67 U	0.67 U	0.67 U	850
B945-SS-1	OU1-B945-SS-2-180725	FD	7/25/2018	Soil Gas – Sub-slab	0.5 J	0.64 U	0.64 U	0.64 U	0.64 U	0.64 U	0.64 U	800
OA-5	OU1-OA-5-180724	N	7/24/2018	Air - Outdoor	0.064 J	0.033 U	0.033 U	0.035 U	0.033 U	0.033 U	0.033 J	1,900

Notes:

[1] – Because the PAL for methane is based on the lower explosive limit (LEL), no attenuation factor was applied. That is, the PAL for both sub-slab vapor and indoor air was established as 10% LEL.

Bold text indicates a concentration that exceeds the PAL

FD - field duplicate; µg/m^3 - micrograms per cubic meter; N - normal sample, with no paired field duplicate; NE - not established; P - parent sample of field duplicate; PAL - project action limit

Decision rules:

For outdoor air samples with field duplicates, the outdoor sample with the minimum concentration was used to compare to the indoor air sample.

When an analyte is not detected in outdoor air, then the maximum detected indoor air concentration is selected as the indoor air corrected value.

When an analyte is detected in outdoor air but not detected in indoor air and the reporting limit is ***below*** the detected outdoor air concentration, then the corrected indoor value is zero.

When an analyte is detected in outdoor air but not detected in indoor air and the reporting limit is ***above*** the detected outdoor air concentration, then the minimum detection limit in indoor air is selected as the corrected indoor value.

If the indoor air sample concentration is less than outdoor air concentration, then the indoor air corrected is zero (no contribution from SSV or indoor air sources; indoor air value is no different from outdoor air)

If the indoor air sample concentration is greater than outdoor air concentration, the indoor air corrected is calculated as follows: Indoor air - Outdoor air

Table D-21. OU 1 2018 Vapor Intrusion Sampling Results – Building 893

				Analyte Name	Tetrachloroethene	Trichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	1,1-Dichloroethene	Vinyl chloride	1,4-Dioxane	Methane[1]
				PAL Air - Indoor (μg/m^3)	40	2	NE	60	200	2.8	5	3,280,164
				PAL Soil Gas – Sub-slab (μg/m3)	1330	66.7	NE	2000	6670	93.3	167	3,280,164
Location Name	Sample Name	Sample Type	Collect Date	Description	Result (μg/m^3)							
March												
B893-IA-1	OU1-B893-IA-1-180320	N	3/20/2018	Air - Indoor	0.04	0.074	0.1	0.015 J	0.013 U	0.012 U	0.019 J	2,800
				Air - Indoor- Corrected	0.011	0.074	0.1	0.015 J	0.013 U	0.012 U	0.019 J	1,000
B893-SS-1	OU1-B893-SS-1-180321	N	3/21/2018	Soil Gas – Sub-slab	5.8 U	5.8 U	6.6 U	7.8 U	7 U	7 U	6.6 U	1,100
B893-IA-2	OU1-B893-IA-2-180320	N	3/20/2018	Air - Indoor	0.042	0.018 J	0.068	0.015 J	0.013 U	0.012 U	0.038 J	2,500
				Air - Indoor- Corrected	0.013	0.018 J	0.068	0.015 J	0.013 U	0.012 U	0.038 J	700
B893-SS-2	OU1-B893-SS-2-180321	N	3/21/2018	Soil Gas – Sub-slab	210	8.2 J	8.7 U	10 U	9.2 U	9.2 U	8.7 U	1,100
B893-IA-3	OU1-B893-IA-3-180320	N	3/20/2018	Air - Indoor	0.04	0.013 J	0.047	0.017 J	0.013 U	0.011 U	0.013 J	2,200
				Air - Indoor- Corrected	0.011	0.013 J	0.047	0.017 J	0.013 U	0.011 U	0.013 J	400
B893-SS-3	OU1-B893-SS-3-180322	N	3/22/2018	Soil Gas – Sub-slab	7.8	0.87 U	1 U	1.2 U	1.1 U	1.1 U	1 U	830
B893-IA-4	OU1-B893-IA-4-180320	P	3/20/2018	Air - Indoor	0.036 J	0.013 U	0.039 J	0.014 J	0.013 U	0.012 U	0.013 U	2,200
B893-IA-4	OU1-B893-IA-8-180320	FD	3/20/2018	Air - Indoor	0.039	0.015 J	0.052 J	0.014 J	0.013 U	0.012 U	0.013 U	2,200
				Air - Indoor- Corrected	0.01	0.015	0.052 J	0.014 J	0.013 U	0.012 U	0.013 U	400
B893-SS-4	OU1-B893-SS4-180322	N	3/22/2018	Soil Gas – Sub-slab	0.82 U	0.82 U	0.94 U	1.1 U	1 U	1 U	0.94 U	840
B893-IA-5	OU1-B893-IA-5-180320	N	3/20/2018	Air - Indoor	0.04	0.025 J	0.071	0.015 J	0.012 U	0.01 U	0.037 J	2,300
				Air - Indoor- Corrected	0.011	0.025 J	0.071	0.015 J	0.012 U	0.01 U	0.037 J	500
B893-SS-5	OU1-B893-SS5-180322	N	3/22/2018	Soil Gas – Sub-slab	0.93 U	0.93 U	1.1 U	1.3 U	1.1 U	1.1 U	1.1 U	970
B893-IA-7	OU1-B893-IA-7-180320	N	3/20/2018	Air - Indoor	0.041	0.016 J	0.067	0.015 J	0.013 U	0.012 U	0.016 J	2,500
				Air - Indoor- Corrected	0.012	0.016 J	0.067	0.015 J	0.013 U	0.012 U	0.016 J	700
OA-7	OU1-OA-7-180320	N	3/20/2018	Air - Outdoor	0.029 J	0.012 U	0.013 U	0.01 U	0.012 U	0.011 U	0.012 U	1,800
B893-IA-6	OU1-B893-IA-6-180321	N	3/21/2018	Air - Indoor	0.036	0.015 J	0.084	0.011 J	0.012 U	0.01 U	0.011 U	2,100
				Air - Indoor- Corrected	0.012	0.015 J	0.051	0.011 J	0.012 U	0.01 U	0.011 U	100
B893-SS-6	OU1-B893-SS6-180322	N	3/22/2018	Soil Gas – Sub-slab	0.82 U	0.82 U	0.94 U	1.1 U	1 U	1 U	0.94 U	1,800
B893-SS-7	OU1-B893-SS-7-180321	P	3/21/2018	Soil Gas – Sub-slab	1.6 J	0.68 J	0.62 U	0.74 U	0.66 U	0.66 U	0.62 U	1,500 J
B893-SS-7	OU1-B893-SS-8-180321	FD	3/21/2018	Soil Gas – Sub-slab	1.6 J	0.83 J	0.64 U	0.76 U	0.68 U	0.68 U	0.64 U	1,100 J
OA-8	OU1-OA-8-180321	N	3/21/2018	Air - Outdoor	0.024 J	0.013 U	0.033 J	0.011 U	0.013 U	0.012 U	0.013 U	2,000

Table D-21. OU 1 2018 Vapor Intrusion Sampling Results – Building 893

				Analyte Name	**Tetrachloroethene**	**Trichloroethene**	**cis-1,2-Dichloroethene**	**trans-1,2-Dichloroethene**	**1,1-Dichloroethene**	**Vinyl chloride**	**1,4-Dioxane**	**Methane[1]**
				PAL Air - Indoor (μg/m^3)	**40**	**2**	**NE**	**60**	**200**	**2.8**	**5**	**3,280,164**
				PAL Soil Gas – Sub-slab (μg/m3)	**1330**	**66.7**	**NE**	**2000**	**6670**	**93.3**	**167**	**3,280,164**
Location Name	**Sample Name**	**Sample Type**	**Collect Date**	**Description**	**Result (μg/m^3)**							
					July							
B893-IA-1	OU1-B893-IA-1-180724	P	7/24/2018	Air - Indoor	0.051	0.034 U	0.034 U	0.036 U	0.034 U	0.034 U	0.035 J	2,100
B893-IA-1	OU1-B893-IA-8-180724	FD	7/24/2018	Air - Indoor	0.039	0.032 U	0.032 U	0.033 U	0.032 U	0.032 U	0.037 J	2,200
				Air - Indoor- Corrected	0.021	0.032 U	0.032 U	0.033 U	0.032 U	0.032 U	0.037 J	300
B893-SS-1	OU1-B893-SS-1-180725	N	7/25/2018	Soil Gas – Sub-slab	1.1 J	0.66 U	0.66 U	0.66 U	0.66 U	0.66 U	0.66 U	700
B893-IA-2	OU1-B893-IA-2-180724	N	7/24/2018	Air - Indoor	0.048	0.034 U	0.034 U	0.012 J	0.034 U	0.034 U	0.42	2,100
				Air - Indoor- Corrected	0.018	0.034 U	0.034 U	0.012 J	0.034 U	0.034 U	0.42	200
B893-SS-2	OU1-B893-SS-2-180725	N	7/25/2018	Soil Gas – Sub-slab	0.47 J	0.67 U	0.67 U	0.67 U	0.67 U	0.67 U	0.67 U	820
B893-IA-3	OU1-B893-IA-3-180724	N	7/24/2018	Air - Indoor	0.081	0.054	0.037 U	0.039 U	0.037 U	0.037 U	0.033 J	2,000
				Air - Indoor- Corrected	0.051	0.054	0.037 U	0.039 U	0.037 U	0.037 U	0.033 J	100
B893-SS-3	OU1-B893-SS-3-180725	N	7/25/2018	Soil Gas – Sub-slab	6	0.64 U	0.64 U	0.64 U	0.64 U	0.64 U	0.64 U	900
B893-IA-4	OU1-B893-IA-4-180724	N	7/24/2018	Air - Indoor	0.065	0.042 U	0.042 U	0.044 U	0.042 U	0.042 U	0.049 J	2,100
				Air - Indoor- Corrected	0.035	0.042 U	0.042 U	0.044 U	0.042 U	0.042 U	0.049 J	200
B893-SS-4	OU1-B893-SS-4-180725	N	7/25/2018	Soil Gas – Sub-slab	0.95 J	0.68 U	0.68 U	0.68 U	0.68 U	0.68 U	0.68 U	970
B893-IA-5	OU1-B893-IA-5-180724	N	7/24/2018	Air - Indoor	0.033 J	0.032 U	0.032 U	0.033 U	0.032 U	0.032 U	0.026 J	1,900
				Air - Indoor- Corrected	0.003 J	0.032 U	0.032 U	0.033 U	0.032 U	0.032 U	0.026 J	0
B893-SS-5	OU1-B893-SS-5-180725	N	7/25/2018	Soil Gas – Sub-slab	0.46 J	0.67 U	0.67 U	0.67 U	0.67 U	0.67 U	15	740
B893-IA-6	OU1-B893-IA-6-180724	N	7/24/2018	Air - Indoor	0.044	0.034 U	0.034 U	0.035 U	0.034 U	0.034 U	0.037 J	1,900
				Air - Indoor- Corrected	0.014	0.034 U	0.034 U	0.035 U	0.034 U	0.034 U	0.004 J	0
B893-SS-6	OU1-B893-SS-6-180725	N	7/25/2018	Soil Gas – Sub-slab	1.2 J	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.46 J	1,800
B893-IA-7	OU1-B893-IA-7-180724	N	7/24/2018	Air - Indoor	0.049	0.036 U	0.036 U	0.038 U	0.036 U	0.036 U	0.038 J	2,000
				Air - Indoor- Corrected	0.019	0.036 U	0.036 U	0.038 U	0.036 U	0.036 U	0.038 J	100
B893-SS-7	OU1-B893-SS-7-180725	P	7/25/2018	Soil Gas – Sub-slab	2.6	0.68 U	0.68 U	0.68 U	0.68 U	0.68 U	1.1 J	670
B893-SS-7	OU1-B893-SS-8-180725	FD	7/25/2018	Soil Gas – Sub-slab	2.6	0.62 U	0.62 U	0.62 U	0.62 U	0.62 U	0.62 U	580
OA-4	OU1-OA-4-180724	N	7/24/2018	Air - Outdoor	0.03 J	0.033 U	0.033 U	0.035 U	0.033 U	0.033 U	0.033 U	1,900

Notes:

[1] – Because the PAL for methane is based on the lower explosive limit (LEL), no attenuation factor was applied. That is, the PAL for both sub-slab vapor and indoor air was established as 10% LEL.

Bold text indicates a concentration that exceeds the PAL

FD - field duplicate; μg/m^3 - micrograms per cubic meter; N - normal sample, with no paired field duplicate; NE - not established; P - parent sample of field duplicate; PAL - project action limit

Decision rules:

For outdoor air samples with field duplicates, the outdoor sample with the minimum concentration was used to compare to the indoor air sample.

When an analyte is not detected in outdoor air, then the maximum detected indoor air concentration is selected as the indoor air corrected value.

When an analyte is detected in outdoor air but not detected in indoor air and the reporting limit is ***below*** the detected outdoor air concentration, then the corrected indoor value is zero.

When an analyte is detected in outdoor air but not detected in indoor air and the reporting limit is ***above*** the detected outdoor air concentration, then the minimum detection limit in indoor air is selected as the corrected indoor value.

If the indoor air sample concentration is less than outdoor air concentration, then the indoor air corrected is zero (no contribution from SSV or indoor air sources; indoor air value is no different from outdoor air)

If the indoor air sample concentration is greater than outdoor air concentration, the indoor air corrected is calculated as follows: Indoor air - Outdoor air

Table D-22. OU 1 2018 Vapor Intrusion Sampling Results – Building 820

				Analyte Name	Tetrachloroethene	Trichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	1,1-Dichloroethene	Vinyl chloride	1,4-Dioxane	Methane[1]
				PAL Air - Indoor (μg/m³)	**40**	**2**	**NE**	**60**	**200**	**2.8**	**5**	**3,280,164**
				PAL Soil Gas – Sub-slab (μg/m3)	**1330**	**66.7**	**NE**	**2000**	**6670**	**93.3**	**167**	**3,280,164**
Location Name	**Sample Name**	**Sample Type**	**Collect Date**	**Description**	**Result (μg/m³)**							
March												
B820-IA-1	OU1-B820-IA-1-180320	N	3/20/2018	Air - Indoor	0.032 J	0.013 U	0.036 J	0.011 U	0.013 U	0.011 U	0.013 U	1,900
				Air - Indoor- Corrected	0.005 J	0.013 U	0.036 J	0.011 U	0.013 U	0.011 U	0.013 U	100
B820-SS-1	OU1-B820-SS-1-180322	P	3/22/2018	Soil Gas – Sub-slab	2.2	18 J	3.2 J	0.74 U	0.66 U	0.66 U	1.6 J	1,000
B820-SS-1	OU1-B820-SS-4-180322	FD	3/22/2018	Soil Gas – Sub-slab	2.8	**96** J	12 J	0.89 U	0.79 U	0.79 U	2 J	930
B820-IA-2	OU1-B820-IA-2-180320	P	3/20/2018	Air - Indoor	0.032 J	0.015 J	0.046	0.011 U	0.012 U	0.011 U	0.012 U	1,800
B820-IA-2	OU1-B820-IA-4-180320	FD	3/20/2018	Air - Indoor	0.096	0.016 J	0.036	0.01 U	0.012 U	0.011 U	0.012 U	1,900
				Air - Indoor- Corrected	0.069	0.016 J	0.046	0.011 U	0.012 U	0.011 U	0.012 U	100
B820-SS-2	OU1-B820-SS-2-180322	N	3/22/2018	Soil Gas – Sub-slab	2.6	0.58 U	0.67 U	0.79 U	0.71 U	0.71 U	0.83 J	1,100
B820-IA-3	OU1-B820-IA-3-180320	N	3/20/2018	Air - Indoor	0.039	0.016 J	0.045	0.0099 U	0.012 U	0.01 U	0.073 J	1,900
				Air - Indoor- Corrected	0.012	0.016 J	0.045	0.0099 U	0.012 U	0.01 U	0.073 J	100
B820-SS-3	OU1-B820-SS-3-180322	N	3/22/2018	Soil Gas – Sub-slab	0.56 U	0.56 U	0.64 U	0.76 U	0.68 U	0.68 U	0.64 U	1,100
OA-6	OU1-OA-6-180320	N	3/20/2018	Air - Outdoor	0.027 J	0.012 U	0.013 U	0.01 U	0.012 U	0.01 U	0.012 U	1,800
July												
B820-IA-1	OU1-B820-IA-1-180724	N	7/24/2018	Air - Indoor	0.046	0.035 U	0.035 U	0.037 U	0.035 U	0.035 U	0.069 J	1,800
				Air - Indoor- Corrected	0.013	0.035 U	0.035 U	0.037 U	0.035 U	0.035 U	0.015 J	0
B820-SS-1	OU1-B820-SS-1-180725	P	7/25/2018	Soil Gas – Sub-slab	4.6	0.68 U	0.68 U	0.68 U	0.68 U	0.68 U	0.42 J	970 J
B820-SS-1	OU1-B820-SS-4-180725	FD	7/25/2018	Soil Gas – Sub-slab	4.7	0.67 U	0.67 U	0.67 U	0.67 U	0.67 U	0.55 J	740 J
B820-IA-2	OU1-B820-IA-2-180724	P	7/24/2018	Air - Indoor	0.11	0.013 J	0.029 U	0.063	0.029 U	0.029 U	0.023 J	2,000
B820-IA-2	OU1-B820-IA-4-180724	FD	7/24/2018	Air - Indoor	0.036 J	0.033 U	0.033 U	0.035 U	0.033 U	0.033 U	0.035 J	1,900
				Air - Indoor- Corrected	0.077	0.013 J	0.029 U	0.063	0.029 U	0.029 U	0	200
B820-SS-2	OU1-B820-SS-2-180725	N	7/25/2018	Soil Gas – Sub-slab	4.5	0.64 U	0.64 U	0.64 U	0.64 U	0.64 U	0.5 J	860
B820-IA-3	OU1-B820-IA-3-180724	N	7/24/2018	Air - Indoor	0.044	0.034 U	0.034 U	0.036 U	0.034 U	0.034 U	0.022 J	2,000
				Air - Indoor- Corrected	0.011	0.034 U	0.034 U	0.036 U	0.034 U	0.034 U	0	200
B820-SS-3	OU1-B820-SS-3-180725	N	7/25/2018	Soil Gas – Sub-slab	1.4 J	0.68 U	0.68 U	0.68 U	0.68 U	0.68 U	0.45 J	750
OA-3	OU1-OA-3-180724	N	7/24/2018	Air - Outdoor	0.033 J	0.034 U	0.034 U	0.036 U	0.034 U	0.034 U	0.054 J	1,800

Notes:

[1] – Because the PAL for methane is based on the lower explosive limit (LEL), no attenuation factor was applied. That is, the PAL for both sub-slab vapor and indoor air was established as 10% LEL.

Bold text indicates a concentration that exceeds the PAL

FD - field duplicate; μg/m³ - micrograms per cubic meter; N - normal sample, with no paired field duplicate; NE - not established; P - parent sample of field duplicate; PAL - project action limit

Decision rules:

For outdoor air samples with field duplicates, the outdoor sample with the minimum concentration was used to compare to the indoor air sample.

When an analyte is not detected in outdoor air, then the maximum detected indoor air concentration is selected as the indoor air corrected value.

When an analyte is detected in outdoor air but not detected in indoor air and the reporting limit is ***below*** the detected outdoor air concentration, then the corrected indoor value is zero.

When an analyte is detected in outdoor air but not detected in indoor air and the reporting limit is ***above*** the detected outdoor air concentration, then the minimum detection limit in indoor air is selected as the corrected indoor value.

If the indoor air sample concentration is less than outdoor air concentration, then the indoor air corrected is zero (no contribution from SSV or indoor air sources; indoor air value is no different from outdoor air)

If the indoor air sample concentration is greater than outdoor air concentration, the indoor air corrected is calculated as follows: Indoor air - Outdoor air

Table D-23. OU 1 2018 Vapor Intrusion Sampling Results – Building 950

				Analyte Name	Tetrachloroethene	Trichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	1,1-Dichloroethene	Vinyl chloride	1,4-Dioxane	Methane[1]
				PAL Air - Indoor (µg/m³)	**40**	**2**	**NE**	**60**	**200**	**2.8**	**5**	**3,280,164**
				PAL Soil Gas – Sub-slab (µg/m3)	**1330**	**66.7**	**NE**	**2000**	**6670**	**93.3**	**167**	**3,280,164**
Location Name	**Sample Name**	**Sample Type**	**Collect Date**	**Description**	**Result (µg/m³)**							
March												
B950-IA-1	OU1-B950-IA-1-180320	P	3/20/2018	Air - Indoor	0.15	0.049	0.24	0.011 U	0.013 U	0.011 U	0.085 J	2,100
B950-IA-1	OU1-B950-IA-2-180320	FD	3/20/2018	Air - Indoor	0.14	0.061	0.24	0.01 U	0.012 U	0.019 J	0.038 J	2,000
				Air - Indoor- Corrected	0.123	0.061	0.24	0.01 U	0.012 U	0.019 J	0.085 J	300
B950-SS-1	OU1-B950-SS-1-180323	P	3/23/2018	Soil Gas – Sub-slab	5.9	0.56 U	0.64 U	0.76 U	0.68 U	0.68 U	0.84 J	480,000
B950-SS-1	OU1-B950-SS-2-180323	FD	3/23/2018	Soil Gas – Sub-slab	7.3	0.54 U	0.62 U	0.74 U	0.66 U	0.66 U	0.85 J	560,000
OA-6	OU1-OA-6-180320	N	3/20/2018	Air - Outdoor	0.027 J	0.012 U	0.013 U	0.01 U	0.012 U	0.01 U	0.012 U	1,800
July												
B950-IA-1	OU1-B950-IA-1-180724	P	7/24/2018	Air - Indoor	0.37	0.022 J	0.035 J	0.018 J	0.035 U	0.035 U	0.035 J	1,900
B950-IA-1	OU1-B950-IA-2-180724	FD	7/24/2018	Air - Indoor	0.45	0.023 J	0.034 J	0.016 J	0.033 U	0.033 U	0.034 J	1,900
				Air - Indoor- Corrected	0.417	0.023 J	0.035 J	0.018 J	0.033 U	0.033 U	0	100
B950-SS-1	OU1-B950-SS-1-180726	P	7/26/2018	Soil Gas – Sub-slab	5.3	0.37 J	0.69 U	0.69 U	0.69 U	0.69 U	0.69 U	**3,400,000**
B950-SS-1	OU1-B950-SS-2-180726	FD	7/26/2018	Soil Gas – Sub-slab	5.5	0.41 J	0.73 U	0.73 U	0.73 U	0.73 U	1 J	**3,500,000**
OA-3	OU1-OA-3-180724	N	7/24/2018	Air - Outdoor	0.033 J	0.034 U	0.034 U	0.036 U	0.034 U	0.034 U	0.054 J	1,800

Notes:

[1] – Because the PAL for methane is based on the lower explosive limit (LEL), no attenuation factor was applied. That is, the PAL for both sub-slab vapor and indoor air was established as 10% LEL.

Bold text indicates a concentration that exceeds the PAL

FD - field duplicate; µg/m³ - micrograms per cubic meter; N - normal sample, with no paired field duplicate; NE - not established; P - parent sample of field duplicate; PAL - project action limit

Decision rules:

For outdoor air samples with field duplicates, the outdoor sample with the minimum concentration was used to compare to the indoor air sample.

When an analyte is not detected in outdoor air, then the maximum detected indoor air concentration is selected as the indoor air corrected value.

When an analyte is detected in outdoor air but not detected in indoor air and the reporting limit is ***below*** the detected outdoor air concentration, then the corrected indoor value is zero.

When an analyte is detected in outdoor air but not detected in indoor air and the reporting limit is ***above*** the detected outdoor air concentration, then the minimum detection limit in indoor air is selected as the corrected indoor value.

If the indoor air sample concentration is less than outdoor air concentration, then the indoor air corrected is zero (no contribution from SSV or indoor air sources; indoor air value is no different from outdoor air)

If the indoor air sample concentration is greater than outdoor air concentration, the indoor air corrected is calculated as follows: Indoor air - Outdoor air

Table D-24. OU 1 2018 Vapor Intrusion Sampling Results – Building 951

				Analyte Name	Tetrachloroethene	Trichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	1,1-Dichloroethene	Vinyl chloride	1,4-Dioxane	Methane[1]
				PAL Air - Indoor ($\mu g/m^3$)	40	2	NE	60	200	2.8	5	3,280,164
				PAL Soil Gas – Sub-slab ($\mu g/m^3$)	1330	66.7	NE	2000	6670	93.3	167	3,280,164
Location Name	Sample Name	Sample Type	Collect Date	Description	Result ($\mu g/m^3$)							
March												
B951-IA-1	OU1-B951-IA-1-180320	N	3/20/2018	Air - Indoor	0.08	0.042	0.27	0.0096 U	0.011 U	0.019 J	0.063 J	2,100
				Air - Indoor- Corrected	0.053	0.042	0.27	0.0096 U	0.011 U	0.019 J	0.063 J	300
B951-SS-1	OU1-B951-SS-1-180323	N	3/23/2018	Soil Gas – Sub-slab	0.55 U	0.55 U	0.63 U	0.75 U	0.67 U	0.67 U	0.63 U	1,300
B951-IA-2	OU1-B951-IA-2-180320	N	3/20/2018	Air - Indoor	0.11	0.043	0.24	0.011 U	0.013 U	0.015 J	0.013 U	1,900
				Air - Indoor- Corrected	0.083	0.043	0.24	0.011 U	0.013 U	0.015 J	0.013 U	100
B951-SS-2	OU1-B951-SS-2-180323	N	3/23/2018	Soil Gas – Sub-slab	0.54 U	0.54 U	0.62 U	0.74 U	0.66 U	0.66 U	0.62 U	3,800
B951-IA-3	OU1-B951-IA-3-180320	P	3/20/2018	Air - Indoor	0.077	0.051	0.29	0.01 U	0.012 U	0.019 J	0.03 J	2,000
B951-IA-3	OU1-B951-IA-4-180320	FD	3/20/2018	Air - Indoor	0.082	0.048	0.32	0.01 U	0.012 U	0.021 J	0.069 J	2,000
				Air - Indoor- Corrected	0.055	0.051	0.32	0.01 U	0.012 U	0.021 J	0.069 J	200
B951-SS-3	OU1-B951-SS-3-180323	P	3/23/2018	Soil Gas – Sub-slab	6.8	3.9	1.1 J	0.73 U	0.65 U	0.65 U	0.61 U	1,400
B951-SS-3	OU1-B951-SS-4-180323	FD	3/23/2018	Soil Gas – Sub-slab	0.54 U	0.54 U	0.61 U	0.73 U	0.65 U	0.65 U	0.61 U	1,400
OA-6	OU1-OA-6-180320	N	3/20/2018	Air - Outdoor	0.027 J	0.012 U	0.013 U	0.01 U	0.012 U	0.01 U	0.012 U	1,800
July												
B951-IA-1	OU1-B951-IA-1-180724	N	7/24/2018	Air - Indoor	0.11	0.032 U	0.067	0.033 U	0.032 U	0.032 U	0.11 J	1,900
				Air - Indoor- Corrected	0.077	0.032 U	0.067	0.033 U	0.032 U	0.032 U	0.056 J	100
B951-SS-1	OU1-B951-SS-1-180726	N	7/26/2018	Soil Gas – Sub-slab	0.54 J	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	660
B951-IA-2	OU1-B951-IA-2-180724	N	7/24/2018	Air - Indoor	0.1	0.032 U	0.061	0.033 U	0.032 U	0.032 U	0.05 J	2,100
				Air - Indoor- Corrected	0.067	0.032 U	0.061	0.033 U	0.032 U	0.032 U	0	300
B951-SS-2	OU1-B951-SS-2-180726	N	7/26/2018	Soil Gas – Sub-slab	0.37 J	0.68 U	0.68 U	0.68 U	0.68 U	0.68 U	0.68 U	910
B951-IA-3	OU1-B951-IA-3-180724	P	7/24/2018	Air - Indoor	0.13 J	0.023 J	0.071	0.026 J	0.04 U	0.04 U	0.046 J	2,000
B951-IA-3	OU1-B951-IA-4-180724	FD	7/24/2018	Air - Indoor	0.089 J	0.013 J	0.085	0.033 U	0.032 U	0.013 J	0.074 J	2,100
				Air - Indoor- Corrected	0.097 J	0.023 J	0.085	0.026 J	0.032 U	0.013 J	0.02 J	300
B951-SS-3	OU1-B951-SS-3-180726	P	7/26/2018	Soil Gas – Sub-slab	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	650
B951-SS-3	OU1-B951-SS-4-180726	FD	7/26/2018	Soil Gas – Sub-slab	0.93 J	0.61 U	0.61 U	0.5 J	0.61 U	0.61 U	0.61 U	780
OA-3	OU1-OA-3-180724	N	7/24/2018	Air - Outdoor	0.033 J	0.034 U	0.034 U	0.036 U	0.034 U	0.034 U	0.054 J	1,800

Notes:

[1] – Because the PAL for methane is based on the lower explosive limit (LEL), no attenuation factor was applied. That is, the PAL for both sub-slab vapor and indoor air was established as 10% LEL.

Bold text indicates a concentration that exceeds the PAL

FD - field duplicate; $\mu g/m^3$ - micrograms per cubic meter; N - normal sample, with no paired field duplicate; NE - not established; P - parent sample of field duplicate; PAL - project action limit

Decision rules:

For outdoor air samples with field duplicates, the outdoor sample with the minimum concentration was used to compare to the indoor air sample.

When an analyte is not detected in outdoor air, then the maximum detected indoor air concentration is selected as the indoor air corrected value.

When an analyte is detected in outdoor air but not detected in indoor air and the reporting limit is ***below*** the detected outdoor air concentration, then the corrected indoor value is zero.

When an analyte is detected in outdoor air but not detected in indoor air and the reporting limit is ***above*** the detected outdoor air concentration, then the minimum detection limit in indoor air is selected as the corrected indoor value.

If the indoor air sample concentration is less than outdoor air concentration, then the indoor air corrected is zero (no contribution from SSV or indoor air sources; indoor air value is no different from outdoor air)

If the indoor air sample concentration is greater than outdoor air concentration, the indoor air corrected is calculated as follows: Indoor air - Outdoor air

Table D-25. OU 1 2018 Vapor Intrusion Sampling Results – Building 1051

				Analyte Name	Tetrachloroethene	Trichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	1,1-Dichloroethene	Vinyl chloride	1,4-Dioxane	Methane[1]
				PAL Air - Indoor (µg/m^3)	40	2	NE	60	200	2.8	5	3,280,164
				PAL Soil Gas – Sub-slab (µg/m^3)	1330	66.7	NE	2000	6670	93.3	167	3,280,164
Location Name	Sample Name	Sample Type	Collect Date	Description	Result (µg/m^3)							
March												
B1051-IA-1	OU1-B1051-IA-1-180319	N	3/19/2018	Air - Indoor	0.05	0.055	0.3	0.02 J	0.015 U	0.018 J	0.015 U	1,900
				Air - Indoor- Corrected	0.016	0.027	0.238	0.003 J	0.015 U	0.018 J	0.015 U	100
B1051-IA-2	OU1-B1051-IA-2-180319	P	3/19/2018	Air - Indoor	0.04	0.059	0.31	0.02 J	0.013 U	0.018 J	0.013 U	1,900
B1051-IA-2	OU1-B1051-IA-8-180319	FD	3/19/2018	Air - Indoor	0.038	0.057	0.31	0.019 J	0.013 U	0.019 J	0.014 J	1,900
				Air - Indoor- Corrected	0.006	0.031	0.248	0.003 J	0.013 U	0.018 J	0.013 J	100
B1051-IA-3	OU1-B1051-IA-3-180319	N	3/19/2018	Air - Indoor	0.036 J	0.059	0.33	0.02 J	0.013 U	0.019 J	0.018 J	2,100
				Air - Indoor- Corrected	0.002 J	0.031	0.268	0.003 J	0.013 U	0.019 J	0.018 J	300
B1051-IA-4	OU1-B1051-IA-4-180319	N	3/19/2018	Air - Indoor	0.087	0.052	0.27	0.026 J	0.021 J	0.016 J	0.012 U	1,900
				Air - Indoor- Corrected	0.053	0.024	0.208	0.009 J	0.021 J	0.016 J	0.012 U	100
B1051-IA-5	OU1-B1051-IA-5-180319	N	3/19/2018	Air - Indoor	0.052	0.078	0.34	0.023 J	0.012 U	0.021 J	0.016 J	1,900
				Air - Indoor- Corrected	0.018	0.05	0.278	0.006 J	0.012 U	0.021 J	0.016 J	100
B1051-IA-6	OU1-B1051-IA-6-180319	N	3/19/2018	Air - Indoor	0.05	0.032 J	0.17	0.066	0.063	0.012 U	0.014 U	2,000
				Air - Indoor- Corrected	0.016	0.004 J	0.108	0.049	0.063	0.012 U	0.014 U	200
B1051-IA-7	OU1-B1051-IA-7-180319	N	3/19/2018	Air - Indoor	0.035 J	0.047	0.25	0.022 J	0.013 U	0.015 J	0.013 U	1,900
				Air - Indoor- Corrected	0.001 J	0.019	0.188	0.005 J	0.013 U	0.015 J	0.013 U	100
B1051-SV-1	OU1-B1051-SV-1-180320	N	3/20/2018	Soil gas	0.53 U	0.53 U	0.6 U	0.71 U	0.64 U	0.64 U	0.6 U	1,700
B1051-SV-2	OU1-B1051-SV-2-180320	N	3/20/2018	Soil gas	1.6 U	1.6 U	1.8 U	2.2 U	2 U	2 U	1.8 U	1,600
B1051-SV-3	OU1-B1051-SV-3-180320	N	3/20/2018	Soil gas	0.51 U	0.51 U	0.58 U	0.69 U	0.62 U	0.62 U	0.58 U	1,100
B1051-SV-4	OU1-B1051-SV-4-180320	N	3/20/2018	Soil gas	1.4 U	1.4 U	1.6 U	1.9 U	1.7 U	1.7 U	1.6 U	970
B1051-SV-5	OU1-B1051-SV-5-180320	N	3/20/2018	Soil gas	1.6 U	1.6 U	1.8 U	2.1 U	1.9 U	1.9 U	1.8 U	890
B1051-SV-6	OU1-B1051-SV-6-180320	N	3/20/2018	Soil gas	0.5 U	0.5 U	0.57 U	0.68 U	0.61 U	0.61 U	0.57 U	730
B1051-SV-7	OU1-B1051-SV-7-180320	N	3/20/2018	Soil gas	0.51 U	0.51 U	0.58 U	0.69 U	0.62 U	0.62 U	0.58 U	1,600
B1051-SV-8	OU1-B1051-SV-8-180320	P	3/20/2018	Soil gas	0.5 U	0.5 U	0.57 U	0.67 U	0.6 U	0.6 U	0.57 U	930
B1051-SV-8	OU1-B1051-SV-9-180320	FD	3/20/2018	Soil gas	0.54 U	0.54 U	0.62 U	0.74 U	0.66 U	0.66 U	0.62 U	1,200
OA-2	OU1-OA-2-180319	N	3/19/2018	Air - Outdoor	0.034 J	0.028 J	0.062	0.017 J	0.012 U	0.01 U	0.011 U	1,800

Table D-25. OU 1 2018 Vapor Intrusion Sampling Results – Building 1051

				Analyte Name	**Tetrachloroethene**	**Trichloroethene**	**cis-1,2-Dichloroethene**	**trans-1,2-Dichloroethene**	**1,1-Dichloroethene**	**Vinyl chloride**	**1,4-Dioxane**	**Methane[1]**
				PAL Air - Indoor (µg/m³)	**40**	**2**	**NE**	**60**	**200**	**2.8**	**5**	**3,280,164**
				PAL Soil Gas – Sub-slab (µg/m³)	**1330**	**66.7**	**NE**	**2000**	**6670**	**93.3**	**167**	**3,280,164**
Location Name	**Sample Name**	**Sample Type**	**Collect Date**	**Description**	**Result (µg/m³)**							
July												
B1051-IA-1	OU1-B1051-IA-1-180724	N	7/24/2018	Air - Indoor	0.047	0.031 U	0.031 U	0.013 J	0.031 U	0.031 U	0.015 J	1,900
B1051-IA-1				Air - Indoor- Corrected	0.014	0.031 U	0.031 U	0.013 J	0.031 U	0.031 U	0	100
B1051-IA-2	OU1-B1051-IA-2-180724	P	7/24/2018	Air - Indoor	0.042	0.031 U	0.031 U	0.013 J	0.031 U	0.031 U	0.013 J	2,000
B1051-IA-2	OU1-B1051-IA-8-180724	FD	7/24/2018	Air - Indoor	0.055	0.035 U	0.035 U	0.012 J	0.035 U	0.035 U	0.035 U	2,000
B1051-IA-2				Air - Indoor- Corrected	0.022	0.031 U	0.031 U	0.013 J	0.031 U	0.031 U	0	200
B1051-IA-3	OU1-B1051-IA-3-180724	N	7/24/2018	Air - Indoor	0.048	0.033 U	0.023 J	0.028 J	0.033 U	0.033 U	0.015 J	2,000
B1051-IA-3				Air - Indoor- Corrected	0.015	0.033 U	0.023 J	0.028 J	0.033 U	0.033 U	0	200
B1051-IA-4	OU1-B1051-IA-4-180724	N	7/24/2018	Air - Indoor	0.11	0.023 J	0.033 U	0.028 J	0.033 U	0.033 U	0.039 J	1,900
B1051-IA-4				Air - Indoor- Corrected	0.077	0.023 J	0.033 U	0.028 J	0.033 U	0.033 U	0.021 J	100
B1051-IA-5	OU1-B1051-IA-5-180724	N	7/24/2018	Air - Indoor	0.38	0.033 U	0.033 U	0.079	0.033 U	0.033 U	0.033 U	1,900
B1051-IA-5				Air - Indoor- Corrected	0.347	0.033 U	0.033 U	0.079	0.033 U	0.033 U	0.033 U	100
B1051-IA-6	OU1-B1051-IA-6-180724	N	7/24/2018	Air - Indoor	0.038 J	0.033 U	0.033 U	0.012 J	0.033 U	0.033 U	0.033 U	2,100
B1051-IA-6				Air - Indoor- Corrected	0.005 J	0.033 U	0.033 U	0.012 J	0.033 U	0.033 U	0.033 U	300
B1051-IA-7	OU1-B1051-IA-7-180724	N	7/24/2018	Air - Indoor	0.054	0.039 U	0.039 U	0.041 U	0.039 U	0.039 U	0.039 U	2,000
B1051-IA-7				Air - Indoor- Corrected	0.021	0.039 U	0.039 U	0.041 U	0.039 U	0.039 U	0.039 U	200
B1051-SV-1	OU1-B1051-SV-1-180723	N	7/23/2018	Soil gas	0.4 J	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	1,600
B1051-SV-2	OU1-B1051-SV-2-180723	N	7/23/2018	Soil gas	0.37 J	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	1,600
B1051-SV-3	OU1-B1051-SV-3-180723	N	7/23/2018	Soil gas	0.87 J	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	1.3 J	1,200
B1051-SV-4	OU1-B1051-SV-4-180723	N	7/23/2018	Soil gas	0.45 J	0.76 U	0.76 U	0.76 U	0.76 U	0.76 U	0.76 U	1,000
B1051-SV-5	OU1-B1051-SV-5-180723	N	7/23/2018	Soil gas	0.52 J	0.77 U	0.77 U	0.77 U	0.77 U	0.77 U	0.77 U	1,000
B1051-SV-6	OU1-B1051-SV-6-180723	N	7/23/2018	Soil gas	0.52 J	0.73 U	0.73 U	0.73 U	0.73 U	0.73 U	0.73 U	850
B1051-SV-7	OU1-B1051-SV-7-180723	N	7/23/2018	Soil gas	0.39 J	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	830
B1051-SV-8	OU1-B1051-SV-8-180723	P	7/23/2018	Soil gas	0.31 J	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	850
B1051-SV-8	OU1-B1051-SV-9-180723	FD	7/23/2018	Soil gas	0.7 J	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.55 J	850
OA-2	OU1-OA-2-180724	P	7/24/2018	Air - Outdoor	0.033 J	0.032 U	0.032 U	0.034 U	0.032 U	0.032 U	0.032 U	1,800
OA-2	OU1-OA-6-180724	FD	7/24/2018	Air - Outdoor	0.042 J	0.033 U	0.033 U	0.034 U	0.033 U	0.033 U	0.018 J	1,800

Notes:

1 – Because the PAL for methane is based on the lower explosive limit (LEL), no attenuation factor was applied. That is, the PAL for both sub-slab vapor and indoor air was established as 10% LEL.

Bold text indicates a concentration that exceeds the PAL

FD - field duplicate; µg/m³ - micrograms per cubic meter; N - normal sample, with no paired field duplicate; NE - not established; P - parent sample of field duplicate; PAL - project action limit

Decision rules:

For outdoor air samples with field duplicates, the outdoor sample with the minimum concentration was used to compare to the indoor air sample.

When an analyte is not detected in outdoor air, then the maximum detected indoor air concentration is selected as the indoor air corrected value.

When an analyte is detected in outdoor air but not detected in indoor air and the reporting limit is ***below*** the detected outdoor air concentration, then the corrected indoor value is zero.

When an analyte is detected in outdoor air but not detected in indoor air and the reporting limit is ***above*** the detected outdoor air concentration, then the minimum detection limit in indoor air is selected as the corrected indoor value.

If the indoor air sample concentration is less than outdoor air concentration, then the indoor air corrected is zero (no contribution from SSV or indoor air sources; indoor air value is no different from outdoor air)

If the indoor air sample concentration is greater than outdoor air concentration, the indoor air corrected is calculated as follows: Indoor air - Outdoor air

Table D-26. OU 1 2018 Vapor Intrusion Sampling Results - Building 824

				Analyte Name	Tetrachloroethene	Trichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	1,1-Dichloroethene	Vinyl chloride	1,4-Dioxane	Methane[1]
				PAL Air - Indoor (µg/m³)	**40**	**2**	**NE**	**60**	**200**	**2.8**	**5**	**3,280,164**
				PAL Soil Gas – Sub-slab (µg/m3)	**1330**	**66.7**	**NE**	**2000**	**6670**	**93.3**	**167**	**3,280,164**
Location Name	**Sample Name**	**Sample Type**	**Collect Date**	**Description**	**Result (µg/m³)**							
March												
B824-IA-1	OU1-B824-IA-1-180320	P	3/20/2018	Air - Indoor	0.038	0.051	0.3	0.01 U	0.012 U	0.019 J	0.012 U	2,000
B824-IA-1	OU1-B824-IA-2-180320	FD	3/20/2018	Air - Indoor	0.033 J	0.051	0.3	0.0099 U	0.012 U	0.018 J	0.012 U	1,900
				Air - Indoor- Corrected	0.012	0.051	0.3	0.0099 U	0.012 U	0.018 J	0	0
B824-SS-1	OU1B824-SS-1-180322	P	3/22/2018	Soil Gas – Sub-slab	0.59 U	0.59 U	0.68 U	0.8 U	0.72 U	0.72 U	0.68 U	1,400
B824-SS-1	OU1-B824-SS-2-180322	FD	3/22/2018	Soil Gas – Sub-slab	0.54 U	0.54 U	0.62 U	0.74 U	0.66 U	0.66 U	0.62 U	1,300
OA-5	OU1-OA-5-180320	N	3/20/2018	Air - Outdoor	0.026 J	0.012 U	0.013 U	0.011 U	0.013 U	0.011 U	0.018 J	2,000
July												
B824-IA-1	OU1-B824-IA-1-180724	P	7/24/2018	Air - Indoor	0.03 J	0.042 U	0.051	0.044 U	0.042 U	0.042 U	0.042 U	2,100
B824-IA-1	OU1-B824-IA-2-180724	FD	7/24/2018	Air - Indoor	0.029 J	0.034 U	0.049	0.035 U	0.034 U	0.034 U	0.034 U	1,900
				Air - Indoor- Corrected	0	0.034 U	0.049	0.035 U	0.034 U	0.034 U	0.034 U	300
B824-SS-1	OU1-B824-SS-1-180726	P	7/26/2018	Soil Gas – Sub-slab	0.4 J	0.66 U	0.66 U	0.66 U	0.66 U	0.66 U	0.66 U	910
B824-SS-1	OU1-B824-SS-2-180726	FD	7/26/2018	Soil Gas – Sub-slab	0.87 J	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	910
OA-1	OU1-OA-1-180724	N	7/24/2018	Air - Outdoor	0.032 J	0.033 U	0.033 U	0.035 U	0.033 U	0.033 U	0.019 J	1,800

Notes:

[1] – Because the PAL for methane is based on the lower explosive limit (LEL), no attenuation factor was applied. That is, the PAL for both sub-slab vapor and indoor air was established as 10% LEL.

Bold text indicates a concentration that exceeds the PAL

FD - field duplicate; µg/m³ - micrograms per cubic meter; N - normal sample, with no paired field duplicate; NE - not established; P - parent sample of field duplicate; PAL - project action limit

Decision rules:

For outdoor air samples with field duplicates, the outdoor sample with the minimum concentration was used to compare to the indoor air sample.

When an analyte is not detected in outdoor air, then the maximum detected indoor air concentration is selected as the indoor air corrected value.

When an analyte is detected in outdoor air but not detected in indoor air and the reporting limit is ***below*** the detected outdoor air concentration, then the corrected indoor value is zero.

When an analyte is detected in outdoor air but not detected in indoor air and the reporting limit is ***above*** the detected outdoor air concentration, then the minimum detection limit in indoor air is selected as the corrected indoor value.

If the indoor air sample concentration is less than outdoor air concentration, then the indoor air corrected is zero (no contribution from SSV or indoor air sources; indoor air value is no different from outdoor air)

If the indoor air sample concentration is greater than outdoor air concentration, the indoor air corrected is calculated as follows: Indoor air - Outdoor air

Table D-27. OU 1 2018 Vapor Intrusion Sampling Results – Building 108

				Analyte Name	**Tetrachloroethene**	**Trichloroethene**	**cis-1,2-Dichloroethene**	**trans-1,2-Dichloroethene**	**1,1-Dichloroethene**	**Vinyl chloride**	**1,4-Dioxane**	**Methane[1]**
				PAL Air - Indoor (μg/m^3)	**40**	**2**	**NE**	**60**	**200**	**2.8**	**5**	**3,280,164**
				PAL Soil Gas – Sub-slab (μg/m3)	**1330**	**66.7**	**NE**	**2000**	**6670**	**93.3**	**167**	**3,280,164**
Location Name	**Sample Name**	**Sample Type**	**Collect Date**	**Description**	**Result (μg/m^3)**							
March												
B108-IA-1	OU1-B108-IA-1-180319	P	3/19/2018	Air - Indoor	0.034 J	0.016 J	0.073	0.011 U	0.013 U	0.011 U	0.044 J	1,900
B108-IA-1	OU1-B108-IA-2-180319	FD	3/19/2018	Air - Indoor	0.033 J	0.02 J	0.071	0.011 J	0.012 U	0.01 U	0.061 J	1,800
				Air - Indoor- Corrected	0.005 J	0.02 J	0.073	0	0.012 U	0.011 U	0.045 J	0
B108-SS-1	OU1-B108-SS-1-180322	P	3/22/2018	Soil Gas – Sub-slab	0.56 U	0.56 U	0.64 U	0.76 U	0.68 U	0.68 U	0.64 U	850 J
B108-SS-1	OU1B108-SS-2-180322	FD	3/22/2018	Soil Gas – Sub-slab	0.86 U	0.86 U	2.5 J	1.2 U	1 U	1 U	0.98 U	1,200 J
OA-1	OU1-OA-1-180319	P	3/19/2018	Air - Outdoor	0.036 J	0.013 U	0.014 U	0.014 J	0.013 U	0.012 U	0.016 J	2,000
OA-1	OU1-OA-3-180319	FD	3/19/2018	Air - Outdoor	0.029 J	0.013 U	0.014 U	0.015 J	0.013 U	0.011 U	0.097 J	1,900
July												
B108-IA-1	OU1-B108-IA-1-180724	P	7/24/2018	Air - Indoor	0.042	0.035 U	0.02 J	0.036 U	0.035 U	0.035 U	0.32	2,000
B108-IA-1	OU1-B108-IA-2-180724	FD	7/24/2018	Air - Indoor	0.045	0.036 U	0.021 J	0.038 U	0.036 U	0.036 U	0.33	2,000
				Air - Indoor- Corrected	0.013	0.035 U	0.021 J	0.036 U	0.035 U	0.035 U	0.311	200
B108-SS-1	OU1-B108-SS-1-180726	P	7/26/2018	Soil Gas – Sub-slab	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	760
B108-SS-1	OU1-B108-SS-2-180726	FD	7/26/2018	Soil Gas – Sub-slab	0.66 U	0.66 U	0.66 U	0.66 U	0.66 U	0.66 U	0.66 U	880
OA-1	OU1-OA-1-180724	N	7/24/2018	Air - Outdoor	0.032 J	0.033 U	0.033 U	0.035 U	0.033 U	0.033 U	0.019 J	1,800

Notes:

[1] – Because the PAL for methane is based on the lower explosive limit (LEL), no attenuation factor was applied. That is, the PAL for both sub-slab vapor and indoor air was established as 10% LEL.

Bold text indicates a concentration that exceeds the PAL

FD - field duplicate; μg/m^3 - micrograms per cubic meter; N - normal sample, with no paired field duplicate; NE - not established; P - parent sample of field duplicate; PAL - project action limit

Decision rules:

For outdoor air samples with field duplicates, the outdoor sample with the minimum concentration was used to compare to the indoor air sample.

When an analyte is not detected in outdoor air, then the maximum detected indoor air concentration is selected as the indoor air corrected value.

When an analyte is detected in outdoor air but not detected in indoor air and the reporting limit is ***below*** the detected outdoor air concentration, then the corrected indoor value is zero.

When an analyte is detected in outdoor air but not detected in indoor air and the reporting limit is ***above*** the detected outdoor air concentration, then the minimum detection limit in indoor air is selected as the corrected indoor value.

If the indoor air sample concentration is less than outdoor air concentration, then the indoor air corrected is zero (no contribution from SSV or indoor air sources; indoor air value is no different from outdoor air)

If the indoor air sample concentration is greater than outdoor air concentration, the indoor air corrected is calculated as follows: Indoor air - Outdoor air

Table D-28. 2017 Groundwater Monitoring Results for PFAS Compounds (ng/L)

	Location Name	MW1-43	MW1-46	MW1-46	MW1-47	MW1-48	MW1-50	MW1-52	MW1-56	MW-57	MW1-58	MW1-58	MW1-60
	Sample Name	MW1-43-171023	MW1-46-171023	FD-171023-01	MW1-47-171023	MW1-48-171024	MW1-50-171024	MW1-52-171024	MW1-56-12.0-171025	MW1-57-10.0-171025	MW1-58-9.0-171115	FD-171115-02	MW1-60-171026
	Sample Type	N	P	FD	N	N	N	N	N	N	P	FD	N
Analyte	PAL	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Perfluorooctane sulfonate (PFOS)	70	3.68 UJ	1.65 UJ	1.74 UJ	5.3 UJ	10.47 J	0.36 UJ	0.62 UJ	2.03 J	8.42	1.95 J	1.71 J	0.36 UJ
N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA)	NE	1.69 UJ	0.74 UJ	0.72 UJ	1.72 UJ	2.08 UJ	0.71 UJ	0.71 UJ	0.63 J	0.71 U	0.44 U	0.45 U	0.71 UJ
N-methylperfluorooctane sulfonamidoacetic acid (NMeFOSAA)	NE	1.64 UJ	1.85 UJ	1.81 UJ	1.08 UJ	0.42 J	1.79 UJ	1.79 UJ	0.72 J	1.79 UJ	1.11 U	1.13 U	1.79 UJ
Perfluorobutanesulfonic acid (PFBS)	380,000	0.37 UJ	0.37 UJ	0.36 UJ	0.36 UJ	0.36 UJ	0.36 UJ	0.36 UJ	0.38 U	0.36 U	0.22 U	0.23 U	0.36 U
Perfluorodecanoic acid (PFDA)	NE	1.1 UJ	0.37 UJ	0.36 UJ	1.03 UJ	0.69 UJ	0.36 UJ	0.36 UJ	0.94 J	0.49 J	0.44 J	0.39 J	0.36 U
Perfluoroheptanoic acid (PFHpA)	NE	1.8 UJ	0.97 UJ	0.99 UJ	4.37 J	3 J	0.36 UJ	0.36 UJ	0.38 U	1.54 J	3.29 J	2.36 J	0.36 U
Perfluorohexanesulfonic acid (PFHxS)	NE	3.18 UJ	1.2 UJ	1.22 UJ	4.49 UJ	3.47 UJ	0.36 UJ	0.36 UJ	4.4 J	8.97	0.22 U	0.23 U	0.36 U
Perfluorononanoic acid (PFNA)	NE	1.39 UJ	0.74 UJ	0.72 UJ	1.57 UJ	1.12 UJ	0.71 UJ	0.71 UJ	1.93 J	0.38 J	0.63 J	0.52 J	0.71 U
Perfluorooctanoic acid (PFOA)	70	6.58 UJ	4.2 UJ	3.78 UJ	13.6 J	14.56 J	1.58 UJ	1.74 UJ	11.26	6.59 J	6.27 U	6.27 U	3.29 J
Perfluorotetradecanoic acid (PFTeDA)	NE	4.24 UJ	1.86 UJ	1.08 UJ	4 UJ	0.71 UJ	0.71 UJ	0.71 UJ	2.56 J	0.36 J	0.44 U	0.55 U	0.71 UJ
Perfluorotridecanoic acid (PFTrDA)	NE	2.11 UJ	0.37 UJ	0.59 UJ	1.98 UJ	0.36 UJ	0.36 UJ	0.36 UJ	1.49 J	0.22 J	0.22 U	0.34 J	0.36 UJ
Perfluoroundecanoic acid (PFUnA)	NE	1.28 UJ	0.74 UJ	0.72 UJ	1.36 UJ	0.71 UJ	0.71 UJ	0.71 UJ	0.69 J	0.71 U	0.44 U	0.45 U	0.71 UJ
Perfluorododecanoic acid (PFDoA)	NE	2.14 UJ	0.37 UJ	0.36 UJ	2.08 UJ	0.36 UJ	0..36 UJ	0.36 UJ	1.03 J	0.36 U	0.22 U	0.12 J	0.36 U
Perfluorohexanoic acid (PFHxA)	NE	2.19 UJ	1.71 UJ	1.82 UJ	6.39 J	3.99 J	0.36 UJ	0.36 UJ	0.38 UJ	1.8 J	3.5 J	1.57 J	0.36 UJ

Notes:

PFAS compounds analyzed by EPA Method 537-MOD.

Bold text indicates that the result or the LOD exceeds the PAL.

FD - Field Duplicate

P – Parent sample of field duplicate.

N – Sample is not part of a field duplicate pair

J - The reported value is an estimated concentration.

NE - Not established.

PAL - Project action limit as established in the sampling and analysis plan.

U - The analyte was not detected at or above the stated limit. (sometimes validators will elevate the limit due to the "B" qualifier using the 5x/10x rule so this definition is different than the lab description).

UJ - The analyte was not detected at the stated sample quantitation limit, which is an estimated value.

ng/L - nanograms per liter

APPENDIX E
OU 2 AREA 2 CUMULATIVE LONG-TERM MONITORING DATA

Table E-1. Target Analytes in Groundwater at OU 2 Area 2 (November 1995 – June 2019)

Location	Sampling Date	cis,1,2-DCE (µg/L)	TCE (µg/L)	Vinyl Chloride (µg/L)
Remedial Goal (Drinking Water)[a]		**16[e]**	**5[f]**	**0.029[g]**
2MW-1	11/21/95	1 U	**41 J**	1 U *
	09/30/96	1 U	**28**	1 U *
	10/16/97	1 U	**29**	1 U *
	10/08/98	0.2 U	**29**	0.2 U *
	11/22/99	0.5 U	**17**	0.5 U *
	11/17/00	0.5 U	**22**	0.5 UJ *
	11/19/01	0.1 U	**16**	0.2 U *
	06/17/02	0.1 U	**11**	0.2 U *
	06/18/03	0.067 U	**12**	0.12 U *
	06/15/04	0.067 U	**9.7**	0.12 U *
	06/21/05	0.2 U	**10**	0.2 U *
	06/20/06	0.5 U	**8.1**	0.2 U *
	06/12/07	0.5 U	**5.8**	0.2 U *
	05/06/08	0.5 U	4.9	0.2 U *
	06/24/09	0.21 J	**5.8 J**	0.2 U *
	06/15/10	NS	NS	NS
	07/20/11	0.08 J	3.8	0.2 U *
	06/13/12	0.059	3.8	0.010 J
	06/24/14	0.089	1.2	0.018 J
	06/21/16	NA	NA	0.022 U
	09/20/18	NA	NA	0.021 J
	06/24/19	NA	NA	0.020 U
2MW-3	11/20/95	**19**	1 J	**4**
2MW-4	11/20/95	1 U	1 U	1 U *
2MW-5	11/21/95	7	**11**	**1**
	09/30/96	1	2	**1**
	10/16/97	1	2	**1**
	10/08/98	0.26	2.1	**0.2**
	11/22/99	0.5	0.4 J	**0.5**
2MW-6[b]	11/20/95	10	1 U	**4**
	09/30/96	15	1 U	**5**
	10/16/97	11	1 U	**4**
	10/08/98	9.5	0.2 U	**2.7**
	11/22/99	12	0.5 U	**2.7**
	11/17/00	15	0.5 U	**2.9 J**
	11/19/01	7 J	0.2 UJ	**1.2 J**
	06/17/02	13	0.2 U	**2.1**
	06/18/03	9.9	0.081 U	**1.5**
	06/15/04	6.9	0.081 U	**0.86**
	06/21/05	4.5	0.2 U	**0.68**
	06/21/06	9	0.5 U	**1.1**
	06/13/07	8.4	0.5 U	**0.99**
	05/07/08	2.7	0.5 U	**0.34**
	06/24/09	7.1	0.03 J	**0.99**
	06/15/10	3.5	0.5 U	**0.32**
	07/20/11	1.5	0.5 U	**0.09 J**
	06/13/12	1.7	0.018 J	**0.099**

Table E-1 (continued). Target Analytes in Groundwater at OU 2 Area 2 (November 1995 – June 2019)

Location	Sampling Date	cis,1,2-DCE (µg/L)	TCE (µg/L)	Vinyl Chloride (µg/L)
Remedial Goal (Drinking Water)[a]		**16[e]**	**5[f]**	**0.029[g]**
	06/23/14	3.9	0.021 UJ	**0.220**
	06/21/16	NA	NA	**0.073**
	09/20/18	NA	NA	**1.4**
	06/24/19	NA	NA	**0.16 M**
MW2-6[c]	11/17/00	0.5 U	0.5 U	0.5 U *
MW2-8[d]	11/19/01	0.72	0.2 U	0.2 U *
	06/17/02	0.97	0.2 U	0.2 U *
	06/18/03	1.4	0.081 U	0.12 U *
	06/15/04	1.9	0.081 U	**0.2 J**
	06/24/05	1.9	0.2 U	0.2 U *
	06/20/06	2	0.5 U	0.2 U *
	06/12/07	1.9	0.5 U	**0.2**
	05/06/08	1.4	0.5 U	**0.07 J**
	06/24/09	1.1	0.5 U	**0.07 J**
	06/15/10	1.1	0.5 U	0.2 UJ *
	07/20/11	1.2	0.5 U	0.2 U *
	06/13/12	0.92 J	0.0045 J	**0.035**
	06/23/14	0.43	0.02 U	0.016 J
	06/21/16	NA	NA	0.020 U
	09/20/18	NA	NA	**0.049 J**
	06/24/19	NA	NA	0.020 U

[a] Protection of human health by ingestion.
[b] The 11/17/00 and 11/19/01 results for 2MW-6 are the average concentrations of the primary and duplicate sample.
[c] Prior to 2000, MW2-6 was last sampled in 1991 during the remedial investigation.
[d] The 06/17/02 results for MW2-8 are the average concentrations of the primary and duplicate sample.
[e] No remedial goal for cis-1,2-DCE was established in the Record of Decision (U.S. Navy, USEPA, Ecology, 1994). For comparison purposes, the current MTCA Method B value is shown in the table.
[f] Value listed accounts for adjustment when the maximum contaminant level or water quality standard is sufficiently protective to serve as the MTCA cleanup level for that individual chemical. Individual chemical cleanup levels may require downward adjustment for multiple chemical contaminants or multiple exposure pathways (WAC 173-340-720[7][b]). Value does not account for adjustments due to background levels or PQLs.
[g] Calculated MTCA Method B remedial goal starting in 2012, based upon the current oral slope value.

Notes:
Bolded value indicates it exceeds or is equal to the remedial goal for drinking water.
Yellow highlighted rows indicate sampling results from this FYR period.
* – The reporting limit exceeds the remedial goal
DCE – dichloroethane
J – The result is an estimated concentration that is less than the MRL, but greater than or equal to the MDL.
M – Laboratory performed a manual integration on the chromatographic peak.
MDL – method detection limit
µg/L – microgram per liter
MRL – method reporting limit
MTCA – Model Toxics Control Act
NA – Compound not analyzed for per recommendation in the fourth FYR.
NS – not sampled
PQL – practical quantitation limits
TCE – trichloroethene
U – The compound was analyzed for but was not detected (“nondetect”) at or above the MRL/MDL.

Table E-2. 1,4-Dioxane in Groundwater at OU 2 Area 2 (June 2007 – June 2019)

Location	Sampling Date	1,4-Dioxane (µg/L)
MTCA Method B Cleanup Level		**0.44**[a]
2MW-1	06/12/07	1.0 U
	06/20/17	0.40 U
	09/20/18	0.40 U
	06/24/19	0.19 U
2MW-6	06/13/07	0.30 J
	06/20/17	0.40 U
	09/19/18	0.17 J
	06/24/19	0.19 U
MW2-8	06/12/07	1.0 U
	06/20/17	0.40 U
	09/20/18	0.40 U
	06/24/19	0.19 U

[a] No remedial goal for 1,4-dioxane was established in the Record of Decision (U.S. Navy, USEPA, Ecology, 1994). For comparison purposes, the MTCA Method B (carcinogenic) cleanup level is provided in the table.

Notes:

Bold indicates detected value is equal to or exceeds the MTCA Method B cleanup level.
J – estimated concentration
U – not detected at or above the practical quantitation limit shown
µg/L – micrograms per liter

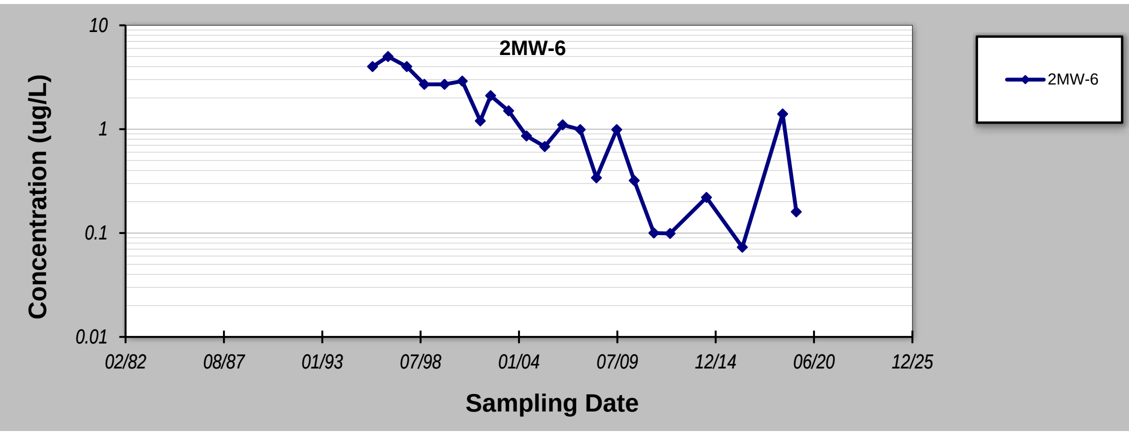
APPENDIX F
OU 2 AREA 2 MANN-KENDALL STATISTICS AT 2MW-6

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **17-Feb-20**
Facility Name: **NBK Keyport, OU 2 Area 2**
Conducted By: **Angela Paolucci/Battelle**

Job ID: **F4125**
Constituent: **Vinyl Chloride**
Concentration Units: **ug/L**

Sampling Point ID:		**2MW-6**						
Sampling Event	Sampling Date	VINYL CHLORIDE CONCENTRATION (ug/L)						
1	20-Nov-95	4						
2	30-Sep-96	5						
3	16-Oct-97	4						
4	8-Oct-98	2.7						
5	22-Nov-99	2.7						
6	17-Nov-00	2.9						
7	19-Nov-01	1.2						
8	17-Jun-02	2.1						
9	18-Jun-03	1.5						
10	15-Jun-04	0.86						
11	21-Jun-05	0.68						
12	21-Jun-06	1.1						
13	13-Jun-07	0.99						
14	7-May-08	0.34						
15	24-Jun-09	0.99						
16	15-Jun-10	0.32						
17	20-Jul-11	0.1						
18	13-Jun-12	0.099						
19	23-Jun-14	0.22						
20	21-Jun-16	0.073						
21	19-Sep-18	1.4						
22	24-Jun-19	0.16						
23								
24								
25								
Coefficient of Variation:		**0.95**						
Mann-Kendall Statistic (S):		**-170**						
Confidence Factor:		**>99.9%**						
Concentration Trend:		Decreasing						



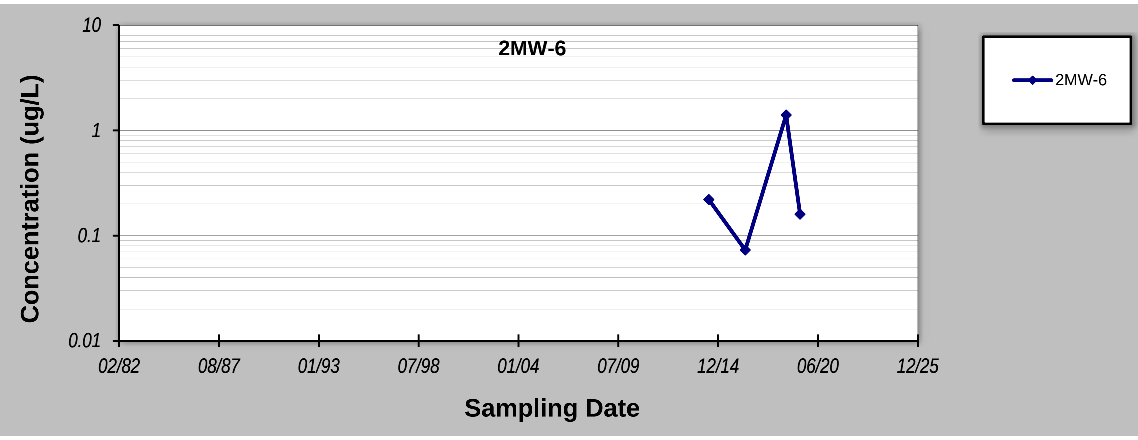
Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	17-Feb-20	Job ID:	F4125
Facility Name:	NBK Keyport, OU 2 Area 2	Constituent:	Vinyl Chloride
Conducted By:	Angela Paolucci/Battelle	Concentration Units:	ug/L

	Sampling Point ID:	2MW-6						
Sampling Event	Sampling Date	VINYL CHLORIDE CONCENTRATION (ug/L)						
1	23-Jun-14	0.22						
2	21-Jun-16	0.073						
3	19-Sep-18	1.4						
4	24-Jun-19	0.16						
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
	Coefficient of Variation:	1.35						
	Mann-Kendall Statistic (S):	0						
	Confidence Factor:	37.5%						
	Concentration Trend:	No Trend						



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

APPENDIX G
OU 2 AREA 8 CUMULATIVE LONG-TERM MONITORING DATA

Table G-1. Summary of Selected VOCs Detected in Groundwater and Seeps at OU 2 Area 8 (1995-2019)

Location	Sampling Date	Analyte Concentration (µg/L)				
		1,1-DCE	cis-1,2-DCE	PCE	1,1,1-TCA	TCE
RG (Drinking Water)[a]		7[b]	70	5[b]	200	5[b]
RG (Surface Water)[a]		3.2[b,c]	--	8.9[b,c]	42,000	81[b,c]
MW8-8	11/95	1.0	2.0	**49**	23	**190**
	06/96	0.90 J	1.0	**34**	11	**110**
	09/96	1.0	2.0	**58**	19	**190**
	05/97	1.0 U	1.0	**15**	3.0	**68**
	10/97	0.60 U	1.0 U	**19**	9.0	**78**
	05/98	1.0 U	0.9 J	**12**	3.0	**63**
	10/98	1.0 U	1.0 U	**30**	9.0	**76**
	05/99	5.0 U *	5.0 U	5.0 U	5.0 U	**58**
	11/99	1.0	3.2	2.0	10	**150 H**
	06/00	1 J	4.5	**23**	6.6	**120**
	06/01	1.3	7.3	**20**	3.9	**84**
	06/02	1.1	7.3	**17**	3.9	**81**
	06/03	0.94	6.8	**12**	2.7	**81 D**
	06/04	1.1	8.5	**13**	2.9	**80 D**
	06/05	0.7	7.4	**11**	2.0	**64**
	06/06	0.68	7.6	**9.2**	2.2	**68 D**
	06/07	0.55	7.5	**7.7**	1.7	**53 D**
	05/08	0.41 J	6.6	**8.4**	1.6	**59**
	06/09	0.69	9.1	**5.6**	1.6	**66**
	06/10	0.55	8.4	**5.1**	1.5	**58**
	07/11	0.37 J	5.9	**6.0**	1.5	**59**
	06/12	0.14 J	2.1	**9.7**	1.1	**38**
	06/13	0.5 U	0.46 J	**9.0**	0.6	**24 J**
	06/14	0.5 U	0.83	**9.8**	0.83	**32**
	06/15	0.5 U	0.45 J	**8.4**	0.87	**26**
	06/16	0.11 J	1.2	**6.9**	0.9	**37**
	06/17	0.11 J	1.6	**7.1**	0.93	**40**
	09/18	0.13 J	1.8	**8.0**	NA	**33 EJ**
	06/19	0.20 UM	1.1	**6.9**	1.1	**35**
MW8-9	11/95	50 U *	27 J	50 U *	50 U	**1600**
	06/96	1.0 U	28	1 U	2.0	**800**
	09/96	1.0 U	28	0.40 J	2.0	**1000**
	05/97	1.0 U	34	0.30 J	2.0	**1600**
	10/97	1.0 U	1.0 U	1.0 U	1.0	**720**
	05/98	1.0 U	12	1.0 U	0.70 J	**370**
	10/98	1.0 U	34	1.0 U	3.0	**610**
	05/99	1.0 U	6.0	1.0 U	1.0 U	**84**
	11/99	0.50 U	30	0.6	1.4	**500**
	06/00	2.5 U	15	2.5 U	1 J	**170**
	06/01	0.24 U	18	0.26 J	0.44 J	**330**
	06/02	0.50 U	7.5	0.23 J	0.69	**60**
	06/03	0.50 U	1.3 U	0.50 U	0.23 J	**21**
	06/04	0.50 U	1.7	0.18 J	0.44 J	**25**
	06/05	0.2 U	0.2	0.2 U	0.2 U	4.1
	06/06	0.50 U	0.42 J	0.20 J	0.28 J	3.9
	06/07	0.5 U	0.27 J	0.5 U	0.15 J	1.9
	05/08	0.5 U	0.23 J	0.16 J	0.14 J	1.7
	06/09	0.2 U	1.3	0.18 J	0.14 J	**20**
	06/10	0.5 U	0.69	0.11 J	0.12 J	**9.4**
	07/11	0.5 U	0.8	0.12 J	0.11 J	**12**
	06/12	0.5 UJ	1.2	0.49 J	0.16 J	**14**
	06/13	0.5 U	2.7	0.18 J	0.13 J	**43 J**
	06/14	0.5 U	1.5	0.29 J	0.12 J	**24**
	06/15	0.5 U	0.35 J	0.16 J	0.13 J	**5.6**
	06/16	0.5 U	0.07 J	0.10 J	0.15 J	0.27 J
	06/17	0.5 U	0.5 U	0.13 J	0.50 U	0.12 J
	09/18	0.02 UJ	0.02 U	0.13	NA	0.059
	06/19	0.2 U	0.2 UM	0.10 J	0.090 J	0.20 U
MW8-10	06/00	0.54	1.8	1.2	4.2	**22**
	06/02	0.24 J	2.4	0.84	0.74	**31**

Table G-1. Summary of Selected VOCs Detected in Groundwater and Seeps at OU 2 Area 8 (1995-2019)

Location	Sampling Date	Analyte Concentration (µg/L)				
		1,1-DCE	cis-1,2-DCE	PCE	1,1,1-TCA	TCE
RG (Drinking Water)[a]		7[b]	70	5[b]	200	5[b]
RG (Surface Water)[a]		3.2[b,c]	--	8.9[b,c]	42,000	81[b,c]
MW8-11	11/95	**44**	1.0 U	1.0 U	**520**	**84**
	06/96	**47**	1.0 U	1.0 U	**460**	**84**
	09/96	**27**	0.30 J	1.0 U	**420**	**80**
	05/97	**42**	1.0 U	1.0 U	**500**	**63**
	10/97	**30**	2.0	1.0 U	**300**	**62**
	05/98	**33**	1.0 U	1.0 U	**200**	**61**
	10/98	**35**	1.0 U	1.0 U	**220**	**62**
	05/99	**8.0**	2.0 U	2.0 U	45	**27**
	11/99	**12**	0.50 U	0.50 U	64 H	**54 H**
	06/00	**12**	0.40 J	0.50 U	82 J	**41 J**
	06/01	**15**	0.38 J	0.27 J	91	**62**
	06/02	1.1	0.46 J	0.79	84	**92**
	06/03	**20**	0.47 J	0.6	80 D	**99 D**
	06/04	**25**	0.37 J	0.66	80	**110 D**
	06/05	**10**	0.2	0.5	33	**61**
	06/06	**10**	0.27 J	0.68	39	**99 D**
	06/07	3.3	0.29 J	0.81	21	**46 D**
	05/08	2.4	0.37 J	1.1	31	**53**
	06/09	1.6	0.38 J	1.2	22	**67**
	06/10	1.6	0.83	1.5	14	**80 J**
	07/11	0.35 J	0.82	0.79	10	**75**
	06/12	0.77 J	0.81	1.1	9.7	**56**
	06/13	0.56	0.61	1.0	6.9	**67**
	06/14	0.21 J	0.45 J	0.9	5.0	**55**
	06/15	0.2 J	0.55	0.77	6.3	**63**
	06/16	0.1 J	0.38 J	0.5	4.2	**45**
	06/17	0.5 U	0.26 J	0.44 J	3.0	**24**
	09/18	0.049 J	0.25	0.41	NA	**24 EJ**
	06/19	0.2 U	0.17 J	0.31 J	3.3	**16**
MW8-12	11/95	**10**	1.0	**13**	140	**85**
	06/96	**14**	1.0 U	**5.0**	180	**63**
	09/96	**20**	2.0	**23**	**250**	**120**
	05/97	6.0	1.0	**12**	67	**120**
	10/97	4.0	1.0 U	**7.0**	41	**44**
	05/98	2.0	2.0	**10**	20	**46**
	10/98	1.0 U	1.0 U	**15**	22	**46**
	05/99	1.0 U	1.0 U	4.0 U	8.0	**25**
	11/99	0.9	2.1	**9.7**	14	**50 H**
	06/00	0.50 J	3.0	**16**	6.8	**54**
	06/01	0.67	4.8	**14**	6.5	**76**
	06/02	0.50 U	4.5	**14**	5.0	**47**
	06/03	0.31 J	3.2	**9.8**	3.2	**36**
	06/04	0.34 J	3.1	**8.5**	4.1	**40**
	06/05	0.3	3.3	**8.8**	2.8	**34**
	06/06	0.28 J	2.5	**7.9**	2.5	**31**
	06/07	0.22 J	3.5	**6.8**	2.0	**37**
	05/08	0.15 J	2.4	**7.7**	1.8	**28**
	06/09	0.18 J	3.4	**11**	2.5	**52**
	06/10	0.2 J	3.9	**6.2**	1.5	**31**
	07/11	0.11 J	3.0	**6.0**	2.1	**31**
	06/12	0.5 UJ	1.8	**6.3**	1.6	**31**
	06/13	0.5 U	0.5	**5.6**	1.2	**23**
	06/14	0.5 U	0.39 J	**5.7**	1.1	**22**
	06/15	0.5 U	0.26 J	4.6	1.7	**17**
	06/16	0.5 U	0.19 J	2.9	1.2	**11**
	06/17	0.5 U	0.28 J	2.8	0.87	**10**
	09/18	0.043 J	0.38	4.1	NA	**16 EJ**
	06/19	0.2 U	0.15 JM	2.3	1.3	**11**

Table G-1. Summary of Selected VOCs Detected in Groundwater and Seeps at OU 2 Area 8 (1995-2019)

Location	Sampling Date	Analyte Concentration (µg/L)				
		1,1-DCE	cis-1,2-DCE	PCE	1,1,1-TCA	TCE
RG (Drinking Water)[a]		**7[b]**	**70**	**5[b]**	**200**	**5[b]**
RG (Surface Water)[a]		**3.2[b,c]**	**--**	**8.9[b,c]**	**42,000**	**81[b,c]**
MW8-14	11/95	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	06/96	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	09/96	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	05/97	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	10/97	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	05/98	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	10/98	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	05/99	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	11/99	0.50 U	3.2	0.50 U	0.50 U	0.50 U
	06/00	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
	06/01	0.12 U	0.12 U	0.11 U	0.84	0.12 U
	06/02	0.50 U	0.50 U	0.50 U	0.18 J	0.50 U
	06/03	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
	06/04	0.50 U	0.50 U	0.50 U	0.12 J	0.50 U
	06/05	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
	06/06	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
	06/07	0.5 U	0.5 U	0.5 U	0.5 U	0.23 J
	05/08	0.5 U	0.5 U	0.5 U	0.11 J	0.5 U
	06/09	0.2 U	0.5 U	0.5 U	0.1 J	0.5 U
	06/10	0.5 U	0.5 U	0.5 U	0.18 J	0.5 U
	07/11	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
	06/12	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U
	06/13	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ
	06/14	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
	06/15	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
	06/16	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
	06/17	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
	09/18	0.02 UJ	0.027	0.014 J	NA	0.031
	06/19	0.2 U	0.2 UM	0.5 U	0.2 U	0.2 U
MW8-15	06/19	0.2 U	0.2 U	0.5 U	0.2 U	0.2 U
MW8-16	11/95	1.0 U	2.0	0.60 J	2.0	**58**
	06/96	1.0 U	2.0	0.80 J	2.0	**72**
	09/96	1.0 U	3.0	0.80 J	2.0	**69**
	05/97	1.0 U	2.0	0.80 J	2.0	**57**
	10/97	1.0 U	1.0 U	0.60 J	2.0	**47**
	05/98	1.0 U	2.0	0.80 J	1.0	**61**
	10/98	1.0 U	3.0	1.0 U	1.0 U	**47**
	05/99	1.0 U	6.0	1.0 U	2.0	**40**
	11/99	0.50 U	5.3	0.8	1.7	**63**
	06/00	0.59	16	0.7	1.1	**51**
	06/01	0.77	21	0.84	1.2	**74**
	06/02	0.67	30 U	0.99	0.83	**130**
	06/03	0.57	28	1.5	0.94	**190 D**
	06/04	0.61	**130 D**	0.75	0.59 J	**120 D**
	06/05	0.9	34	2.2	0.7	**350**
	06/06	0.64	**93 D**	1.1	0.33 J	**200 D**
	06/07	0.68	38	1.5	0.42 J	**430 D**
	05/08	0.65	67 D	1.0	0.18 J	**380 D**
	06/09	0.21	14	0.64	0.13 J	**140 D**
	06/10	0.13 J	9.2	0.64	0.16 J	**79 J**
	07/11	0.1 J	3.6	0.76	0.22 J	**90**
	06/12	0.08	2.7	0.8	0.18 J	**56**
	06/13	0.5 U	0.93	0.79	0.21 J	**50**
	06/14	0.5 U	1.0	0.97	0.19 J	**50**
	06/15	0.09 J	1.8	0.51	0.19 J	**48**
	06/16	0.11 J	28	0.5 U	0.5 U	**8.1**
	06/17	0.09 J	26	0.15 J	0.5 U	**7.2**
	09/18	0.088 J	23 EJ	0.064	NA	4.4
	06/19	0.1 JM	23	0.5 U	0.074 JM	4.6

Table G-1. Summary of Selected VOCs Detected in Groundwater and Seeps at OU 2 Area 8 (1995-2019)

Location	Sampling Date	Analyte Concentration (µg/L)				
		1,1-DCE	cis-1,2-DCE	PCE	1,1,1-TCA	TCE
RG (Drinking Water)[a]		7[b]	70	5[b]	200	5[b]
RG (Surface Water)[a]		3.2[b,c]	--	8.9[b,c]	42,000	81[b,c]
Seep A	05/96	16	7.0	3.0	88	68
	06/00	3.1	3.7	0.30 J	19	7.4
	06/01	1.4	1.3	0.31 J	11	3.0
	06/02	1.0	0.68	0.50 U	9.5	1.2
	06/03	0.50 U	0.50 U	0.24 J	1.6	0.36 J
	06/04	13	9.9	0.92	77	49
	06/05	0.2 U	0.2 U	0.3	2.2	0.3
	06/06	1.5 J	2.0 J	0.3 J	12 J	3.6 J
	06/07	0.42	0.85	0.31 J	2.8	2.4
	05/08	1.1	1.7	0.55	5.5	7.7
	06/09	1.5	1.9	0.39 J	5.7	6.4
	06/10	0.36 J	1.6	0.29 J	1.8	4.4
	07/11	0.5 U	0.09 J	0.1 J	0.5 U	1.4
	06/12	11 J	1.9	1.0	53 J	13
	06/13	0.5 U	1.3	0.26 J	1.0	3.3 J
	06/14	2.9	1.0	0.73	21	7.4
	06/15	0.25 J	1.3	0.3 J	3.6	2.5
	06/16	5.4	0.82	0.65	44 J	7.9
	06/17	2.6	0.69	0.58	18	6.7
Seep B	05/96	1.0 U	0.70 J	1.0 U	1.0	14
	06/00	0.50 U	0.50 U	0.50 U	0.30 J	2.2
	06/01	0.12 U	0.44 J	0.13 J	0.26 J	3.1
	06/02	0.50 U	0.52	0.12 J	0.15 J	5.4
	06/03	0.50 U	0.20 J	0.14 J	0.50 U	1.9
	06/04	0.50 U	0.23 J	0.39 J	0.8	0.61
	06/05	0.2 U	0.2 U	0.4	0.3	0.3
	06/06	0.5 U	0.18 J	0.22 J	0.12 J	0.48 J
	06/07	0.5 U	0.5 U	0.5 U	0.5 U	0.14 J
	05/08	0.5 U	0.12 J	0.17 J	0.1 J	0.41 J
	06/09	0.2 U	0.5 U	0.18 J	0.16 J	0.4 J
	06/10	0.5 U	0.51	0.18 J	0.09 J	5.7
	07/11	0.5 U	0.09 J	0.12 J	0.5 U	1.3
Seep C	09/18	1.0 UJ	0.0078 J	0.14 J	NA	0.06 J
	06/19	0.2 UJ M	0.055 J	0.17 J	0.71	0.26

[a]Protection of human health for ingestion
[b]Value listed accounts for adjustment when the maximum contaminant level or water quality standard is sufficiently protective to serve as the RG for that individual chemical. Individual cleanup levels may require downward adjustment for multiple chemical contaminants or multiple exposure pathways. Value does not account for adjustments due to background levels or practical laboratory quantitation limits.
[c]Protection of human health for fish ingestion
Notes:
Bolded value indicates concentration in the monitoring well exceeds or is equal to the RG for drinking water, or in the seep exceeds or is equal to the RG for surface water.
Shaded row indicates data evaluated in this review period.
Yellow highlighted value exceeds or is equal to the surface water RG.
* - The reporting limit exceeds the RG
Data from 1995 to 2004 are from U.S. Navy 2005a, from 2005 to 2008 are from U.S. Navy 2008c, from 2009 are from U.S. Navy 2009d, and from 2010 through 2014 in U.S. Navy 2015c.
D - The reported result is from a dilution.
DCE - dichloroethene
H - Analytical result is from an analysis reported past the holding time.
J - The result is an estimated concentration that is less than the MRL, but greater than or equal to the MDL.
MDL - method detection limit
µg/L - microgram per liter
MRL - method reporting limit
PCE - tetrachloroethene
RG - remediation goal
TCA - trichloroethane
TCE - trichloroethene
U - The compound was analyzed for, but was not detected ("nondetect") at or above the MRL/MDL.

Table G-2. Summary of Other VOCs Detected in Groundwater at OU 2 Area 8 (2015-2019)

Location ID	Sampling Date	Chloroform (µg/L)	CT (µg/L)	1,1-DCA (µg/L)	1,2-DCA (µg/L)	trans-1,2-DCE (µg/L)	1,1,2-TCA (µg/L)	Toluene (µg/L)	Total Xylenes (µg/L)
Drinking Water Remediation Goals		**7.2**	**0.34**	**800**	**5**	**100**	**5**	**1,000**	**10,000**
Surface Water Remediation Goals		**470**	**4.4**	**NE**	**5.9**	**33,000**	**42**	**49,000**	**NE**
MW8-8	06-15	1.4		0.5 U		1.5		0.46 J	0.5 U
MW8-8	06-16	1.9		0.5 U		2.2		0.5 U	0.5 U
MW8-8	06-17	0.62		0.5 U		3.0	0.019 J	0.5 U	0.5 U
MW8-8	09-18	0.54 J	0.26 J	0.5 U	0.006 J	1.8	0.23		
MW8-8	06-19	0.58	0.2 U	0.063 JM	0.2 U	1.9	0.2 UM		
MW8-9	06-15	0.16 J		0.5 U		0.12 J		0.77	0.11 J
MW8-9	06-16	0.5 U		0.5 U		0.5 U		0.17 J	0.5 U
MW8-9	06-17	0.5 U		0.5 U		0.5 U		0.5 U	0.5 U
MW8-9	09-18	0.024 J	0.046 J		0.02 J	0.02 U	0.02 U		
MW8-9	06-19	0.2 UM	0.2 U	0.2 UM	0.2 U	0.2 U	0.2 U		
MW8-11	06-15	0.48 J		0.12 J		0.56		1.1	0.5 U
MW8-11	06-16	0.5 U		0.9 J		0.26 J		0.12 J	0.5 U
MW8-11	06-17	0.23 J		0.1 J		0.11 J		0.5 U	0.5 U
MW8-11	09-18	0.26 J	**0.86 J**		0.019 J	0.14	0.033		
MW8-11	06-19	0.18 J	0.2 U	0.08 J	0.2 U	0.2 U	0.2 U		
MW8-11 (Dup)	06-16	0.5 U		0.11 J		0.26 J		0.1 J	0.5 U
MW8-11 (Dup)	06-17	0.23 J		0.1 J		0.14 J		0.5 U	0.5 U
MW8-11 (Dup)	09-18	0.26 J	**0.86 J**		0.019 J	0.14	0.032		
MW8-11 (Dup)	06-19	0.18 J	0.2 U	0.084 J	0.2 U	0.2 U	0.2 U		
MW8-12	06-15	3.0		0.5 U		1.2		0.5 U	0.13 J
MW8-12	06-16	1.1		0.5 U		0.75		0.1 J	0.5 U
MW8-12	06-17	0.74		0.5 U		0.78		0.5 U	0.5 U
MW8-12	09-18	0.79 J	**0.46 J**		0.006 J	0.89	0.13		
MW8-12	06-19	0.31	0.2 U	0.2 UM	0.2 U	0.37 M	0.2 U		
MW8-14	06-15	0.5 U		0.5 U		0.5 U		0.5 U	0.5 U
MW8-14	06-16	0.5 U		0.5 U		0.5 U		0.5 U	0.5 U
MW8-14	06-17	0.5 U		0.5 U		0.5 U		0.5 U	0.5 U
MW8-14	09-18	0.009 J	0.02 UJ		0.02 U	0.02 U	0.02 U		
MW8-14	06-19	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		
MW8-15	06-19	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		
MW8-16	06-15	1.8		0.5 U		0.5 U		0.49 J	0.12 J
MW8-16	06-16	0.5 U		0.5 U		0.13 J		0.5 U	0.5 U
MW8-16	06-17	0.14 J		0.08 J		0.19 J		0.5 U	0.5 U
MW8-16	09-18	0.84 J	0.029 J		0.02 U	0.25	0.02 U		
MW8-16	06-19	0.11 JM	0.2 U	0.081 JM	0.2 U	0.25	0.2 U		

Notes:
Bold indicates detected value is equal to or exceeds the drinking water RG.
µg/L – microgram per liter
CT – carbon tetrachloride
DCA – dichloroethane
DCE – dichloroethene
Dup – field duplicate
ID – identification
J – analyte positively identified, but result is estimated
M – manual integrated compound
TCA – trichloroethane
U – analyte was not detected at or above the indicated practical quantitation limit
VOC – volatile organic compounds

Table G-3. Summary of 1,4-Dioxane Results in Groundwater and Seeps at OU 2 Area 8 (2007-2019)

Location	Sampling Date	1,4-Dioxane (µg/L)
MW8-8	06/07	**0.70 J**
	07/11	1.0 U *
	06/12	**0.76 J**
	06/13	1.0 U *
	06/14	1.0 U *
	06/15	0.22 J
	06/16	0.41
	06/17	**1.1**
	09/18	0.43
	06/19	**0.47**
MW8-9	06/07	1.0 U *
	07/11	1.0 U *
	06/12	1.0 U *
	06/13	1.0 U *
	06/14	1.0 U *
	06/15	0.40 U
	06/16	0.25 J
	06/17	0.40 U
	09/18	0.40 U
	06/19	0.19 U
MW8-11	06/07	**39**
	07/11	**29**
	06/12	**19**
	06/13	**11**
	06/14	**11**
	06/15	**12**
	06/16	**14**
	06/17	**16**
	09/18	**8.1**
	06/19	**8.7**
MW8-12	06/07	**1.1**
	07/11	0.18 J
	06/12	**0.53 J**
	06/13	1.0 U *
	06/14	0.31 J
	06/15	**0.53**
	06/16	**1.1**
	06/17	**1.1**
	09/18	**0.96**
	06/19	**0.44**

Table G-3. Summary of 1,4-Dioxane Results in Groundwater and Seeps at OU 2 Area 8 (2007-2019)

Location	Sampling Date	1,4-Dioxane (µg/L)
MW8-14	06/07	1.0 U *
	07/11	1.0 U *
	06/12	1.0 J
	06/13	1.0 U *
	06/14	1.0 U *
	06/15	0.40 U
	06/16	0.16 J
	06/17	0.40 U
	09/18	0.40 U
	06/19	0.19 U
MW8-15	06/19	0.19 U
MW8-16	06/07	1.0 U *
	07/11	1.0 U *
	06/12	1.0 U *
	06/13	1.0 U *
	06/14	1.0 U *
	06/15	0.40 U
	06/16	0.22 J
	06/17	0.40 U
	09/18	0.40 U
	06/19	0.19 U
Seep A	07/11	1.0 U *
Seep B	07/11	1.0 U *

Notes:

No remediation goal is established for 1,4-dioxane.

Bold value is equal to or exceeds the Model Toxics Control Act Method B cleanup level (0.44 µg/L).

Data are from U.S. Navy 2015c.

* - Reporting limit exceeds the MTCA Method B cleanup level.

J - The result is an estimated concentration that is less than the MRL, but greater than or equal to the MDL.

MDL - method detection limit

µg/L - microgram per liter

MRL - method reporting limit

U - The compound was analyzed for, but was not detected ("nondetect") at or above the MRL/MDL.

Table G-4. Summary of Inorganics Detected in Groundwater and Seeps at OU 2 Area 8 Exceeding One-Half of the MTCA Method B Cleanup Levels (1995-2019)

		Analyte Concentration (µg/L)																							
		Arsenic				Cadmium		Total Chromium		Chromium VI		Copper		Lead		Mercury		Nickel		Silver		Thallium		Zinc	
Location	Sampling Date	Total	Total (ICP)	Dissolved	Dissolved (ICP)	Total	Dissolved	Total	Dissolved[b]	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
RG Drinking Water		0.05[e]				5		50[c]		80		590		15		2		100		48		1.1		4,800	
RG Surface Water		0.14[a,e]				8		50[d]		50		2.5		5.8		0.025		7.9		1.2		1.6		77	
MW8-6	06/96	NA	NA	NA	1.1 B	NA	(-)	NA	NA	(-)	NA	NA	(-)	NA	NA	NA	NA	NA	(-)	NA	NA	NA	(-)	NA	54.8
MW8-7	11/95	3.3 +	NA	NA	NA	(-)	NA	NA	NA	(-)	NA	(-)	NA	(-)	NA	0.11	NA	(-)	NA	(-)	NA	NS	2.4 +	(-)	NA
	11/95	(-)	NA	NA	NA	(-)	NA	NA	NA	390	NA	4.8 +	NA	(-)	NA	(-)	NA	12.8 +	NA	(-)	NA	(-)	NA	(-)	NA
	05/96	NA	NA	NA	1.4 B	NA	(-)	NA	NA	380	NA	NA	(-)	NA	NA	NA	NA	NA	(-)	NA	NA	NA	1.2 BN	NA	(-)
	09/96	NA	NA	(-)	NA	NA	(-)	330	NA	320	NA	NA	(-)	NA	NA	NA	NA	NA	(-)	NA	(-)	NA	NA	NA	(-)
	05/97	NA	NA	2.0 UN *	NA	NA	(-)	NA	319	NA	350	NA	2.0 U	NA	(-)	NA	0.20 U *	NA	5.0 U	NA	4.0 U *	NA	1.0 UN	NA	(-)
	10/97	NA	NA	0.50 UN *	NA	NA	(-)	NA	372	NA	NA	NA	2.3 B	NA	(-)	NA	0.10 U *	NA	11.0 U *	NA	1.8 B	NA	1.8 UN *	NA	(-)
	05/99	NA	NA	0.50 U *	NA	NA	(-)	NA	344	NA	NA	NA	(-)	NA	(-)	NA	0.10 U *	NA	4.0 U	NA	1.0 UN	NA	1.2 U *	NA	(-)
	10/98	NA	NA	1.8 U *	NA	NA	(-)	NA	322	NA	NA	NA	(-)	NA	(-)	NA	0.10 U *	NA	(-)	NA	1.0 UN	NA	1.2 U *	NA	(-)
	05/99	NA	NA	1.7 U *	NA	NA	(-)	NA	184 N	NA	NA	NA	(-)	NA	(-)	NA	0.10 U *	NA	3.5 BN	NA	2.2 U *	NA	1.0 UN	NA	(-)
	11/99	NA	NA	5 U *	NA	NA	2.5	NA	154	NA	NA	NA	10 U *	NA	2 U	NA	0.2 U *	NA	20 U *	NA	10 U *	NA	5 U *	NA	10 U
	06/00	NA	NA	0.20 J	NA	NA	1.33	NA	95.7	NA	102 J	NA	0.46 J	NA	0.03	NA	0.10 U *	NA	3.21 J	NA	0.907	NA	0.01 U	NA	3.1
	06/01	NA	NA	0.3 UJ *	NA	NA	0.58	NA	71.4	NA	NS	NA	0.29 J	NA	0.04 U	0.0022	NA	NA	1.5	NA	0.62	NA	0.005 U	NA	2 U
	06/02	NA	NA	0.13 J	NA	NA	0.83 J	NA	191	NA	NA	NA	0.40	NA	0.15 UJ	NA	0.10 U *	NA	1.45	NA	0.47 J	NA	0.006 J	NA	0.8
	06/03	NA	NA	0.43 J	NA	NA	0.15	NA	84.1 J	NA	NA	NA	0.49	NA	0.04	NA	0.10 U *	NA	0.76 J	NA	0.17	NA	0.005 B	NA	0.7
	06/04	NA	NA	0.32 B	NA	NA	0.2	NA	111	NA	NA	NA	0.45	NA	0.009 B	NA	0.04 U *	NA	0.79	NA	0.489	NA	0.003 U	NA	1.45
MW8-8	06/05	NA	NA	0.44	NA	NA	1.23	NA	88.3	NA	NA	NA	0.42	NA	0.1 U	NA	0.1 U *	NA	2.8	NA	0.265	NA	0.01 U	NA	0.99
	06/06	NA	NA	0.27 B	NA	NA	0.334	NA	88.6	NA	NA	NA	0.369	NA	0.021 U	NA	0.2 U *	NA	0.61 J	NA	0.284	NA	0.02 U	NA	1.02
	06/07	NA	NA	0.26 J	NA	NA	0.12	NA	81.9	NA	NA	NA	5.1	NA	0.24	NA	0.2 U *	NA	0.69	NA	0.19	NA	0.02 U	NA	1
	05/08	NA	NA	0.21 B	NA	NA	0.124	NA	96	NA	NA	NA	0.496	NA	0.054 U	NA	0.2 U *	NA	1.08	NA	0.182	NA	0.005 B	NA	0.77
	06/09	NA	NA	0.21 J	NA	NA	0.432	NA	43.8	NA	NA	NA	0.437	NA	0.020 U	NA	0.2 U *	NA	1.05	NA	0.746 J	NA	0.009 J	NA	1.43
	06/10	NA	NA	0.85	NA	NA	0.114	NA	55.6	NA	NA	NA	0.77	NA	0.02 UJ	NA	0.02 J	NA	0.72	NA	0.292	NA	0.02 U	NA	0.87
	07/11	NA	NA	0.91	NA	NA	0.036 UJ	NA	118	NA	NA	NA	0.55	NA	0.02 UJ	NA	0.2 U *	NA	0.4	NA	0.198	NA	0.02 U	NA	0.48 J
	06/12	NA	NA	0.7	NA	NA	0.022	NA	59.6	NA	NA	NA	0.51	NA	0.107	NA	0.2 U *	NA	0.68	NA	0.2	NA	0.013 J	NA	0.5
	06/13	NA	NA	0.648	NA	NA	0.008	NA	52.3	NA	NA	NA	0.33	NA	0.02 U	NA	0.2 U *	NA	0.34	NA	0.211	NA	0.02 U	NA	0.37 J
	06/14	NA	NA	0.56	NA	NA	0.015 J	NA	66.7	NA	NA	NA	0.39 J	NA	0.05	NA	0.0023	NA	0.33	NA	0.336	NA	0.02 U	NA	0.38 J
	06/15	NA	NA	0.61	NA	NA	0.04 UJ	NA	83.2	NA	NA	NA	1.05	NA	0.122	NA	0.00361	NA	0.28	NA	0.327 J	NA	0.02 UJ	NA	1.69
	06/16	NA	NA	0.8	NA	NA	0.082	NA	53.6	NA	NA	NA	0.3	NA	0.147	NA	0.00264	NA	0.3	NA	0.496	NA	0.02 UJ	NA	2.1
	07/17	NA	NA	0.33 J	NA	NA	0.057	NA	70.2	NA	NA	NA	0.32	NA	0.008 J	NA	NA	NA	0.41	NA	0.466	NA	NA	NA	0.54
	09/18	NA	NA	0.6 J	NA	NA	0.061	NA	60.4	NA	NA	NA	0.41	NA	0.04 U	NA	NA	NA	0.43	NA	0.484	NA	NA	NA	0.5 U
	06/19	NA	NA	0.42 J	NA	NA	0.207	NA	64.4	NA	NA	NA	0.27	NA	0.02 U	NA	NA	NA	0.57	NA	0.613	NA	NA	NA	2.2
	11/95	3.0 NW	NA	NA	NA	(-)	NA	NA	NA	(-)	NA	3.6 W+	NA	(-)	NA	(-)	NA	(-)	NA	(-)	NA	(-)	NA	(-)	NA
	05/96	NA	NA	NA	2.6 B	NA	(-)	NA	NA	380	NA	NA	(-)	NA	NA	NA	NA	NA	(-)	NA	NA	NA	(-)	NA	(-)
	09/96	NA	NA	3.4 BW	NA	NA	3.5 B	(-)	NA	(-)	NA	NA	(-)	NA	NA	NA	NA	NA	(-)	NA	(-)	NA	NA	NA	(-)
	05/97	NA	NA	3.2 NW	NA	NA	(-)	NA	(-)	NA	(-)	NA	2.0 U	NA	(-)	NA	0.20 UN *	NA	5.0 U	NA	4.0 U *	NA	134 N	NA	(-)
	10/97	NA	NA	1.4 BNW	NA	NA	(-)	NA	(-)	NA	NA	NA	(-)	NA	(-)	NA	0.35	NA	11.0 U	NA	1.0 U	NA	1.8 UNW *	NA	(-)
	04/98	NA	NA	1.1 BW	NA	NA	(-)	NA	(-)	NA	NA	NA	(-)	NA	(-)	NA	0.10 U *	NA	7.0 B	NA	1.0 UN	NA	6.0 U *	NA	(-)
	10/98	NA	NA	5.4 B	NA	NA	(-)	NA	(-)	NA	NA	NA	(-)	NA	(-)	NA	0.13 B	NA	38.2 B	NA	2.0 B	NA	6.0 UW *	NA	(-)
	05/99	NA	NA	2.0 B	NA	NA	(-)	NA	(-)	NA	NA	NA	(-)	NA	(-)	NA	0.10 U *	NA	16.3 BN	NA	2.7 B	NA	10.0 UNW *	NA	(-)
	11/99	NA	NA	5 U *	NA	NA	14	NA	8	NA	NA	NA	10 U *	NA	2 U	NA	0.2 U *	NA	20 U *	NA	10	NA	5 U	NA	10 U
	06/00	NA	NA	0.80 J	NA	NA	1.05	NA	9.8	NA	16 J	NA	0.95 J	NA	0.97	NA	0.10 U *	NA	8.57 J	NA	3.7	NA	0.01 U	NA	8.6
	06/01	NA	NA	0.5 J	NA	NA	1.13	NA	9.7	NA	NS	NA	0.78 J	NA	0.04 U	0.0036		NA	4.2	NA	1.61	NA	0.005 B	NA	3 U
	06/02	NA	NA	0.43 J	NA	NA	0.65 J	NA	6.43	NA	NA	NA	0.90	NA	0.049 UJ	NA	0.10 U *	NA	4.97	NA	1.44 J	NA	0.003 J	NA	3.2
	06/03	NA	NA	0.58 J	NA	NA	0.98	NA	6.9 J	NA	NA	NA	1.38	NA	0.23	NA	0.10 B	NA	4.85 J	NA	1.66	NA	0.015 B	NA	4.9
	06/04	NA	NA	0.42 B	NA	NA	0.51	NA	7.09	NA	NA	NA	0.73	NA	0.52	NA	0.05 U *	NA	3.91	NA	1.3	NA	0.003 U	NA	1.57
MW8-9	06/05	NA	NA	0.43	NA	NA	0.904	NA	6.8	NA	NA	NA	0.75	NA	0.1 U	NA	0.1 U *	NA	3.5	NA	0.68	NA	0.01 U	NA	2.17
	06/06	NA	NA	0.49 B	NA	NA	0.454	NA	6.87	NA	NA	NA	0.652	NA	0.02 U	NA	0.2 U *	NA	2.57 J	NA	0.863	NA	0.02 U	NA	1.01
	06/07	NA	NA	0.52 J	NA	NA	0.3	NA	6.1	NA	NA	NA	8.1	NA	0.35	NA	0.2 U *	NA	2.3	NA	0.48	NA	0.02 U	NA	1.3
	05/08	NA	NA	0.69	NA	NA	0.363	NA	6.38	NA	NA	NA	0.654	NA	0.026 U	NA	0.2 U *	NA	2.25	NA	0.421	NA	0.004 B	NA	0.82
	06/09	NA	NA	0.63 J	NA	NA	0.59	NA	4.85	NA	NA	NA	0.659	NA	0.020 U	NA	0.2 U *	NA	1.55	NA	0.263 J	NA	0.020 U	NA	0.59
	06/10	NA	NA	0.73	NA	NA	0.174	NA	4.28	NA	NA	NA	0.739	NA	0.02 UJ	NA	0.2 U *	NA	1.2	NA	0.312	NA	0.02 UJ	NA	4.57
	07/11	NA	NA	0.63	NA	NA	0.343	NA	7.46	NA	NA	NA	0.739	NA	0.014 J	NA	0.2 U *	NA	1.74	NA	0.497	NA	0.02 UJ	NA	0.65
	06/12	NA	NA	0.61	NA	NA	0.286	NA	6.09	NA	NA	NA	0.581	NA	0.015 J	NA	0.2 U *	NA	1.48	NA	0.43	NA	0.02 UJ	NA	0.6
	06/13	NA	NA	0.67	NA	NA	0.238	NA	5.41	NA	NA	NA	0.561	NA	0.009 J	NA	0.2 U *	NA	1.28	NA	0.245	NA	0.02 UJ	NA	0.48 J
	06/14	NA	NA	0.66	NA	NA	0.231	NA	6.3	NA	NA	NA	0.564	NA	0.18	NA	0.00439	NA	1.38	NA	0.36	NA	0.02 UJ	NA	0.7
	06/15	NA	NA	0.67 J	NA	NA	0.438	NA	6.32	NA	NA	NA	1.98	NA	0.09	NA	0.003	NA	1.87	NA	0.488	NA	0.02 U	NA	2.5
	06/16	NA	NA	0.56	NA	NA	0.523	NA	7.81	NA	NA	NA	0.99	NA	12	NA	0.00374	NA	1.54	NA	0.668	NA	0.02 U	NA	6.58
	07/17	NA	NA	0.49 J	NA	NA	0.284	NA	5	NA	NA	NA	0.57	NA	0.016 J	NA	NA	NA	1.51	NA	0.439	NA	NA	NA	0.67
	09/18	NA	NA	0.7	NA	NA	0.476	NA	10.3	NA	NA	NA	0.59	NA	0.05 UJ	NA	NA	NA	1.24	NA	0.507	NA	NA	NA	0.65
	06/19	NA	NA	0.66	NA	NA	0.73	NA	8.3	NA	NA	NA	0.47	NA	0.059 UJ	NA	NA	NA	1.44	NA	0.375	NA	NA	NA	0.57

Table G-4. Summary of Inorganics Detected in Groundwater and Seeps at OU 2 Area 8 Exceeding One-Half of the MTCA Method B Cleanup Levels (1995-2019)

		Analyte Concentration (µg/L)																							
		Arsenic				Cadmium		Total Chromium		Chromium VI		Copper		Lead		Mercury		Nickel		Silver		Thallium		Zinc	
Location	Sampling Date	Total	Total (ICP)	Dissolved	Dissolved (ICP)	Total	Dissolved	Total	Dissolved[b]	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
RG Drinking Water		0.05[e]				5		50[c]		80		590		15		2		100		48		1.1		4,800	
RG Surface Water		0.14[a,e]				8		50[d]		50		2.5		5.8		0.025		7.9		1.2		1.6		77	
MW8-11	11/95	2.0 W+	NA	NA	NA	251	NA	NA	NA	950	NA	13.4 S	NA	(-)	NA	0.22	NA	51.3	NA	4.2	NA	(-)	NA	207	NA
	05/96	NA	NA	NA	1.0 U *	NA	444	NA	NA	800	NA	NA	18.9 B	NA	NA	NA	NA	NA	39.5 B	NA	NA	NA	(-)	NA	248
	09/96	NA	NA	2.4 BW	NA	NA	262	626	NA	720	NA	NA	14.3 B	NA	NA	NA	NA	NA	42.3	NA	(-)	NA	NA	NA	166
	05/97	NA	NA	2.1 NW	NA	NA	210	NA	441	NA	610	NA	12.4	NA	(-)	NA	0.20 UN *	NA	30.5	NA	7.0 N	NA	10.0 UW *	NA	161
	10/97	NA	NA	0.66 BNW	NA	NA	278	NA	377	NA	NA	NA	11.7 B	NA	(-)	NA	0.32	NA	40.0	NA	4.4 B	NA	9.0 UNW *	NA	178
	05/98	NA	NA	0.50 UW *	NA	NA	320	NA	303	NA	NA	NA	12.5 B	NA	(-)	NA	0.10 U *	NA	36.9 B	NA	5.2 BN	NA	6.0 U *	NA	193
	10/98	NA	NA	2.1 B	NA	NA	126 E	NA	459	NA	NA	NA	9.0 B	NA	(-)	NA	0.17 B	NA	16.2 B	NA	2.2 B	NA	1.2 UW *	NA	50.9
	05/99	NA	NA	2.6 B	NA	NA	33.5 N	NA	198	NA	NA	NA	5.3 B	NA	(-)	NA	0.10 B	NA	4.6 BN	NA	2.2 U *	NA	10.0 UNW *	NA	(-)
	11/99	NA	NA	5 U *	NA	NA	205	NA	201	NA	NA	NA	10 U *	NA	2U	NA	0.2 U *	NA	20 U *	NA	10	NA	5 U *	NA	89
	06/00	NA	NA	0.80 J	NA	NA	106	NA	221	NA	227 J	NA	4.44 J	NA	0.16	NA	0.10 U *	NA	10.2 J	NA	2.09	NA	0.04	NA	109
	06/01	NA	NA	0.7 J	NA	NA	129	NA	429	NA	NS	NA	4.95 J	NA	0.062	0.0071		NA	13	NA	2.29	NA	0.038	NA	110
	06/02	NA	NA	0.52 J	NA	NA	420 J	NA	608	NA	NA	NA	4.90	NA	0.047 UJ	NA	0.10 U *	NA	9.46	NA	3.87 J	NA	0.040 J	NA	221
	06/03	NA	NA	0.61 J	NA	NA	353	NA	302 J	NA	NA	NA	5.15	NA	0.02 U	NA	0.10 U *	NA	9.10 J	NA	5.87	NA	0.041	NA	134
	06/04	NA	NA	0.57	NA	NA	357	NA	290	NA	NA	NA	5.29	NA	0.036	NA	0.08 U *	NA	31.9	NA	6.45	NA	0.053	NA	157
	06/05	NA	NA	1.9	NA	NA	266	NA	230	NA	NA	NA	4.63	NA	0.1 U	NA	0.1 U *	NA	24.4	NA	6	NA	0.05	NA	91
	06/06	NA	NA	0.61	NA	NA	338	NA	157	NA	NA	NA	3.48	NA	0.066 U	NA	0.2 U *	NA	25.8 J	NA	6.17	NA	0.0405	NA	135
	06/07	NA	NA	0.53 J	NA	NA	231	NA	150	NA	NA	NA	3.60	NA	0.094	NA	0.2 U *	NA	19.3	NA	4.70	NA	0.038	NA	81.0
	05/08	NA	NA	0.82	NA	NA	154	NA	191	NA	NA	NA	3.44	NA	0.055 U	NA	0.2 U *	NA	15.1	NA	3.5	NA	0.025	NA	58.1
	06/09	NA	NA	0.94 J	NA	NA	115	NA	163	NA	NA	NA	3.1	NA	0.020 U	NA	0.2 U *	NA	11.1	NA	2.45 J	NA	0.024	NA	49.1
	06/10	NA	NA	0.87	NA	NA	214	NA	157	NA	NA	NA	3.09	NA	0.02 UJ	NA	0.02 J	NA	19.8	NA	5.86	NA	0.034 UJ	NA	85.7
	07/11	NA	NA	0.68	NA	NA	166	NA	165	NA	NA	NA	3	NA	0.023	NA	0.2 U *	NA	16	NA	3.55	NA	0.025	NA	68
	06/12	NA	NA	0.7	NA	NA	152	NA	153	NA	NA	NA	2.81	NA	0.02 U	NA	0.2 U *	NA	11.4	NA	3.22	NA	0.026 UJ	NA	68.4
	06/13	NA	NA	0.86	NA	NA	85.1	NA	187	NA	NA	NA	2.61	NA	0.014 J	NA	0.2 U *	NA	9.77	NA	2.77	NA	0.022 UJ	NA	44
	06/14	NA	NA	0.93	NA	NA	106	NA	164	NA	NA	NA	2.76	NA	0.05	NA	0.00973	NA	12.1	NA	2.6	NA	0.033 UJ	NA	43
	06/15	NA	NA	0.87 J	NA	NA	127	NA	182	NA	NA	NA	3.52	NA	0.047	NA	0.0102	NA	13.8	NA	3.11	NA	0.026	NA	52.4
	06/16	NA	NA	0.74	NA	NA	131	NA	145	NA	NA	NA	5.75	NA	8.02	NA	0.0114	NA	19.1	NA	4.21	NA	0.029	NA	85
	06/17	NA	NA	0.91	NA	NA	135	NA	140	NA	NA	NA	2.62	NA	0.017 J	NA	NA	NA	14.6	NA	2.7	NA	NA	NA	48
	09/18	NA	NA	0.77	NA	NA	122	NA	168	NA	NA	NA	2.81	NA	0.094 UJ	NA	NA	NA	5.87	NA	3.85	NA	NA	NA	47
	06/19	NA	NA	1.09	NA	NA	161	NA	135	NA	NA	NA	2.52	NA	0.05 U	NA	NA	NA	13.7	NA	2.77	NA	NA	NA	47.9
MW8-12	11/95	5.1 N	NA	NA	NA	28.6	NA	NA	NA	1500	NA	329 S+	NA	11.7	NA	0.19	NA	34.6 +	NA	(-)	NA	(-)	NA	(-)	NA
	05/96	NA	NA	NA	3.6 B	NA	46.1	NA	NA	380	NA	NA	(-)	NA	NA	NA	NA	NA	17.9 B	NA	NA	NA	(-)	NA	29.7
	09/96	NA	NA	1.9 B	NA	NA	53.8	1740	NA	1800	NA	NA	(-)	NA	NA	NA	NA	NA	49.3	NA	(-)	NA	NA	NA	(-)
	05/97	NA	NA	2.0 UN *	NA	NA	565	NA	1280	NA	1400	NA	64.4	NA	20 UN *	NA	0.20 UN *	NA	673	NA	40 UN *	NA	1.0 UNW	NA	727
	10/97	NA	NA	1.8 BN	NA	NA	154	NA	961	NA	NA	NA	150	NA	(-)	NA	0.10 U *	NA	423	NA	1.8 B	NA	1.8 UNW *	NA	325
	05/98	NA	NA	2.4 BW	NA	NA	7.3	NA	728	NA	NA	NA	5.2 B	NA	(-)	NA	0.10 U *	NA	7.5 B	NA	1.0 BN	NA	1.2 U *	NA	(-)
	10/98	NA	NA	1.8 U *	NA	NA	6.5 E	NA	1090	NA	NA	NA	4.0 B	NA	(-)	NA	0.15 B	NA	8.9 B	NA	1.2 B	NA	1.2 U *	NA	(-)
	5/99	NA	NA	1.7 U *	NA	NA	45.7 N	NA	815 N	NA	NA	NA	19.9 B	NA	3.2 N	NA	0.10 U *	NA	70.0 N	NA	2.2 U *	NA	1.0 UNW	NA	48.9
	11/99	NA	NA	NA	NA	NA	(-)	NA	(-)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	06/00	NA	NA	0.20 J	NA	NA	20	NA	163	NA	216 J	NA	5.65 J	NA	0.75	NA	0.10 U *	NA	26.8 J	NA	0.88	NA	0.01 U	NA	24.9
	06/01	NA	NA	0.3 J	NA	NA	20.7	NA	193	NA	NA	NA	6.14 J	NA	1.2	0.0022	NA	NA	22	NA	1.24	NA	0.013 B	NA	25.3
	06/02	NA	NA	0.37 J	NA	NA	4.42 J	NA	238	NA	NA	NA	4.10	NA	0.17 UJ	NA	0.10 U *	NA	2.77	NA	0.27 K	NA	0.006 J	NA	1.8
	06/03	NA	NA	0.32 J	NA	NA	7.84	NA	107 J	NA	NA	NA	2.78	NA	0.15	NA	0.10 U *	NA	4.36 J	NA	0.47	NA	0.013 B	NA	2.3
	06/04	NA	NA	0.43 B	NA	NA	3.23	NA	146	NA	NA	NA	5.15	NA	0.096	NA	0.05 U *	NA	2.55	NA	-0.197	NA	0.007 B	NA	0.92
	06/05	NA	NA	1.3	NA	NA	2.04	NA	114	NA	NA	NA	3.7	NA	0.219	NA	0.1 U *	NA	3	NA	0.22	NA	0.01 U	NA	5.97
	06/06	NA	NA	0.28 B	NA	NA	2.71	NA	113	NA	NA	NA	2.67	NA	0.048 U	NA	0.2 U *	NA	1.99 J	NA	0.279	NA	0.02 U	NA	4.17
	06/07	NA	NA	0.47 J	NA	NA	0.31	NA	101	NA	NA	NA	2.6	NA	0.054	NA	0.2 U *	NA	0.92	NA	0.037	NA	0.02 U	NA	0.67
	05/08	NA	NA	0.53	NA	NA	0.431	NA	100	NA	NA	NA	2.18	NA	0.036 U	NA	0.2 U *	NA	1.07	NA	0.057	NA	0.004 B	NA	0.25 B
	06/09	NA	NA	0.68 J	NA	NA	0.109	NA	80.8	NA	NA	NA	1.65	NA	0.018 J	NA	0.2 U *	NA	0.57	NA	0.016 J	NA	0.006 J	NA	0.15 J
	06/10	NA	NA	0.35 J	NA	NA	0.433	NA	74.8	NA	NA	NA	2.48	NA	0.264 J	NA	0.02 J	NA	0.93	NA	0.05	NA	0.02 UJ	NA	0.39 J
	07/11	NA	NA	0.46 J	NA	NA	0.194	NA	137	NA	NA	NA	2.22	NA	0.048	NA	0.2 U *	NA	0.66	NA	0.027 UJ	NA	0.02 UJ	NA	0.2 J
	06/12	NA	NA	0.5	NA	NA	0.128	NA	106	NA	NA	NA	1.78	NA	0.028	NA	0.2 U *	NA	0.57	NA	0.019 J	NA	0.034 J	NA	0.5 UJ
	06/13	NA	NA	4.63	NA	NA	0.063	NA	89.4	NA	NA	NA	1.53	NA	0.032	NA	0.2 U *	NA	0.42	NA	0.008 J	NA	0.02 U	NA	0.43 J
	06/14	NA	NA	2.2	NA	NA	0.096	NA	97.2	NA	NA	NA	2.7 J	NA	0.064	NA	0.00142	NA	0.33	NA	0.02 UJ	NA	0.02 U	NA	0.35 J
	06/15	NA	NA	2.3	NA	NA	0.082	NA	118	NA	NA	NA	2.11	NA	0.425	NA	0.00328	NA	0.58	NA	0.02 UJ	NA	0.02 UJ	NA	0.58
	06/16	NA	NA	0.3 J	NA	NA	0.797	NA	87.69	NA	NA	NA	2.29	NA	0.057 UJ	NA	0.00367	NA	1.11	NA	0.141	NA	0.02 U	NA	1.63
	06/17	NA	NA	0.45 J	NA	NA	0.352	NA	72.9	NA	NA	NA	1.45	NA	0.039	NA	NA	NA	0.79	NA	0.045	NA	NA	NA	0.33 J
	09/18	NA	NA	0.45 J	NA	NA	0.272	NA	159	NA	NA	NA	1.79	NA	0.061 UJ	NA	NA	NA	0.88	NA	0.052	NA	NA	NA	0.43 J
	06/19	NA	NA	0.33 J	NA	NA	2.73	NA	89.7	NA	NA	NA	1.65	NA	0.132 UJ	NA	NA	NA	2.99	NA	0.327	NA	NA	NA	13.5

Table G-4. Summary of Inorganics Detected in Groundwater and Seeps at OU 2 Area 8 Exceeding One-Half of the MTCA Method B Cleanup Levels (1995-2019)

Location	Sampling Date	Analyte Concentration (µg/L)																							
		Arsenic				Cadmium		Total Chromium		Chromium VI		Copper		Lead		Mercury		Nickel		Silver		Thallium		Zinc	
		Total	Total (ICP)	Dissolved	Dissolved (ICP)	Total	Dissolved	Total	Dissolved[b]	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
RG Drinking Water		0.05[e]				5		50[c]		80		590		15		2		100		48		1.1		4,800	
RG Surface Water		0.14[a,e]				8		50[d]		50		2.5		5.8		0.025		7.9		1.2		1.6		77	
MW8-14	11/95	**5.1 W+**	NA	NA	NA	**22.4**	NA	NA	NA	**90**	NA	152 S	NA	**203 N**	NA	0.52	NA	**100**	NA	(-)	NA	(-)	NA	241	NA
	05/96	NA	NA	NA	**3.3 B**	NA	**10.9**	NA	NA	(-)	NA	NA	6.7 B	NA	NA	NA	NA	NA	(-)	NA	NA	NA	(-)	NA	29.9
	09/96	NA	NA	**3.1 BW**	NA	NA	**19.9**	(-)	NA	(-)	NA	NA	(-)	NA	NA	NA	NA	NA	(-)	NA	8.6 B	NA	NA	NA	(-)
	05/97	NA	NA	**2.8 NW**	NA	NA	**9.8**	NA	(-)	NA	(-)	NA	2.0 U	NA	(-)	NA	0.20 UN *	NA	5.0 U	NA	7.3 N	NA	10.0 UN *	NA	(-)
	10/97	NA	NA	**1.0 BNW**	NA	NA	3.2	NA	(-)	NA	NA	NA	(-)	NA	(-)	NA	0.48	NA	11.0 U *	NA	2.0 B	NA	1.8 UBN *	NA	(-)
	05/98	NA	NA	**0.86 BW**	NA	NA	**12.6**	NA	(-)	NA	NA	NA	(-)	NA	(-)	NA	0.10 U *	NA	4.8 B	NA	1.2 BN	NA	6.0 U *	NA	(-)
	10/98	NA	NA	**10.8**	NA	NA	**16.9 E**	NA	(-)	NA	NA	NA	(-)	NA	(-)	NA	0.15 B	NA	4 B	NA	1.0 U	NA	6.0 UW *	NA	(-)
	05/99	NA	NA	**2.2 B**	NA	NA	**10.5 N**	NA	(-)	NA	NA	NA	13.2	NA	(-)	NA	0.10 U *	NA	(-)	NA	2.2 U *	NA	10.0 UNW *	NA	(-)
	11/99	NA	NA	5 U *	NA	NA	**13**	NA	7	NA	NA	NA	10 U *	NA	2U	NA	0.2U *	NA	20 U *	NA	10 U *	NA	5 U	NA	10 U
	06/00	NA	NA	**2**	NA	NA	**13.8**	NA	14.4	NA	58.8 J	NA	1.22 J	NA	0.61	NA	0.10 U *	NA	3.71 J	NA	0.564	NA	0.01 U	NA	3.2
	06/01	NA	NA	**1.3 J**	NA	NA	**13.2**	NA	29.7	NA	NA	NA	1.16 J	NA	0.959	.0009 B		NA	2.4	NA	0.31	NA	0.007 B	NA	3 U
	06/02	NA	NA	**1.53 J**	NA	NA	**14.9 J**	NA	15.8	NA	NA	NA	1.70	NA	0.74 UJ	NA	0.10 U *	NA	4.63	NA	0.44 J	NA	0.007 J	NA	4
	06/03	NA	NA	**2.08 J**	NA	NA	**14.6**	NA	16.2 J	NA	NA	NA	1.53	NA	0.74	NA	0.10 U *	NA	4.71 J	NA	0.38	NA	0.006 B	NA	2.6
	06/04	NA	NA	**1.63**	NA	NA	**13.5**	NA	22.2	NA	NA	NA	1.37	NA	0.89	NA	0.06 U *	NA	5.61	NA	0.351	NA	0.007 B	NA	2.6
	06/05	NA	NA	**2**	NA	NA	**12.5**	NA	17.8	NA	NA	NA	1.65	NA	1.1	NA	0.1 U *	NA	6.9	NA	0.46	NA	0.01 U	NA	2.92
	06/06	NA	NA	**1.66**	NA	NA	**11.1**	NA	14.9	NA	NA	NA	1.13	NA	0.682	NA	0.2 U *	NA	5.17 J	NA	0.358	NA	0.02 U	NA	2.25
	06/07	NA	NA	**1.5 J**	NA	NA	**9.8**	NA	15.4	NA	NA	NA	2.9	NA	0.99	NA	0.2 U *	NA	5.5	NA	0.33	NA	0.02 U	NA	2.6
	05/08	NA	NA	**1.91**	NA	NA	**8.33**	NA	21	NA	NA	NA	1.38	NA	0.817	NA	0.2 U *	NA	5.21	NA	0.24	NA	0.012 B	NA	2.2
	06/09	NA	NA	**1.78 J**	NA	NA	**8.91**	NA	18.2	NA	NA	NA	1.76	NA	1.18	NA	0.2 U *	NA	5.08	NA	0.259 J	NA	0.005 J	NA	2.58
	06/10	NA	NA	**1.91**	NA	NA	**10.4**	NA	28.3	NA	NA	NA	1.42	NA	1.57 J	NA	0.2 U *	NA	4.89	NA	0.383	NA	0.02 UJ	NA	2.23
	07/11	NA	NA	**1.75**	NA	NA	**8.65**	NA	15.1	NA	NA	NA	1.87	NA	1.06	NA	0.2 U *	NA	5.42	NA	0.285	NA	0.02 UJ	NA	2.38
	06/12	NA	NA	**1.67**	NA	NA	**7.9**	NA	19.8	NA	NA	NA	1.29	NA	0.88	NA	0.2 U *	NA	4.42	NA	0.223	NA	0.039 J	NA	2.1
	06/13	NA	NA	**1.56**	NA	NA	**8.52**	NA	23.9	NA	NA	NA	1.29	NA	1.07	NA	0.2 U *	NA	4.25	NA	0.237	NA	0.02 UJ	NA	2.01
	06/14	NA	NA	**1.6**	NA	NA	**7.6**	NA	15.76	NA	NA	NA	1.91	NA	1.17	NA	0.00202	NA	4.35	NA	0.25	NA	0.02 UJ	NA	2.6
	06/15	NA	NA	**1.61 J**	NA	NA	**9.04**	NA	17.94	NA	NA	NA	1.76	NA	1.71	NA	0.00197	NA	5.19	NA	0.286	NA	0.011 J	NA	3.1
	06/16	NA	NA	**1.35**	NA	NA	**6.94**	NA	14.78	NA	NA	NA	1.83	NA	1.96	NA	0.00125	NA	4.64	NA	0.232	NA	0.008 J	NA	4.42
	06/17	NA	NA	**1.47**	NA	NA	**5.91**	NA	12.4	NA	NA	NA	1.39	NA	0.984	NA	NA	NA	4.37	NA	0.21	NA	NA	NA	2.41
	09/18	NA	NA	**1.61**	NA	NA	**10.1**	NA	31.2	NA	NA	NA	1.26	NA	1.45	NA	NA	NA	3.59	NA	0.305	NA	NA	NA	2.69
	06/19	NA	NA	**1.53**	NA	NA	**7.14 J**	NA	13.5	NA	NA	NA	1.25	NA	1.37	NA	NA	NA	5.08	NA	0.234	NA	NA	NA	2.43
MW8-15	11/95	(-)	NA	1.0 UN *	NA	(-)	(-)	NA	NA	(-)	NA	2.5 +	(-)	(-)	(-)	(-)	NA	(-)	9.3 +	(-)	3.0 UNW *	NS	(-)	(-)	35.6
	06/19	NA	NA	**0.23 J**	NA	NA	0.02 U	NA	0.28	NA	NA	NA	0.02 U	NA	0.025 UJ	NA	NA	NA	0.29	NA	0.020 U	NA	NA	NA	2.0 U
MW8-16	11/95	**2.3 +**	NA	NA	NA	(-)	NA	NA	NA	(-)	NA	(-)	NA	(-)	NA	0.16	NA	(-)	NA	(-)	NA	(-)	NA	(-)	NA
	05/96	NA	NA	NA	**2.8 B**	NA	(-)	NA	NA	(-)	NA	NA	(-)	NA	NA	NA	NA	NA	(-)	NA	NA	NA	**1.1 BNW**	NA	(-)
	09/96	NA	NA	**2.9 B**	NA	NA	(-)	(-)	NA	(-)	NA	NA	(-)	NA	NA	NA	NA	NA	(-)	NA	(-)	NA	NA	NA	(-)
	05/97	NA	NA	**2.3 N**	NA	NA	(-)	NA	(-)	NA	(-)	NA	2.0 U	NA	(-)	NA	0.20 UN *	NA	5.0 U	NA	4.0 UN *	NA	1.0 UNW	NA	(-)
	10/97	NA	NA	**1.4 BN**	NA	NA	(-)	NA	(-)	NA	NA	NA	(-)	NA	(-)	NA	0.10 U *	NA	11.0 U *	NA	1.0 U	NA	1.8 UN *	NA	(-)
	05/98	NA	NA	**1.2 B**	NA	NA	(-)	NA	(-)	NA	NA	NA	(-)	NA	(-)	NA	0.10 U *	NA	5.7 B	NA	1.0 UN	NA	1.2 U *	NA	(-)
	10/98	NA	NA	1.8 U *	NA	NA	(-)	NA	(-)	NA	NA	NA	(-)	NA	(-)	NA	0.10 U *	NA	(-)	NA	1.0 U	NA	1.2 U *	NA	(-)
	05/99	NA	NA	1.7 U *	NA	NA	(-)	NA	(-)	NA	NA	NA	(-)	NA	3.4 N	NA	0.11 B	NA	4,1 BN	NA	2.2 U *	NA	1.0 UNW	NA	(-)
	11/99	NA	NA	5 U *	NA	NA	4 U	NA	5U	NA	NA	NA	10 U *	NA	2 U	NA	0.2 U *	NA	20 U *	NA	10 U *	NA	5 U *	NA	10 U
	06/00	NA	NA	**1.14 J**	NA	NA	0.16	NA	.17 U	NA	4.0 U	NA	0.20 J	NA	7 U *	NA	0.10 U *	NA	1.02 J	NA	0.020 B	NA	0.03 U	NA	4
	06/01	NA	NA	**1.5 J**	NA	NA	0.21	NA	0.45	NA	NA	NA	0.2 R	NA	0.04 U	.0003 B	NA	NA	1.4	NA	0.07 U	NA	0.005 U	NA	36.5
	06/02	NA	NA	**1.82 J**	NA	NA	0.065 J	NA	0.04 U	NA	NA	NA	0.20	NA	0.011 UJ	NA	0.10 U *	NA	2.59	NA	0.001 J	NA	0.002 J	NA	1.7
	06/03	NA	NA	**2.37 J**	NA	NA	0.42	NA	1.0 UJ	NA	NA	NA	0.10 U	NA	0.10 U	NA	0.10 U *	NA	9.34 J	NA	0.04 U	NA	0.02 U	NA	2.3 B
	06/04	NA	NA	**2.75**	NA	NA	0.055	NA	0.04 U	NA	NA	NA	0.38	NA	0.011 B	NA	0.04 U *	NA	3.76	NA	0.005 U	NA	0.001 U	NA	1.07
	06/05	NA	NA	**3**	NA	NA	2 U	NA	5 U	NA	NA	NA	2	NA	2 U	NA	0.1 U *	NA	10 U *	NA	3 U *	NA	1 U	NA	6 U
	06/06	NA	NA	**2.44**	NA	NA	0.186	NA	0.2 U	NA	NA	NA	0.043 B	NA	0.02 U	NA	0.2 U *	NA	3.61 J	NA	0.028	NA	0.02 U	NA	1.15
	06/07	NA	NA	**2.3 J**	NA	NA	0.098	NA	1	NA	NA	NA	0.77	NA	0.075	NA	0.2 U *	NA	2.7	NA	0.02 U	NA	0.02 U	NA	1
	05/08	NA	NA	**3.61**	NA	NA	0.125	NA	0.41	NA	NA	NA	0.043 B	NA	0.044 U	NA	0.2 U *	NA	0.64	NA	0.01 B	NA	0.002 U	NA	0.36 B
	06/09	NA	NA	**3.50 J**	NA	NA	0.013 J	NA	0.10 J	NA	NA	NA	0.156	NA	0.020 U	NA	0.2 U *	NA	0.42	NA	0.004 J	NA	0.02 U	NA	0.10 J
	06/10	NA	NA	**1.52**	NA	NA	0.022 UJ	NA	0.06 J	NA	NA	NA	0.1 UJ	NA	0.02 UJ	NA	0.2 U *	NA	1	NA	0.005 J	NA	0.02 UJ	NA	0.21 J
	07/11	NA	NA	**4.1**	NA	NA	0.059	NA	0.29	NA	NA	NA	0.72	NA	0.02 UJ	NA	0.2 U *	NA	0.65	NA	0.02 UJ	NA	0.02 U	NA	0.46 J
	06/12	NA	NA	**2.04**	NA	NA	0.027	NA	0.33	NA	NA	NA	0.295	NA	0.009 J	NA	0.2 U *	NA	0.35	NA	0.015 J	NA	0.02 UJ	NA	0.5 UJ
	06/13	NA	NA	**4.19**	NA	NA	0.037	NA	2.49	NA	NA	NA	0.5	NA	0.042	NA	0.2 U *	NA	0.68	NA	0.053	NA	0.02 U	NA	1.25
	06/14	NA	NA	**3.9**	NA	NA	0.013 J	NA	1.11	NA	NA	NA	1.06 J	NA	0.054	NA	0.00289	NA	0.31	NA	0.022 UJ	NA	0.02 U	NA	0.84
	06/15	NA	NA	**2.6**	NA	NA	0.022	NA	0.42	NA	NA	NA	0.66	NA	0.046	NA	0.00218	NA	0.26	NA	0.02 UJ	NA	0.02 UJ	NA	0.99
	06/16	NA	NA	**2.14**	NA	NA	0.074	NA	0.2 UJ	NA	NA	NA	0.1 UJ	NA	0.02 UJ	NA	0.00034 B	NA	1.93	NA	0.02 UJ	NA	0.007 J	NA	0.76
	06/17	NA	NA	**2.17**	NA	NA	0.006 J	NA	1.01	NA	NA	NA	0.1 UJ	NA	0.016 J	NA	NA	NA	4.45	NA	0.008 J	NA	NA	NA	0.5
	09/18	NA	NA	**2.39**	NA	NA	0.02 UJ	NA	1.86	NA	NA	NA	0.06 J	NA	0.05 U	NA	NA	NA	4.1	NA	0.02 U	NA	NA	NA	0.52
	06/19	NA	NA	**2.21**	NA	NA	0.02 U	NA	0.51	NA	NA	NA	0.1 U	NA	0.05 U	NA	NA	NA	5.85	NA	0.02 U	NA	NA	NA	0.22

Table G-4. Summary of Inorganics Detected in Groundwater and Seeps at OU 2 Area 8 Exceeding One-Half of the MTCA Method B Cleanup Levels (1995-2019)

		Analyte Concentration (µg/L)																							
		Arsenic				Cadmium		Total Chromium		Chromium VI		Copper		Lead		Mercury		Nickel		Silver		Thallium		Zinc	
Location	Sampling Date	Total	Total (ICP)	Dissolved	Dissolved (ICP)	Total	Dissolved	Total	Dissolved[b]	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
RG Drinking Water		**0.05[e]**				**5**		**50[c]**		**80**		**590**		**15**		**2**		**100**		**48**		**1.1**		**4,800**	
RG Surface Water		**0.14[a,e]**				**8**		**50[d]**		**50**		**2.5**		**5.8**		**0.025**		**7.9**		**1.2**		**1.6**		**77**	
MW8-17	11/95	**3.0 N**	NA	NA	NA	(-)	NA	NA	NA	(-)	NA	26.7 S+	NA	(-)	NA	0.11	NA	35.2 +	NA	(-)	NA	NA	(-)	(-)	NA
MW8-18	11/95	**1.8 N**	NA	**1.2 N**	NA	(-)	(-)	NA	NA	(-)	NA	3.8 +	(-)	(-)	(-)	(-)	NA	16.0 +	9.0 +	(-)	3.0 UNW *	NA	(-)	(-)	(-)
MW8-19	11/95	**3.3 NW**	NA	**1.9 N**	NA	(-)	(-)	NA	NA	(-)	NA	22.9 S+	1.3 +	3.2	NA	(-)	NA	25.7 +	9.0 U + *	(-)	3.0 UNW *	NA	(-)	(-)	(-)
MW8-20	11/95	(-)	NA	NA	NA	(-)	NA	NA	NA	(-)	NA	7.9 +	NA	(-)	NA	(-)	NA	18.6 +	NA	(-)	NA	NA	(-)	(-)	NA
Seep A[f]	05/96	NA	NA	NA	1.3 B	46.7	33.9	183	159	240	NA	7.8 B	5.1 B	NA	NA	NA	NA	NA	(-)	NA	NA	NA	NA	NA	(-)
	05/97	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	(-)	NA	NA
	06/00	NA	NA	2.4 J	NA	NA	0.14	NA	0.6	NA	NA	NA	0.27	NA	1.3 J	NA	NA	NA	5.59 J	NA	1.14 J	NA	0.02	NA	0.8
	06/01	NA	NA	0.9 J	NA	NA	23.2	NA	5.6	NA	NA	NA	1 J	NA	0.06	0.0034	NA	NA	1	NA	0.1	NA	0.022	NA	7.6 B
	06/02	NA	NA	1.95 J	NA	NA	2.57 J	NA	0.44 U	NA	NA	NA	0.80	NA	0.054 UJ	NA	0.10 U *	NA	0.95	NA	0.011 UJ	NA	0.003 J	NA	1.3
	06/03	NA	NA	1.29 J	NA	NA	38.3	NA	7.6 J	NA	NA	NA	0.89	NA	0.03	NA	0.10 U *	NA	1.22 J	NA	0.02	NA	0.012 B	NA	4.5 B
	06/04	NA	NA	0.66	NA	NA	88.9	NA	45.5	NA	NA	NA	1.08	NA	0.032	NA	0.06 U *	NA	4.29	NA	0.031	NA	0.015 B	NA	0.83
	06/05	NA	NA	1.7	NA	NA	50.3	NA	11	NA	NA	NA	1.13	NA	0.1 U	NA	0.1 U *	NA	2	NA	0.032 U	NA	0.014	NA	1.83
	06/06	NA	NA	1.21	NA	NA	14.4	NA	3.58	NA	NA	NA	0.814	NA	0.08 U	NA	0.2 U *	NA	1.74 J	NA	0.162	NA	0.02 U	NA	1.4
	06/07	NA	NA	1 J	NA	NA	19.4	NA	7.2	NA	NA	NA	1.2	NA	0.063	NA	0.2 U *	NA	1.5	NA	0.02 U	NA	0.02 U	NA	1.5
	05/08	NA	NA	2.48	NA	NA	7.96	NA	10.6	NA	NA	NA	0.867	NA	0.092 U	NA	0.2 U *	NA	1.77	NA	0.037	NA	0.01 B	NA	1.44
	06/09	NA	NA	1.50 J	NA	NA	2.57	NA	5.0	NA	NA	NA	0.383	NA	0.028	NA	0.2 U *	NA	1.18	NA	0.013 J	NA	0.003 J	NA	1.00
	06/10	NA	NA	1.66	NA	NA	6.6	NA	4.87	NA	NA	NA	0.517	NA	0.042 UJ	NA	0.2 U *	NA	1.94	NA	0.03	NA	0.02 UJ	NA	2.58
	07/11	NA	NA	1.19	NA	NA	1.08	NA	3.59	NA	NA	NA	0.651	NA	0.036	NA	0.2 U *	NA	1.58	NA	0.02 UJ	NA	0.02 UJ	NA	0.6
	06/12	NA	NA	0.98	NA	NA	15.4	NA	7.52	NA	NA	NA	0.468	NA	0.047	NA	0.2 U *	NA	2.99	NA	0.107	NA	0.026 UJ	NA	1.21
	06/13	NA	NA	1.27	NA	NA	0.848	NA	4.32	NA	NA	NA	0.435	NA	0.016 J	NA	0.2 U *	NA	1.03 UJ	NA	0.009 J	NA	0.02 UJ	NA	0.68
	06/14	NA	NA	1.1	NA	NA	2.9	NA	7.3	NA	NA	NA	0.511	NA	0.03	NA	0.00162	NA	1.97	NA	0.02 UJ	NA	0.02 UJ	NA	0.8
	06/15	NA	NA	0.99 J	NA	NA	0.729	NA	1.37	NA	NA	NA	0.38	NA	0.047	NA	0.00506	NA	1.05	NA	0.011 J	NA	0.006 J	NA	2.3
	06/16	NA	NA	0.89	NA	NA	10.5	NA	3.22	NA	NA	NA	0.372	NA	0.053 UJ	NA	0.00134	NA	6.83	NA	0.057	NA	0.008 J	NA	0.62
	06/17	NA	NA	0.93	NA	NA	10.5	NA	6.14	NA	NA	NA	0.42	NA	0.034	NA	NA	NA	6.78	NA	0.039	NA	NA	NA	0.87
Seep B[f]	05/96	NA	3.0 B	NA	4.6 B	(-)	(-)	NA	NA	(-)	NA	24.5 B	8.5 B	NA	NA	NA	NA	NA	(-)	NA	NA	NA	NA	NA	(-)
	05/97	NA	NA	NA	NA	NA	NS	NA	NS	NA	NA	NA	NS	NA	NA	NA	NA	NA	NS	NA	NA	NA	(-)	NA	NA
	06/00	NA	NA	2.5 J	NA	NA	0.82	NA	6.4	NA	NA	NA	0.76	NA	.22 J	NA	NA	NA	.83 J	NA	0.297 J	NA	0.01 U	NA	1.4
	06/01	NA	NA	1.4 J	NA	NA	1.52	NA	4.4	NA	NA	NA	0.8 J	NA	0.04 U	.0009 B	NA	NA	1	NA	0.1 U	NA	0.011 B	NA	3.4 U
	06/02	NA	NA	1.29 J	NA	NA	2.23 J	NA	3.54	NA	NA	NA	0.90	NA	0.024 UJ	NA	0.10 U *	NA	1.95	NA	0.049 J	NA	0.011 J	NA	1.9
	06/03	NA	NA	1.33 J	NA	NA	4.18	NA	2.9 J	NA	NA	NA	0.76	NA	0.02 U	NA	0.10 U *	NA	1.26 J	NA	0.09	NA	0.013 B	NA	9.0 B
	06/04	NA	NA	1.02	NA	NA	8.33	NA	15.9	NA	NA	NA	0.71	NA	0.27	NA	0.06 U *	NA	4.31	NA	0.097	NA	0.017 B	NA	0.97
	06/05	NA	NA	1.43	NA	NA	2.06	NA	6.52	NA	NA	NA	0.89	NA	0.1 U	NA	0.1 U *	NA	2.77	NA	0.035	NA	0.01 U	NA	1.12
	06/06	NA	NA	1.32	NA	NA	2.1	NA	3.33	NA	NA	NA	0.602	NA	0.022	NA	0.2 U *	NA	2.64 J	NA	0.085	NA	0.02 U	NA	1.01
	06/07	NA	NA	1.1 J	NA	NA	1.1	NA	2.7	NA	NA	NA	0.6	NA	0.058	NA	0.2 U *	NA	1.8	NA	0.02 U	NA	0.02 U	NA	0.96
	05/08	NA	NA	2.27	NA	NA	1.26	NA	3.28	NA	NA	NA	0.668	NA	0.18 U	NA	0.2 U *	NA	2.11	NA	0.051	NA	0.019 B	NA	1.39
	06/09	NA	NA	1.26 J	NA	NA	0.616	NA	3.19	NA	NA	NA	0.618	NA	0.058	NA	0.2 U *	NA	1.10	NA	0.009 J	NA	0.004 J	NA	0.73
	06/10	NA	NA	1.4	NA	NA	0.928	NA	3.7	NA	NA	NA	0.646	NA	0.02 UJ	NA	0.2 U *	NA	1.46	NA	0.202	NA	0.02 UJ	NA	2.31
	07/11	NA	NA	1.17	NA	NA	1.05	NA	3.53	NA	NA	NA	0.69	NA	0.025	NA	0.2 U *	NA	1.61	NA	0.024 UJ	NA	0.018 J	NA	0.68
Seep C	09/18	NA	NA	1.18	NA	NA	20.8	NA	5.51	NA	NA	NA	0.92	NA	0.209 UJ	NA	NA	NA	1.58	NA	0.018 J	NA	NA	NA	2.25
	06/19	NA	NA	1.3	NA	NA	0.726	NA	4.36	NA	NA	NA	0.7	NA	0.050 U	NA	NA	NA	1.26	NA	0.007 J	NA	NA	NA	0.50 U

[a]Value listed is the lower of the cancer or noncancer value.

[b]Results are less than the results reported for chromium (VI) because of variation in analytical methods. Variance in results for these analytes is common.

[c]Value is for total chromium. Chromium (VI) is 80 µg/L.

[d]50 µg/L is for chromium (VI). There is no goal for total chromium.

[e]The background concentration of arsenic in groundwater at the site is 12 µg/L.

[f]Seeps are only compared to surface water RGs.

Notes:

Data from 1995 to 2004 are from U.S. Navy 2005a, from 2005 to 2008 are from U.S. Navy 2008e, from 2009 are from U.S. Navy 2009d, and from 2010 through 2014 are from U.S. Navy 2014b (updated some values based on Naval Installation Restoration Information Solution download).

Shaded row indicates data evaluated in this 5-year review period.

Bolded value indicates it exceeds or is equal to the RG for drinking water.

Yellow highlightec value exceeds or is equal to the surface water RG.

* - The reporting limit exceeds the RG.

(-) - undetected above one-half of the MTCA Method B cleanup levels

\+ - Duplicate analysis is not within control limits.

B - between instrument detection limit and contract required detection limit

J - The result is an estimated concentration that is less than the MRL, but greater than or equal to the MDL.

MDL - method detection limit

µg/L - microgram per liter

MRL - method reporting limit

MTCA - Model Toxics Control Act

N - Spiked sample is outside of control limits.

NA - not analyzed

RG - remediation goal

S - determined by method of standard additions

W - Post-digestion spike for furnace atomic absorption spectrophotometric analysis is out of control limits (85 to 115%), and sample is less than 50% of spike absorbance.

U - The compound was analyzed for, but was not detected ("nondetect") at or above the MRL/MDL.

Table G-5. PFAS Results for Area 8 Groundwater Sampling Locations, 2018 and 2019

Well Identification	**MW8-8**	**MW8-8**	**MW8-9**	**MW8-9**	**MW8-11**	**MW8-11**	**MW8-11 (Dup)**	**MW8-11 (Dup)**	**MW8-12**	**MW8-12**	**MW8-14**	**MW8-14**	**MW8-15**	**MW8-15**	**MW8-16**	**MW8-16**	**Field Blank**	**Field Blank**	**Field Blank**
	AREA-8-18-200	**AREA-8-19-200**	**AREA-8-18-201**	**AREA-8-19-201**	**AREA-8-18-202**	**AREA-8-19-202**	**AREA-8-18-203**	**AREA-8-19-203**	**AREA-8-18-204**	**AREA-8-19-204**	**AREA-8-18-205**	**AREA-8-19-205**	**AREA-8-18-207**	**AREA-8-19-207**	**AREA-8-18-206**	**AREA-8-19-206**	**AREA-8-18-210**	**AREA-8-19-212**	**AREA-8-19-213**
Sample Date	**09/17/18**	**06/10/19**	**09/17/18**	**06/11/19**	**09/18/18**	**06/25/19**	**09/18/18**	**06/25/19**	**09/17/18**	**06/10/19**	**09/18/18**	**06/25/19**	**09/18/18**	**06/10/19**	**09/17/18**	**06/11/19**	**09/17/18**	**06/10/19**	**06/25/19**
Units	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**
Analyte																			
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	19 U	21 U	19 U M	20 U	19 U	18 U M	19 U	18 U	18 U	20 U	19 U	18 U	19 U	20 U	19 U	20 U	18 U	20 U	18 U
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	19 U	21 U	19 U	20 U	19 U	18 U	19 U M	18 U	18 U	20 U	19 U M	18 U	19 U	20 U	19 U	20 U	18 U M	20 U	18 U M
Perfluorobutanesulfonic acid (PFBS)	**4.7**	**4.8**	**0.79 J M**	**0.76 J M**	**1.2 J M**	**1.1 J M**	**1.3 J**	**0.93 J M**	**4.5**	**3.6**	1.9 U M	1.8 U M	1.9 U	2.0 U	**0.77 J M**	**0.74 J**	1.8 U	2.0 U M	1.8 U
Perfluorodecanoic acid (PFDA)	**3.9**	**2.6**	1.9 U	2.0 U	**0.53 J**	**0.68 J**	**0.79 J M**	**0.66 J**	**2.7**	**1.5 J M**	1.9 U M	1.8 U	1.9 U	2.0 U	**0.75 J**	**0.76 J M**	1.8 U	2.0 U M	1.8 U
Perfluorododecanoic acid (PFDoA)	1.9 U	2.1 U	1.9 U	2.0 U	1.9 U	1.8 U	1.9 U	1.8 U	1.8 U	2.0 U	1.9 U	1.8 U	1.9 U	2.0 U	1.9 U	2.0 U	1.8 U	2.0 U	1.8 U
Perfluoroheptanoic acid (PFHpA)	**8.4**	**6.5 M**	**0.72 J**	**1.1 J M**	**3.5**	**3.0 M**	**3.4**	**2.6 M**	**7.7**	**4.7 M**	1.9 U	1.8 U	1.9 U	2.0 U M	**1.2 J**	**0.99 J M**	1.8 U	2.0 U M	1.8 U
Perfluorohexanesulfonic acid (PFHxS)	**2.6**	1.8 J M	4.6	**2.5 M**	**3.2**	**2.7 M**	**3.5**	**2.8 M**	**2.9**	**2.6 M**	**0.61 J M**	**0.60 J J1 M**	1.9 U	2.0 U M	**1.3 J M**	**1.3 J M**	1.8 U	2.0 U M	1.8 U M
Perfluorohexanoic acid (PFHxA)	**13**	**13**	**1.5 J M**	**2.4 M**	**3.5**	**3.3 M**	**3.5**	**3.3 M**	**13**	**11 M**	1.9 U M	**0.46 J**	1.9 U	2.0 U M	**1.8 J M**	**1.8 J M**	1.8 U	2.0 U	1.8 U
Perfluorononanoic acid (PFNA)	**3.7**	**2.8**	1.9 U M	2.0 U M	**1.0 J M**	**1.2 J**	**1.3 J**	**1.2 J M**	**3.7 M**	**2**	1.9 U J1 M	1.8 U	1.9 U	2.0 U	**0.60 J M**	**0.55 J M**	1.8 U	2.0 U M	1.8 U
Perfluorooctanesulfonic acid (PFOS)	**47**	**42**	**7.6**	**6.0 M**	**63**	**46**	**57**	**42**	**60**	**31**	**1.9 J M**	**1.7 J M**	3.8 U M	4.0 U M	**5.9**	**6.4 M**	3.5 U M	3.9 U M	3.6 U
Perfluorooctanoic acid (PFOA)	**17**	**13**	**1.7 J M**	**2.1 M**	**11**	**8.4 M**	**10 M**	**8.1 M**	**17 M**	**8.6 M**	**0.64 J M**	**0.62 J M**	1.9 U M	2.0 U	**2.4 M**	**2.4 M**	1.8 U M	2.0 U	1.8 U M
Perfluorotetradecanoic acid (PFTeA)	3.7 U	4.1 U	3.7 U	4.0 U	3.8 U M	3.5 U	3.8 U	3.5 U	3.6 U	4.1 U	3.7 U	3.5 U	3.8 U	4.0 U	3.8 U	4.0 U	3.5 U	3.9 U	1.8 U
Perfluorotridecanoic acid (PFTriA)	3.7 U	4.1 U	3.7 U	4.0 U	3.8 U	3.5 U	3.8 U	3.5 U	3.6 U	4.1 U	3.7 U	3.5 U	3.8 U	4.0 U	3.8 U	4.0 U	3.5 U	3.9 U	1.8 U
Perfluoroundecanoic acid (PFUnA)	1.9 U M	2.1 U M	1.9 U	2.0 U	1.9 U	1.8 U	1.9 U	1.8 U	1.8 U M	2.0 U	1.9 U J1	1.8 U M	1.9 U	2.0 U M	1.9 U	2.0 U M	1.8 U	2.0 U M	1.8 U
Total PFOS + PFOA	**64**	**55**	**9.3 J M**	**8.1 M**	**74**	**54.4 M**	**67 M**	**50.1 M**	**77 M**	**39.6 M**	**2.54 J M**	**2.32 J M**	5.7 U	6.0 U	**8.3**	**8.8**	5.3 U M	5.9 U M	5.4 U M
EPA Heath Advisory Level for PFOA, PFOS, or PFOA+PFOS	**70**	**70**	**70**	**70**	**70**	**70**	**70**	**70**	**70**	**70**	**70**	**70**	**70**	**70**	**70**	**70**	**70**	**70**	**70**

Notes :

Bold indicates the analyte was detected in the groundwater sample.

Shading indicates detected value is equal to or exceeds EPA Health Advisory Level of 70 ng/L.

Dup – field duplicate

J – analyte was positively identified; but the result is estimated estimation

J1 – the result is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria

M – manual integrated compound

ng/L – nanograms per liter

U – not detected at value shown

Table G-6. Selected VOC Results for OU 2 Area 8 Surface Water, June 2019

Location ID	Sample ID	Sampling Date	TCE (µg/L)	PCE (µg/L)	1,1-DCE (µg/L)	cis-1,2-DCE (µg/L)	1,1,1-TCA (µg/L)
Surface Water Remediation Goals			**81**	**8.9**	**3.2**	**--**	**42,000**
Seep C	AREA-8-19-210	06/17/19	0.2 UJ M J1	0.5 UJ J1	0.2 UJ M J1	0.2 UJ M J1	0.2 UJ J1
Seep C (DUP)	AREA-8-19-211	06/17/19	0.2 UJ M	0.5 UJ	0.2 UJ M	0.2 UJ M	0.2 UJ M

Notes:

Shading indicates detected value is equal to or exceeds surface water RG.

µg/L – microgram(s) per liter

DCE – dichloroethene

DUP – field duplicate

J1 –the result is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria

M – manually integrated compound

PCE – tetrachloroethene

TCA – trichloroethane

TCE – trichloroethene

UJ – analyte not detected, but the reported quantitation/detection limit is estimated

Table G-7. Dissolved Metals Results for OU 2 Area 8 Surface Water, June 2019

Location ID	Sample ID	Sampling Date	Arsenic (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Copper (µg/L)	Lead (µg/L)	Nickel (µg/L)	Silver (µg/L)	Zinc (µg/L)
Surface Water Remediation Goals			**0.14**[1/]	**8**	**50**[2/]	**2.5**	**5.8**	**7.9**	**1.2**	**77**
Seep C	AREA-8-19-210	06/17/19	1.3	0.418	0.32	0.44	0.077 UJ	0.5	0.02 U	1.19
Seep C (DUP)	AREA-8-19-211	06/17/19	1.28	0.539	0.39	0.47	0.066 UJ	0.54	0.02 U	1.18

Notes:

[1/]The background concentration of arsenic in groundwater at the site is 12 µg/L.

[2/]The RG of 50 µg/L is for hexavalent chromium [Cr(VI)]. There is no RG established for total dissolved chromium.

All concentrations are dissolved (except where noted above) and in µg/L.

Shading indicates detected value is equal to or exceeds the surface water RG.

µg/L – microgram(s) per liter

DUP – field duplicate

U – analyte was not detected at or above the indicated practical quantitation limit

UJ – analyte not detected, but the reported quantitation/detection limit is estimated

Table G-8. Dissolved Metals for OU 2 Area 8 Sediment, June 2019

Location ID	Sample ID	Sampling Date	Arsenic (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Nickel (mg/kg)	Silver (mg/kg)	Zinc (mg/kg)
Sediment Cleanup Goal[1/]			**57**	**5.1**	**260**	**390**	**450.0**	**NE**	**6.1**	**410**
Seep C	AREA-8-19-250	06/19/19	1.9 D	**14 JD J1**	46 D J1	11 JD J1	4.3 D	22 JD J1	0.48 D	36 JD
Seep C (DUP)	AREA-8-19-251	06/19/19	2.0 JD	**13 JD**	46 JD	12 JD	5.3 D	21 JD	0.66 D	42 JD

Notes:

[1/]The sediment cleanup goals are equal to the Washington State SQS values.

Bold indicates detected value is equal to or exceeds the sediment cleanup goal.

mg/kg – milligram(s) per kilogram

D – result reported from a diluted analysis

DUP – field duplicate

J – analyte positively identified, but result is estimated

J1 – the result is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria

SQS – Sediment Quality Standard

APPENDIX H
OU 2 AREA 8 DATA COLLECTED DURING FYR PERIOD

Table H-1. Metals and Total Solids Analysis Results for Reference Area Tissue

Sampling Station ID	Sample Date	Sample No.	Arsenic (mg/kg)	Inorganic Arsenic (µg/g)	Cadmium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Nickel (mg/kg)	Silver (mg/kg)	Zinc (mg/kg)	Mercury (ng/g)	Methyl Mercury (ng/g)	Total Solids (%)
Mean [a]			**2.22**	**0.035**	**0.445**	**0.4**	**1.16**	**0.022**	**0.399**	**--**	**15**	**6.2**	**3.9**	**14.6**
Median [a]			**2.19**	**0.033**	**0.438**	**0.343**	**1.12**	**0.0204**	**0.368**	**--**	**14.8**	**6.19**	**3.7**	**14.6**
Minimum [a]			**1.7**	**0.026**	**0.31**	**0.216**	**0.896**	**0.0132**	**0.229**	**--**	**13.1**	**3.35**	**2.2**	**13.3**
Maximum [a]			**3.09**	**0.055**	**0.63**	**1.72**	**1.45**	**0.0678**	**1.2**	**0.0475**	**17.1**	**8.22**	**6.6**	**16.2**
No. of Detected / No. Sampled			**22/22**	**22/22**	**22/22**	**22/22**	**22/22**	**22/22**	**22/22**	**1/22**	**22/22**	**22/22**	**22/22**	**22/22**
Range of Reporting Limits			**--**	**--**	**--**	**--**	**--**	**--**	**--**	**0.0069-0.0186**	**--**	**--**	**--**	**--**
PP01	6/2/2015	PP1-CL15	2.08	0.037	0.512	0.387	1.04	0.025	0.441	0.0156 U	16.2	3.35	3.4	13.3
PP02	6/2/2015	PP2-CL15	1.7	0.037	0.484	0.251	1.23	0.0164	0.348	0.0126 U	17	6.19	3.6	13.7
PP03	6/2/2015	PP3-CL15	1.72	0.041	0.438	0.432	1.12	0.0219	0.486	0.0143 U	15.6	6.51	3.2	13.7
PP04	6/2/2015	PP4-CL15	1.87	0.034	0.365	0.461	1.29	0.021	0.414	0.0186 U	14.9	5.26	3.3	14.4
PP05	6/2/2015	PP5-CL15	2.14	0.043	0.629	0.381	1.42	0.0211	0.445	0.0118 U	16.6	6.1	6.6	13.9
PP06	6/2/2015	PP6-CL15	2.12	0.035	0.372	0.31	1.35	0.0244	0.412	0.0101 U	17	5.86	3.7	14.6
PP07	6/2/2015	PP7-CL15	2.26	0.031	0.404	0.329	0.986	0.0295	0.318	0.0086 U	14.1	6.56	4.1	14.6
PP08	6/2/2015	PP8-CL15	1.79	0.045	0.31	0.496	1.34	0.0229	0.404	0.0115 U	14	5.79	3.2	15.2
PP09	6/2/2015	PP9-CL15	3.09	0.035	0.506	0.307	0.994	0.0149	0.385	0.0076 U	13.8	6.28	4.3	13.9
PP10	6/3/2015	PP10-CL15	2.28	0.029	0.444	0.285	1.19	0.0194	0.335	0.0073 U	14.7	5.78	4.2	14.1
PP11	6/3/2015	PP11-CL15	1.93	0.03	0.418	0.383	1.12	0.0184	0.443	0.0089 U	15.5	6.59	4.4	15.2
PP12	6/3/2015	PP12-CL15	2.31	0.026	0.462	0.258	1.04	0.0142	0.287	0.009 U	13.1	5.38	4.6	14.7
PP13	6/3/2015	PP13-CL15	2.83	0.03	0.49	0.395	0.896	0.0152	0.387	0.0096 U	13.5	5.18	2.2	13.5
PP14	6/3/2015	PP14-CL15	2.6	0.055	0.411	1.72	1.32	0.0678	1.2	0.0093 U	14.7	8.17	4.3	16.2
PP15	6/3/2015	PP15-CL15	2.23	0.036	0.415	0.283	1.07	0.0228	0.311	0.0475	14.5	8.22	4.6	16.1
PP16	6/3/2015	PP16-CL15	2.01	0.031	0.481	0.357	1.27	0.0164	0.362	0.0129 U	14.5	6.45	3.7	15.3
PP17	6/3/2015	PP17-CL15	2.13	0.033	0.461	0.369	1.45	0.0222	0.373	0.0117 U	14.7	7.71	3.7	15.5
PP18	6/3/2015	PP18-CL15	2.34	0.029	0.396	0.235	0.96	0.0151	0.229	0.0113 U	17.1	6.18	3.7	16.1
PP19	6/3/2015	PP19-CL15	2.72	0.03	0.565	0.216	0.996	0.0132	0.253	0.0094 U	13.5	7.55	3.3	13.8
PP20	6/3/2015	PP20-CL15	2.37	0.032	0.437	0.224	1.01	0.0198	0.325	0.0069 U	14.9	6.4	3.8	13.9
PP21	6/3/2015	PP21-CL15	1.91	0.032	0.349	0.431	1.12	0.0234	0.339	0.0123 U	14.8	5.19	2.9	14.9
PP22	6/3/2015	PP22-CL15	2.43	0.031	0.434	0.298	1.28	0.0186	0.287	0.0098 U	15.3	5.64	4.5	14.9

Notes:
Tissue results are reported in wet weight.
[a] Only detected concentrations are included
ID - identification
µg/g - microgram per gram
mg/kg - milligram per kilogram
ng/g - nanogram per gram
No. - number
U - The compound was analyzed for, but was not detected ("nondetect") at or above the method reporting limit/method detection limit

Table H-2. Metals and Total Solids Analysis Results for Area 8 Tissue

Transect	Sampling Station ID	Sample Date	Sample No.	Arsenic (mg/kg)	Inorganic Arsenic (µg/g)	Cadmium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Nickel (mg/kg)	Silver (mg/kg)	Zinc (mg/kg)	Mercury (ng/g)	Methyl Mercury (ng/g)	Total Solids (%)
			Mean [a]	**2.32**	**0.027**	**0.375**	**0.478**	**1.22**	**0.0723**	**0.476**	**0.176**	**13.4**	**16.1**	**8.3**	**16.4**
			Median [a]	**2.27**	**0.026**	**0.264**	**0.396**	**1.2**	**0.0727**	**0.435**	**0.117**	**13.6**	**13.6**	**7.9**	**16.5**
			Minimum [a]	**1.65**	**0.017**	**0.169**	**0.155**	**0.759**	**0.0431**	**0.27**	**0.0371**	**9.6**	**8.6**	**1**	**11.8**
			Maximum [a]	**3.5**	**0.05**	**1**	**1.13**	**1.73**	**0.13**	**1**	**0.582**	**16.3**	**42.2**	**18**	**19**
No. of Detected / No. Sampled				**41/41**	**39/41**	**41/41**	**41/41**	**41/41**	**41/41**	**41/41**	**41/41**	**41/41**	**41/41**	**41/41**	**41/41**
Range of Reporting Limits				**--**	**0.014-0.015**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
1	S.STATION01	6/15/2015	SS01-CL15	1.97	0.023	0.335	0.289	1.03	0.0587	0.329	0.0711	13.6	10.9	5.8	14.2
1	S.STATION07	6/17/2015	SS07-CL15	2.01	0.032	0.222	0.794	1.52	0.0853 J	0.543	0.106 J	11.7	9.2	3.7	18.6
2	S.STATION02	6/7/2015	SS02-CL15	2.01	0.029	0.351	0.617	1.36	0.0793 J	0.465	0.118 J	11.9	9.73	9.1	15.6
2	S.STATION05	6/17/2015	SS05-CL15	2.21	0.026	0.757	0.953	1.15	0.092 J	0.694	0.211 J	14	13.4	8	17.8
2	S.STATION08	6/17/2015	SS08-CL15	2.44	0.028	0.344	0.922	1.35	0.0823 J	0.683	0.0751 J	13.6	13	6.9	18.9
2	S.STATION62	6/21/2016	SS62-CL16	2.96	0.017	0.501	0.261	0.994	0.0502	0.844	0.375 J	15.1	22.3	13	14.6
2 & 3	S.STATION64	6/21/2016	SS64-CL16	2.72	0.015 U	1	0.61	1.24	0.0431	0.735	0.582 J	14.7	37.5	9.1	14.6
3	S.STATION03	6/16/2015	SS03-CL15	3.04	0.023	0.891	1.13	1.1	0.0641	0.614	0.164	13	14.5	9	16.4
3	S.STATION09	6/17/2015	SS09-CL15	1.81	0.029	0.209	0.779	1.2	0.0796 J	0.538	0.0678 J	13.2	9.35	5.5	17.3
3 & 8	S.STATION65	6/21/2016	SS65-CL16	3.5	0.018	0.613	0.434	1.29	0.0597	1	0.437 J	13.8	23.6	14	16.3
8	S.STATION67	6/21/2016	SS67-CL16	2.99	0.02	0.664	0.183	1.08	0.0498	0.649	0.364 J	13.3	25.1	18	15.4
8	S.STATION32	6/17/2015	SS32-CL15	1.67	0.031	0.191	0.917	1.36	0.0873 J	0.567	0.0466 J	12.6	10.1	1 J	17.8
8	S.STATION34	6/17/2015	SS34-CL15	1.65	0.026	0.295	0.718	1.1	0.0828 J	0.524	0.066 J	12.4	12.8	6.6	16.5
8	SEEPC	6/15/2015	SEEPC-CL15	2.11	0.022	0.579	0.388	0.978	0.0617	0.291	0.0748	10.8	11.9	7.7	13.6
9	S.STATION70	6/21/2016	SS70-CL16	3.09	0.017	0.973	0.237	1.5	0.13	0.53	0.453 J	16.3	42.2	11.9	15.8
9	OF03703	6/16/2015	OF03703-CL15	2.58	0.018	0.867	0.38	1.12	0.047	0.329	0.463	14.4	20	9	14.9
9	S.STATION35	6/17/2015	SS35-CL15	1.84	0.027	0.21	0.66	1.33	0.0799 J	0.448	0.0599 J	12.9	10.8	7.1	18.9
9	S.STATION36	6/16/2015	SS36-CL15	2.27	0.029	0.219	0.681	1.73	0.0858 J	0.482	0.0604 J	14.4	12.4	6.8	18.8
9	S.STATION37	6/17/2015	SS37-CL15	2.36	0.028	0.419	0.44	1.2	0.0862 J	0.405	0.117 J	13.9	16.8	9.3	17.9
9	S.STATION53	6/16/2015	SS53-CL15	2.18	0.03	0.209	0.596	1.48	0.0913	0.435	0.0959	12.7	10.1	5.5	18.1
9 & 10	S.STATION74	6/21/2016	SS74-CL16	2.33	0.034	0.279	0.227	0.964	0.0794	0.45	0.137 J	14	17.8	11.7	15.1
10	S.STATION73	6/21/2016	SS73-CL16	2.84	0.041	0.41	0.155	1.08	0.0689	0.736	0.508 J	15.8	25.2	11.4	17.2
10	S.STATION38	6/16/2015	SS38-CL15	2.26	0.026	0.245	0.444	1.38	0.0789	0.402	0.0735	14.8	12.3	5.2	19
10	S.STATION40	6/16/2015	SS40-CL15	1.71	0.029	0.204	1.03	1.32	0.0787	0.584	0.0538	12.7	11.3	6.9	18.7
10	S.STATION56	6/17/2015	SS56-CL15	1.87	0.026	0.22	0.363	1.11	0.0651 J	0.341	0.0615 J	12.9	11.8	5.6	17.5
10	SEEPD	6/15/2015	SEEPD-CL15	2.91	0.023	0.336	0.57	1.38	0.0727	0.405	0.129	12.9	13.6	5.1	16.1
10 & 11	S.STATION75	6/21/2016	SS75-CL16	2.49	0.028	0.237	0.242	1.1	0.0687	0.321	0.0756 J	13	16.4	11.9	14.9
11	S.STATION43	6/17/2015	SS43-CL15	1.81	0.024	0.205	0.396	1.24	0.0687 J	0.372	0.0598 J	14.6	10.5	6.9	17.7
11	SEEPE	6/15/2015	SEEPE-CL15	2.48	0.023	0.264	0.677	1.29	0.06	0.364	0.0907	14.5	14.1	7.9	17
12	S.STATION46	6/17/2015	SS46-CL15	1.67	0.03	0.169	0.375	1.4	0.0724 J	0.362	0.0474 J	15	11.2	6	19
12	SEEPF	6/15/2015	SEEPF-CL15	2.64	0.025	0.256	0.471	1.52	0.0651	0.42	0.181	13.8	15.4	5.6	17.8
13	SS-03701	6/16/2015	OF03701-CL15	2.3	0.021	0.469	0.367	1.12	0.0672	0.299	0.366	12.4	28.9	9	14.6
13	S.STATION49	6/16/2015	SS49-CL15	2.86	0.022	0.304	0.347	1.09	0.0749	0.315	0.35	12.2	21.1	11.3	15.4
13	SEEPG	6/15/2015	SEEPG-CL15	2.4	0.05	0.214	0.493	1.37	0.0846	0.385	0.129	13.8	11.6	5.7	15.7
S. 13	S.STATION76	6/21/2016	SS76-CL16	2.88	0.038	0.24	0.208	1.21	0.0742	0.315	0.095 J	15.8	21	13.6	16.9
S. 13	S.STATION77A	6/21/2016	SS77A-CL16	1.87	0.034	0.197	0.205	1.05	0.0706	0.288	0.0955 J	11.6	14.5	9.6	14.7
N. 13	S.STATION78	6/21/2016	SS78-CL16	2.26	0.023	0.259	0.248	1.11	0.0831	0.628	0.292 J	15.1	19	10.4	18.9
N. 13	S.STATION79A	6/21/2016	SS79A-CL16	2.03	0.039	0.201	0.182	1.21	0.0851	0.33	0.138 J	14.4	14.8	8	18.6
14	S.STATION57	6/21/2016	SS57-CL16	2.84 J	0.014 U	0.398	0.163	0.759	0.0431	0.531 J	0.153 J	10.3	14.8	12.3	12
14	S.STATION58	6/21/2016	SS58-CL16	1.66	0.024	0.203	0.158	1.03	0.0474	0.27	0.139 J	9.6	8.58	3.7	11.8
14	S.STATION59	6/21/2016	SS59-CL16	1.68	0.025	0.202	0.307	0.998	0.0582	0.277	0.0371 J	10.9	9.31	6.6	13.4

Notes:
Tissue results are reported in wet weight.
[a] Only detected concentrations are included
ID - identification
J - The result is an estimated concentration.
µg/g - microgram per gram
mg/kg - milligram per kilogram
ng/g - nanogram per gram
No. - number
U - The compound was analyzed for, but was not detected ("nondetect") at or above the method reporting limit/method detection limit

Table H-3. Metals Analysis Results for Area 8 Sediment

Transect	Sampling Station ID	Sample Date	Sample No.	Sample Depth (cm)	Sample Type	Arsenic (mg/kg)	Cadmium (mg/kg)	Total Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Nickel (mg/kg)	Silver (mg/kg)	Zinc (mg/kg)	Mercury (mg/kg)
Mean [a]						**2.32**	**1.734**	**30.2**	**17.19**	**10.64**	**16.1**	**0.806**	**39.3**	**0.165**
Median [a]						**2.22**	**0.787**	**30.2**	**8.58**	**5.01**	**16.1**	**0.281**	**30.8**	**0.067**
Minimum [a]						**0.42**	**0.152**	**2.32**	**3.81**	**1.71**	**2.37**	**0.048**	**12.5**	**0.006**
Maximum [a]						**6.47**	**11.4**	**84.8**	**439**	**185**	**40.8**	**17**	**396**	**2.42**
No. of Detected / No. Sampled						**81/81**	**81/81**	**81/81**	**81/81**	**81/81**	**81/81**	**81/81**	**81/81**	**81/81**
1	S.STATION01	6/15/2015	SS01-SD15	0-10	N	1.92	0.343 J	18.1 J	8.51 J	4.13	16.5	0.136	31.8 J	0.011 J
1	S.STATION04	6/15/2015	SS04-SD15	0-10	N	2.03	0.395 J	22 J	7.75 J	5.59	15.6	0.714	28.6 J	0.032
1	S.STATION07	6/17/2015	SS07-SD15	0-10	N	3.33	0.41	19 J	14.8 J	4.43	17.5	0.059	30.6	0.038
1	S.STATION07	6/17/2015	SS07-SD15B	10-24	N	2.87	0.309	19.6 J	7.41 J	4.18	16.3	0.061	26.3	0.037
1	S.STATION60	6/21/2016	SS60-SD16	0-10	N	3.22	0.325	18	8.11	5.46 J	15.9	0.07	30.5	0.029
1	S.STATION60	6/21/2016	SS-FD1	0-10	FD	3.18	0.302 J	22.3 J	7.86	5.62	16.5	0.074 J	29	0.048
1	S.STATION55	6/16/2015	SS55-SD15	0-10	N	2.12	0.152 J	8.03 J	8.17 J	3.23	23.6	0.048	18.2 J	0.025
1	S.STATION10	6/17/2015	SS10-SD15	0-10	N	3.43	0.284	11.2	7.92	4.73	9.31	0.068	21.4	0.033
1 & 2	S.STATION61	6/21/2016	SS61-SD16	0-10	N	1.28	0.306	13.4	10.9	14.4 J	13.7	0.072	40.2	0.011 J
2	S.STATION62	6/21/2016	SS62-SD16	0-10	N	1.57	0.484	21.1	12.5	6.18 J	19.8	0.124	44.5	0.015 J
2	S.STATION63	6/21/2016	SS63-SD16	0-10	N	1.52	0.385	19.8	11.4	4.73 J	19.1	0.116	37.9	0.111
2	S.STATION02	6/17/2015	SS02-SD15	0-10	N	2.56	1.61	29.9 J	10.6 J	3.79	12.3	0.283	24.7	0.05
2	S.STATION05	6/17/2015	SS05-SD15	0-10	N	2.53	3	34.7 J	8.57 J	4.6	20.1	1.12	31.6	0.033
2	S.STATION08	6/17/2015	SS08-SD15	0-10	N	2.18	2.84	45 J	8.92 J	4.62	17.4	0.857	30.2	1.67
2	S.STATION08	6/17/2015	SS08-SD15B	10-24	N	2.09	3.02	35 J	7.67 J	4.94	17.1	0.829	29.6	0.038
2	S.STATION30	6/17/2015	SS30-SD15	0-10	N	2.12	0.289	19.9 J	7.73 J	5.76	21.1	0.068	25.1	0.031
2	S.STATION11	6/16/2015	SS11-SD15	0-10	N	3.37	0.258 J	12.5 J	6.64 J	4	12.4	0.072	21.5 J	0.034
2 & 3	S.STATION64	6/21/2016	SS64-SD16	0-10	N	1.22	2.71	18.9	11.5	5.67 J	18.8	0.208	63.8	0.082
3	S.STATION50	6/15/2015	SS50-SD15	0-10	N	1.84	8.84 J	38 J	19.4 J	7.2	27.9	0.469	53.5 J	0.308
3	S.STATION51	6/15/2015	SS51-SD15	0-10	N	1.91	10.2 J	84.8 J	61.6 J	47.8	40.8	0.099	113 J	2.42
3	S.STATION03	6/16/2015	SS03-SD15	0-10	N	6.47	11.4	34.1 J	8.16	4.01 J	15.5	0.433	31	0.074
3	S.STATION06	6/16/2015	SS06-SD15	0-10	N	2.27	5.85 J	49.9 J	9.31 J	5.36	17.5	0.552	31.8 J	0.051
3	S.STATION06	6/16/2015	SS06-SD15B	10-24	N	1.62	4.86 J	46.1 J	6.73 J	3.95	13.9	0.437	25.6 J	0.044
3	S.STATION09	6/17/2015	SS09-SD15	0-10	N	2.73	2.36	69.5 J	8.64 J	4.86	17.5	0.305	35.9	0.045
3	S.STATION09	6/17/2015	SS09-SD15B	10-24	N	2.8	2.29	64.2 J	8.58 J	4.96	17.2	0.287	32.7	0.066
3	S.STATION31	6/16/2015	SS31-SD15	0-10	N	3.27	0.468 J	37.1 J	7.14 J	4.13	12.5	0.109	23.5 J	0.028
3	S.STATION12	6/16/2015	SS12-SD15	0-10	N	3.4	0.339 J	22.4 J	6.81 J	4.27	11.3	0.075	22.9 J	0.037
3 & 8	S.STATION65	6/21/2016	SS65-SD16	0-10	N	1.48	2.06	20.3	12.1	7.66 J	16.8	0.099	39.7	0.506
8	S.STATION66	6/21/2016	SS66-SD16	0-10	N	0.78	0.876	6.62	7.98	3.66 J	10.6	0.12	19.1	0.06
8	S.STATION67	6/21/2016	SS67-SD16	0-10	N	3.74	1.3	16.8	14.2	6.41 J	11.5	0.106	46.1	0.182
8	SEEPC	6/15/2015	SEEPC-SD15	0-10	N	1.66	6.8 J	34.1 J	12.6 J	4.15	14.8	0.299	32.5 J	0.133
8	S.STATION34	6/17/2015	SS34-SD15	0-10	N	2.22	3.38	53.4 J	14.2 J	5.04 J	21.1	0.274	32.9	0.132
8	S.STATION34	6/17/2015	DUP3-SD15	0-10	FD	1.74	3.82	47.7 J	8.36 J	4.22	14.9	0.28	27.2	0.116
8	S.STATION34	6/17/2015	SS34-SD15B	10-24	N	1.54	3.77	51.1 J	7.4 J	4.68	13.9	0.281	26.4	0.17 J
8	S.STATION34	6/17/2015	DUP4-SD15B	10-24	FD	1.47	3.48	43.8 J	6.33 J	3.79	12.6	0.245	23.4	0.083 J
8	S.STATION32	6/17/2015	SS32-SD15	0-10	N	3.02	0.791	40.8 J	8.2 J	5.24	17.1	0.148	30.3	0.077
8	S.STATION54	6/16/2015	SS54-SD15	0-10	N	4.02	0.709	36.7 J	13.3	6.53 J	19.4	0.136	38.5	0.057
8 & 9	S.STATION68	6/21/2016	SS68-SD16	0-10	N	0.42 J	1.15	2.32	3.81	1.71 J	2.37	0.355	12.5	0.044
8 & 9	S.STATION69	6/21/2016	SS69-SD16	0-10	N	0.73	1.17	5.43	4.61	2.05 J	7.07	0.076	17.1	0.055
9	S.STATION70	6/21/2016	SS70-SD16	0-10	N	1.57	3.18 J	27.5 J	77.5	50.2	19.5	7.75 J	148	0.491
9	S.STATION71	6/21/2016	SS71-SD16	0-10	N	1.49	1.22 J	45.3 J	439	19.7	23.4	2.63 J	46.7	0.113
9	OF03703	6/16/2015	OF03703-SD15	0-10	N	2.01	3.33	49.2 J	13.9	6.61 J	22	1.47	44.1	0.627
9	OF03703	6/16/2015	DUP5-SD15	0-10	FD	1.93	3.93	46.4 J	12.2	5.77 J	19.6	1.98	37.9	0.422
9	S.STATION37	6/17/2015	SS37-SD15	0-10	N	1.67	3.15	29.1 J	8.76 J	4.42	11.8	0.414	26.6	0.111
9	S.STATION36	6/16/2015	SS36-SD15	0-10	N	1.31	1.15	26 J	5.24	2.85 J	8.94	0.151	17.2	0.083
9	S.STATION36	6/16/2015	SS36-SD15B	10-24	N	1.68	1.7	38.5 J	6	3.1 J	12.4	0.261	23.2	0.073
9	S.STATION53	6/16/2015	SS53-SD15	0-10	N	2.31	0.44	23.6 J	5.68	4.12 J	11.4	0.1	20.9	0.027
9 & 10	S.STATION72	6/21/2016	SS72-SD16	0-10	N	1.44	1.18 J	26.5 J	48.8	67.7	19.6	17 J	54.2	0.163
9 & 10	S.STATION74	6/21/2016	SS74-SD16	0-10	N	1.57	1.99 J	36 J	10.6	5.9	16.9	2.2 J	35.3	0.176

Table H-3. Metals Analysis Results for Area 8 Sediment

Transect	Sampling Station ID	Sample Date	Sample No.	Sample Depth (cm)	Sample Type	Arsenic (mg/kg)	Cadmium (mg/kg)	Total Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Nickel (mg/kg)	Silver (mg/kg)	Zinc (mg/kg)	Mercury (mg/kg)
					Mean [a]	**2.32**	**1.734**	**30.2**	**17.19**	**10.64**	**16.1**	**0.806**	**39.3**	**0.165**
					Median [a]	**2.22**	**0.787**	**30.2**	**8.58**	**5.01**	**16.1**	**0.281**	**30.8**	**0.067**
					Minimum [a]	**0.42**	**0.152**	**2.32**	**3.81**	**1.71**	**2.37**	**0.048**	**12.5**	**0.006**
					Maximum [a]	**6.47**	**11.4**	**84.8**	**439**	**185**	**40.8**	**17**	**396**	**2.42**
					No. of Detected / No. Sampled	**81/81**	**81/81**	**81/81**	**81/81**	**81/81**	**81/81**	**81/81**	**81/81**	**81/81**
10	S.STATION73	6/21/2016	SS73-SD16	0-10	N	2.26	0.9 J	19.9 J	19.1	8.77	12.7	1.91 J	39.7	0.099
10	SEEPD	6/15/2015	SEEPD-SD15	0-10	N	0.9	1.08 J	8.73 J	4.2 J	2.64	5.17	0.398	13.2 J	0.165
10	S.STATION40	6/16/2015	SS40-SD15	0-10	N	1.41	3.82	41.1 J	9.85	5.27 J	14.9	1.41	29.8	0.068
10	S.STATION40	6/16/2015	SS40-SD15B	10-24	N	1.44	1.16	30.2 J	9.22	4.55 J	14.6	1.16	34.1	0.767
10	S.STATION38	6/16/2015	SS38-SD15	0-10	N	1.48	0.487	25.6 J	6.58	3.22 J	13.4	0.238	19.6	0.066
10	S.STATION39	6/16/2015	SS39-SD15	0-10	N	2.49	0.524	33.2 J	6.05	7.67 J	13.7	0.113	23.8	0.034
10	S.STATION52	6/16/2015	SS52-SD15	0-10	N	2.95	0.437	33.6 J	6.82	10.2 J	15.1	0.116	26.7	0.037
10 & 11	S.STATION75	6/21/2016	SS75-SD16	0-10	N	2.85	1.55 J	34.1 J	13.4	6.83	18.2	0.889 J	47.7	0.205
11	SEEPE	6/15/2015	SEEPE-SD15	0-10	N	1.63	0.715 J	30.9 J	9.71 J	3.99	15.4	0.446	27.2 J	0.107
11	S.STATION43	6/17/2015	SS43-SD15	0-10	N	2.58	0.814	38.4 J	8.58 J	4.38	16.7	0.342	32.4	0.054
11	S.STATION43	6/17/2015	SS43-SD15B	10-24	N	1.95	0.782	30 J	7.25 J	3.3	17.2	0.295	24.8	0.067
11	S.STATION41	6/16/2015	SS41-SD15	0-10	N	3.27	0.533	34.4 J	8.5	4.98 J	16.2	0.117	30	0.045
11	S.STATION42	6/16/2015	SS42-SD15	0-10	N	3.25	0.403	28.3 J	6.97	4.78 J	15.1	0.091	27.2	0.043
12	SEEPF	6/15/2015	SEEPF-SD15	0-10	N	2.22	0.754 J	19.8 J	6.68 J	4.9	10.4	0.228	28.8 J	0.136
12	S.STATION46	6/16/2015	SS46-SD15	0-10	N	2.53	0.677	39.1 J	8.05	5.11 J	15.7	0.345	29.4	0.095
12	S.STATION46	6/16/2015	SS46-SD15B	10-24	N	2.5	0.88	34 J	7.64	7.82 J	14.5	0.368	34.3	0.054
12	S.STATION44	6/16/2015	SS44-SD15	0-10	N	1.94	0.38	21.3 J	4.74	3.15 J	10.3	0.102	17.7	0.034
12	S.STATION45	6/16/2015	SS45-SD15	0-10	N	3.37	0.339	30.8 J	6.48	4.45 J	16.9	0.079	28	0.034
13	SS-03701	6/16/2015	OF03701-SD15	0-10	N	2.47	1.97	30.2 J	39.8	185 J	24.2	5.99	396	0.224
13	S.STATION49	6/16/2015	SS49-SD15	0-10	N	1.67	0.524	20.3 J	10.2 J	7.86	12.5	0.999	36.5	0.151
13	SEEPG	6/15/2015	SEEPG-SD15	0-10	N	2.37	0.585 J	26.6 J	11 J	8.32	15.4	0.616	40.8 J	0.144
13	SEEPG	6/15/2015	SEEPG-SD15B	10-24	N	2.09	0.487 J	31.6 J	10.6 J	12.8	17.4	0.423	43.8 J	0.099
13	S.STATION48	6/15/2015	SS48-SD15	0-10	N	3.56	0.771 J	35.8 J	23.1 J	8.83	17.4	0.527	45.2 J	0.608
13	S.STATION47	6/16/2015	SS47-SD15	0-10	N	3.19	0.375	20.3 J	6.67	4.33 J	14.4	0.081	25.5	0.026
S. 13	S.STATION76	6/21/2016	SS76-SD16	0-10	N	3.12	0.765 J	40.5 J	14.7	41.8	20.6	0.479 J	55.2	0.112
S. 13	S.STATION77	6/21/2016	SS77-SD16	0-10	N	3.31	0.681 J	32.5 J	9.31	6.99	19	0.218 J	37.5	0.112
N. 13	S.STATION78	6/21/2016	SS78-SD16	0-10	N	2.25	1.14 J	31.8 J	14.6 J	12.5 J	18.4	1.33 J	49	0.107
N. 13	S.STATION78	6/21/2016	SS-FD2	0-10	FD	1.46	0.285 J	18.2 J	8.68 J	32.5 J	12.6	0.622 J	31.2	0.121
N. 13	S.STATION79	6/21/2016	SS79-SD16	0-10	N	3.71	0.655 J	34.9 J	11	13.4	20.4	0.356 J	46.3	0.066
14	S.STATION57	6/21/2016	SS57-SD16	0-10	N	3.16	0.33	12.9	7.04	4.61 J	10.8	0.071	42	0.006 J
14	S.STATION58	6/21/2016	SS58-SD16	0-10	N	2.37	0.259	21.6	11.5	6.15 J	17.9	0.067	36.1	0.018 J
14	S.STATION59	6/21/2016	SS59-SD16	0-10	N	2.44	0.233	12.9	7.93	5.1 J	12.6	0.056	25.8	0.046

Notes:
Sediment results are reported in dry weight.
[a] Only detected concentrations are included
cm - centimeter
FD - field duplicate
ID - identification
J - The result is an estimated concentration
mg/kg - milligram per kilogram
N - normal environmental sample
No. - number

Table H-4. AVS/SEM Analysis Results for Area 8 Sediment

Sampling Station ID	Sample Date	Sample No.	Sample Type	Acid Volatile Sulfides (µmol/g)	Cadmium (µmol/g)	Copper (µmol/g)	Lead (µmol/g)	Nickel (µmol/g)	Zinc (µmol/g)	Mercury (µmol/g)
S.STATION06	6/16/2015	SS06-SD15B	N	3.9	0.04937 J	0.0261	0.038	0.0325 J	0.211	5.80E-05 U
S.STATION07	6/17/2015	SS07-SD15	N	3.65	0.00315 J	0.0271	0.0175 J	0.0278	0.207	6.30E-05 U
S.STATION08	6/17/2015	SS08-SD15	N	4.77	0.02675	0.0318	0.0181 J	0.0365	0.229	6.10E-05 U
S.STATION08	6/17/2015	SS08-SD15B	N	7.5	0.02361	0.0184 J	0.0154 J	0.0338	0.204	5.30E-05 U
S.STATION09	6/17/2015	SS09-SD15	N	7.9	0.0165	0.0148 J	0.0153 J	0.0338	0.239	5.10E-05 U
S.STATION09	6/17/2015	SS09-SD15B	N	8.9	0.01694	0.027	0.0188 J	0.0384	0.246	6.00E-05 U
S.STATION34	6/17/2015	SS34-SD15	N	4.88	0.04421	0.0417	0.0245 J	0.0402	0.24	6.20E-05 U
S.STATION34	6/17/2015	SS34-SD15B	N	0.85	0.03604 J	0.0379	0.0175	0.0398 J	0.199	6.10E-05 U
S.STATION34	6/17/2015	DUP3-SD15	FD	3.95	0.03639	0.035	0.018 J	0.0318	0.184	5.50E-05 U
S.STATION34	6/17/2015	DUP4-SD15B	FD	0.55	0.03042 J	0.0375	0.0181	0.0314 J	0.172	6.10E-05 U
S.STATION36	6/16/2015	SS36-SD15	N	7.7	0.01683 J	0.0309	0.0148	0.0442 J	0.221	5.80E-05 U
S.STATION36	6/16/2015	SS36-SD15B	N	5.98	0.01822 J	0.0272	0.0153	0.0411 J	0.226	5.90E-05 U
S.STATION40	6/16/2015	SS40-SD15B	N	9.1	0.01199 J	0.0381	0.029	0.0605 J	0.388	6.20E-05 U
S.STATION40	6/16/2015	SS40-SD15	N	9.3	0.01588 J	0.051	0.0235	0.0738 J	0.41	6.10E-05 U
S.STATION43	6/17/2015	SS43-SD15	N	2.21	0.00801 J	0.0345	0.0178	0.0401 J	0.211	6.30E-05 U
S.STATION46	6/16/2015	SS46-SD15	N	2.13	0.0073 J	0.036	0.021	0.0361 J	0.239	6.10E-05 U
S.STATION48	6/15/2015	SS48-SD15	N	7.06	0.00625	0.043	0.0269	0.0415	0.376	6.50E-05 U
S.STATION57	6/21/2016	SS57-SD16	N	0.017 U	0.00552 U	0.0427 J	0.0276 U	0.0249 J	0.284	6.60E-05 U
S.STATION58	6/21/2016	SS58-SD16	N	2.33	0.00169 J	0.0394 J	0.0209 J	0.0359	0.233	5.40E-05 U
S.STATION59	6/21/2016	SS59-SD16	N	0.09	0.00213 J	0.0437 J	0.0205 J	0.0229	0.22	5.40E-05 U
S.STATION62	6/21/2016	SS62-SD16	N	0.013 U	0.00305 J	0.0794	0.0227	0.0297	0.297	5.20E-05 U
S.STATION64	6/21/2016	SS64-SD16	N	0.013 U	0.01754	0.0874	0.0285	0.137	0.846	2.60E-05 J
S.STATION65	6/21/2016	SS65-SD16	N	0.045	0.01271	0.51	0.0542	0.0556	0.37	1.60E-03
S.STATION67	6/21/2016	SS67-SD16	N	0.041	0.00906	0.106	0.0316	0.055	0.509	6.10E-05 U
S.STATION70	6/21/2016	SS70-SD16	N	0.016 J	0.02552 J	0.975	0.221	0.0783	1.71	3.00E-05 J
S.STATION73	6/21/2016	SS73-SD16	N	0.012 U	0.00768 J	0.1	0.0459	0.0485	0.33	5.10E-05 J
S.STATION74	6/21/2016	SS74-SD16	N	2.77	0.01725 J	0.0492	0.0328	0.0466	0.34	5.50E-05 U
S.STATION75	6/21/2016	SS75-SD16	N	2.54	0.01619 J	0.0701	0.0312	0.0709	0.38	5.50E-05 U
S.STATION76	6/21/2016	SS76-SD16	N	9.7	0.00724 J	0.0685	0.0488	0.072	0.614	5.60E-05 U
S.STATION77	6/21/2016	SS77-SD16	N	1.27	0.00547 J	0.0449	0.0273	0.0373	0.27	6.10E-05 U
S.STATION78	6/21/2016	SS78-SD16	N	1.22	0.00438 J	0.0906	0.0548	0.0683	0.515	5.30E-05 U
S.STATION79	6/21/2016	SS79-SD16	N	2.38	0.00651 J	0.0481	0.0345	0.0451	0.391	6.00E-05 U
S.STATION78	6/21/2016	SS-FD2	FD	1.12	0.00567 J	0.0888	0.0742	0.057	0.581	5.40E-05 U

Notes:
AVS - acid volatile sulfides
FD - field duplicate
ID - identification
J - The result is an estimated concentration.
µmol/g - micromole per gram
N - normal environmental sample
No. - number
SEM - simultaneously extracted metals
U - The compound was analyzed for, but was not detected ("nondetect") at or above the method reporting limit/method detection limit

Table H-5. Total Organic Carbon, Total Solids, and Grain Size Analysis Results for Area 8 Sediment

Sampling Station ID	Sample Date	Sample No.	Sample Type	Total Organic Carbon (%)	Total Solids (%)	Gravel >2 mm (%)	Sand, Very Coarse 1-2 mm (%)	Sand, Coarse 0.5-1 mm (%)	Sand, Medium 0.25-0.5 mm (%)	Sand, Fine 0.125-0.25 mm (%)	Sand, Very Fine 0.0625-0.125 mm (%)	Silt 0.0039-0.0625 mm (%)	Clay < 0.0039 mm (%)
OF03701	6/16/2015	OF03701-SD15	N	0.723	72.3	59.39	13.12	12.44	7.71	2.52	1.16	6.39	4
OF03703	6/16/2015	OF03703-SD15	N	0.4	81.8	31.23	16.98	25.01	16.79	4.85	1.63	5.42	2.38
OF03703	6/16/2015	DUP5-SD15	FD	0.398	82.2	34.29	16.13	22.64	16.56	4.86	1.77	5.23	2.3
S.STATION01	6/15/2015	SS01-SD15	N	NA	79.8	NA	NA	NA	NA	NA	NA	NA	NA
S.STATION02	6/17/2015	SS02-SD15	N	NA	76.5	NA	NA	NA	NA	NA	NA	NA	NA
S.STATION03	6/16/2015	SS03-SD15	N	0.221	78.4	NA	NA	NA	NA	NA	NA	NA	NA
S.STATION04	6/15/2015	SS04-SD15	N	NA	73.8	NA	NA	NA	NA	NA	NA	NA	NA
S.STATION05	6/17/2015	SS05-SD15	N	NA	80.8	NA	NA	NA	NA	NA	NA	NA	NA
S.STATION06	6/16/2015	SS06-SD15	N	NA	81.3	NA	NA	NA	NA	NA	NA	NA	NA
S.STATION06	6/16/2015	SS06-SD15B	N	0.333	81.9	12.69	7.36	13.99	38.7	9.73	1.4	3.65	2.16
S.STATION07	6/17/2015	SS07-SD15	N	NA	74.9	NA	NA	NA	NA	NA	NA	NA	NA
S.STATION07	6/17/2015	SS07-SD15B	N	0.36	73.5	19.7	15.6	13.5	30.53	13.95	1.8	4.14	2.73
S.STATION08	6/17/2015	SS08-SD15	N	NA	77.6	NA	NA	NA	NA	NA	NA	NA	NA
S.STATION08	6/17/2015	SS08-SD15B	N	0.362	73.2	47.98	5.7	9.67	23.3	16.01	1.22	3.31	1.88
S.STATION09	6/17/2015	SS09-SD15	N	NA	86	NA	NA	NA	NA	NA	NA	NA	NA
S.STATION09	6/17/2015	SS09-SD15B	N	0.424	76.2	23.64	6.74	17.35	29.54	11.26	1.89	6.65	2.76
S.STATION10	6/17/2015	SS10-SD15	N	NA	69	NA	NA	NA	NA	NA	NA	NA	NA
S.STATION11	6/16/2015	SS11-SD15	N	NA	77.1	NA	NA	NA	NA	NA	NA	NA	NA
S.STATION12	6/16/2015	SS12-SD15	N	NA	72.6	NA	NA	NA	NA	NA	NA	NA	NA
S.STATION30	6/17/2015	SS30-SD15	N	0.439	76.7	36.94	9.49	11.89	18.75	11.18	4.11	7.86	2.23
S.STATION31	6/16/2015	SS31-SD15	N	0.469	76.1	37.83	11.11	8.74	21.82	9.01	2.47	5.38	2.36
S.STATION32	6/17/2015	SS32-SD15	N	0.51	72.3	8.42	4.41	10.8	36.22	17.62	9.11	14.58	3.61
S.STATION34	6/17/2015	SS34-SD15	N	0.433	75.2	22.06	13.78	23.54	22.7	5.97	1.99	6.81	2.33
S.STATION34	6/17/2015	SS34-SD15B	N	0.273	77.6	47.24	14.94	17.3	16.26	3.67	1.06	2.48	1.49
S.STATION34	6/17/2015	DUP3-SD15	FD	0.392	80.5	32.47	12.52	20.25	18.72	4.69	1.6	5.12	2.09
S.STATION34	6/17/2015	DUP4-SD15B	FD	0.268	78.2	40.23	16.1	19.07	18.23	4.08	1.16	2.7	1.59
S.STATION36	6/16/2015	SS36-SD15	N	0.405	80.3	11.38	9.55	22.87	34.02	8.54	2.52	5.42	2.71
S.STATION36	6/16/2015	SS36-SD15B	N	0.235	78.8	18.71	14.37	24.09	31.7	6.11	1.14	2.21	1.41
S.STATION37	6/17/2015	SS37-SD15	N	0.464	72.2	22.57	18.89	28.87	21.45	4.62	1.4	4.21	2.21
S.STATION38	6/16/2015	SS38-SD15	N	0.254	77.8	24.72	11.9	21.94	30	5.6	1.37	2.46	1.77
S.STATION39	6/16/2015	SS39-SD15	N	0.451	77.4	9.9	4.9	10.55	48.14	14.71	2.63	4.09	2.04
S.STATION40	6/16/2015	SS40-SD15B	N	0.274	74.7	23.13	22.48	29.22	17.63	3.58	0.98	2.31	1.92
S.STATION40	6/16/2015	SS40-SD15	N	0.257	73.7	30.97	20.44	27.12	15.64	3.4	1.03	2.41	1.98
S.STATION41	6/16/2015	SS41-SD15	N	0.382	79.6	15.63	5.67	7.89	38.4	19.38	4.33	5.39	2.41
S.STATION42	6/16/2015	SS42-SD15	N	0.334	77.4	11.22	5.8	7.03	40.87	19.26	4.63	6.75	2.51
S.STATION43	6/17/2015	SS43-SD15B	N	0.242	81	41.92	10.69	14.33	26.39	6.01	1.16	1.13	1.01
S.STATION43	6/17/2015	SS43-SD15	N	0.36	74.7	20.99	11.38	19.9	31.69	8.32	3.17	4.79	2.21
S.STATION44	6/16/2015	SS44-SD15	N	0.259	77	8.75	5.87	10.37	41.32	21.49	3.87	3.98	1.93
S.STATION45	6/16/2015	SS45-SD15	N	0.254	77.3	13.45	3.49	5.96	38.03	27.48	5.5	4.54	2.06
S.STATION46	6/16/2015	SS46-SD15	N	0.321	77.3	16.8	5.77	9.88	38.18	15.96	4.11	4.85	2.05
S.STATION46	6/16/2015	SS46-SD15B	N	0.293	77.8	39.45	7.35	8.97	29.09	11.01	2.52	3.02	1.61
S.STATION47	6/16/2015	SS47-SD15	N	0.353	76.5	18.25	6.72	7.83	30.37	19.39	6.04	7.26	2.56
S.STATION48	6/15/2015	SS48-SD15	N	0.399	72.1	4.8	4.05	13.5	45.93	14.07	4.23	6.76	3.04
S.STATION49	6/16/2015	SS49-SD15	N	0.411	76	NA	NA	NA	NA	NA	NA	NA	NA
S.STATION50	6/15/2015	SS50-SD15	N	0.245	84.7	30.7	25.8	24.02	9.92	2.37	0.61	4.06	2.95
S.STATION51	6/15/2015	SS51-SD15	N	0.239	91.4	37.5	19.59	16.18	9.79	3.06	0.92	3.1	2.25
S.STATION52	6/16/2015	SS52-SD15	N	0.269	79	11.32	4.86	10.65	48.83	14.13	3.12	4.89	2.16
S.STATION53	6/16/2015	SS53-SD15	N	0.435	76.9	49.87	5.31	6.46	22.87	9.31	2.91	6.23	2.28
S.STATION54	6/16/2015	SS54-SD15	N	0.757	63.4	10.34	3.88	5.08	23.72	15.7	8.98	27.86	6.03
S.STATION55	6/16/2015	SS55-SD15	N	NA	78.7	NA	NA	NA	NA	NA	NA	NA	NA
SEEPC	6/15/2015	SEEPC-SD15	N	0.402	73.9	NA	NA	NA	NA	NA	NA	NA	NA
SEEPD	6/15/2015	SEEPD-SD15	N	0.412	74.4	NA	NA	NA	NA	NA	NA	NA	NA
SEEPE	6/15/2015	SEEPE-SD15	N	0.313	74.8	29.38	19.05	26.71	18.32	3.35	0.84	1.78	1.49
SEEPF	6/15/2015	SEEPF-SD15	N	0.411	73.2	27.24	18.51	22.48	22.41	4.28	1.07	2.38	2.11
SEEPG	6/15/2015	SEEPG-SD15	N	0.429	74	11.17	11.11	24.64	29.67	7.02	2.53	6.85	3.63
SEEPG	6/15/2015	SEEPG-SD15B	N	0.201	80.8	37.77	11.4	20.55	22.83	4.37	1.23	2.46	1.88

Notes:
Total organic carbon and grain size analytical method was American Society for Testing and Materials D422 modified for the Puget Sound Estuary Program.
FD - field duplicate
ID - identification
N - normal environmental sample
NA - not analyzed
No. - number
mm - millimeter

Table H-6. Metals Analysis Results for Area 8 Seeps and Outfalls

Sampling Station ID	Sample Date	Sample No.	Sample Type	Dissolved Arsenic (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Chromium, Total (µg/L)	Dissolved Copper (µg/L)	Dissolved Lead (µg/L)	Dissolved Nickel (µg/L)	Dissolved Silver (µg/L)	Dissolved Zinc (µg/L)	Dissolved Mercury (µg/L)
OF03701	6/16/2015	OF03701-OF15	N	0.84 J	6.91	8.25	5.39	0.355	1.13	0.266 J	54.9	0.00427
OF03701	6/16/2015	DUP6-OF15	FD	1.6 J	5.7	6.77	5.06	0.344	1.16	0.58 J	40.2	0.00534
SEEPA	6/15/2015	SEEPA-SW15	N	1.26	45.7	9.68	1.88	0.047	1.65	0.057	1.63	0.00849
SEEPB	6/15/2015	SEEPB-SW15	N	1.44	0.321	2.61	1.13	0.026	0.93	0.021	1.24	0.001
SEEPC	6/15/2015	SEEPC-SW15	N	1.55	2.41	1.21	0.687	0.089	1.81	0.016 J	1.43	0.00866
SEEPD	6/15/2015	SEEPD-SW15	N	0.71	0.003 U	0.42	0.132 U	0.01 U	0.53	0.003 J	1.38	0.00589
SEEPE	6/15/2015	SEEPE-SW15	N	1.76	0.015 J	0.2 J	0.345	0.027	0.53	0.003 J	0.54 U	0.0141
SEEPF	6/16/2015	SEEPF-SW15	N	2.51	0.027 J	0.34 J	0.492	0.028 J	0.78	0.011 J	1.49 J	0.00205 J
SEEPF	6/16/2015	DUP2-SW15	FD	1.96	0.038 J	0.24 J	0.44	0.023 J	0.53	0.013 J	0.77 J	0.00256
SEEPG	6/17/2015	SEEPG-SW15	N	2.28	0.044	0.25	0.438	0.017 J	0.96	0.008 J	1.24	0.00129

Notes:
FD - field duplicate
ID - Identification
J - The result is an estimated concentration
µg/L - microgram per liter
N - normal environmental sample
No. - number
U - The compound was analyzed for, but was not detected ("nondetect") at or above the method reporting limit/method detection limit

Table H-7. Metals Analysis Results for Reference Area Marine Water

Sampling Station ID	Sample Date	Sample No.	Sample Type	Dissolved Arsenic (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Chromium, Total (µg/L)	Dissolved Copper (µg/L)	Dissolved Lead (µg/L)	Dissolved Nickel (µg/L)	Dissolved Silver (µg/L)	Dissolved Zinc (µg/L)	Dissolved Mercury (µg/L)
			Mean [a]	**1.08**	**0.047**	**0.14**	**0.604**	**0.018**	**0.77**	**0.006**	**1**	**0.00032**
			Median [a]	**1.17**	**0.056**	**0.16**	**0.537**	**0.016**	**0.78**	**0.005**	**0.9**	**0.00033**
			Minimum [a]	**0.49**	**0.014**	**0.07**	**0.365**	**0.014**	**0.51**	**0.003**	**0.6**	**0.00021**
			Maximum [a]	**1.54**	**0.066**	**0.23**	**0.901**	**0.031**	**0.93**	**0.011**	**1.4**	**0.00043**
		No. of Detected / No. Sampled		**9/9**	**8/9**	**9/9**	**9/9**	**7/9**	**9/9**	**6/9**	**5/9**	**9/9**
			Range of Reporting Limits	**--**	**0.009**	**--**	**--**	**0.01**	**--**	**0.005**	**0.2 - 0.4**	**--**
PP01	6/3/2015	PP1-MW15	N	1.54	0.064	0.11 J	0.901	0.031	0.75	0.011 J	1.4	0.00043 J
PP03	6/3/2015	PP3-MW15	N	1.21	0.066	0.16 J	0.537	0.021	0.71	0.006 J	0.6	0.00033 J
PP03	6/3/2015	PPDUP-MW15	FD	1.54	0.059	0.17 J	0.822	0.014 J	0.65	0.005 J	0.9	0.00029 J
PP05	6/3/2015	PP5-MW15	N	1.17	0.052	0.16 J	0.456	0.016 J	0.86	0.005 J	1.4	0.00029 J
PP07	6/3/2015	PP7-MW15	N	1.18	0.06	0.17 J	0.534	0.015 J	0.51	0.005 J	0.7	0.00028 J
PP09	6/3/2015	PP9-MW15	N	0.65	0.014 J	0.1 J	0.386	0.01 U	0.93	0.005 U	0.3 U	0.00036 J
PP11	6/3/2015	PP11-MW15	N	1.06	0.035	0.23	0.804	0.018 J	0.78	0.003 J	0.4 U	0.00021 J
PP13	6/3/2015	PP13-MW15	N	0.91	0.026	0.12 J	0.63	0.014 J	0.84	0.005 U	0.4 U	0.00035 J
PP15	6/3/2015	PP15-MW15	N	0.49 J	0.009 U	0.07 J	0.365	0.01 U	0.93	0.005 U	0.2 U	0.00037 J

Notes:
[a] Only detected concentrations are included
FD - field duplicate
ID - identification
J - The result is an estimated concentration
N - normal environmental sample
No. - number
µg/L - microgram per liter
U - The compound was analyzed for, but was not detected ("nondetect") at or above the method reporting limit/method detection limit

Table H-8. Metals Analysis Results for Area 8 Marine Water

Sampling Station ID	Sample Date	Sample No.	Sample Type	Dissolved Arsenic (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Chromium, Total (µg/L)	Dissolved Copper (µg/L)	Dissolved Lead (µg/L)	Dissolved Nickel (µg/L)	Dissolved Silver (µg/L)	Dissolved Zinc (µg/L)	Dissolved Mercury (µg/L)
			Mean [a]	**1.34**	**0.43**	**0.43**	**0.696**	**0.056**	**0.63**	**0.012**	**1.39**	**0.00168**
			Median [a]	**1.31**	**0.185**	**0.43**	**0.609**	**0.047**	**0.6**	**0.009**	**0.96**	**0.00141**
			Minimum [a]	**1.23**	**0.041**	**0.19**	**0.488**	**0.029**	**0.45**	**0.005**	**0.63**	**0.00061**
			Maximum [a]	**1.58**	**1.57**	**0.86**	**1.34**	**0.099**	**1.01**	**0.051**	**3.59**	**0.00372**
		No. of Detected / No. Sampled		**10/10**	**10/10**	**10/10**	**10/10**	**10/10**	**10/10**	**10/10**	**10/10**	**10/10**
OF03703	6/15/2015	OF03703-MW15	N	1.58	0.224	0.21	1.34	0.08	0.76	0.051	1.88	0.00243
S.STATION05	6/16/2015	SS5-MW15	N	1.23	0.277	0.58	0.803	0.047	0.68	0.005 J	0.86	0.00061
SEEPA	6/15/2015	SEEPA-MW15	N	1.37	1.3	0.46	0.614	0.099	0.75	0.009 J	0.76 J	0.00089
SEEPA	6/15/2015	DUP1-MW15	FD	1.35	1.57	0.42	0.604	0.074	0.6	0.009 J	0.63	0.00099
SEEPB	6/15/2015	SEEPB-MW15	N	1.24	0.145	0.86	0.843	0.047	1.01	0.014 J	3.59	0.00127
SEEPC	6/15/2015	SEEPC-MW15	N	1.27	0.551	0.43	0.635	0.056	0.6	0.008 J	0.94	0.00248
SEEPD	6/15/2015	SEEPD-MW15	N	1.32	0.041	0.58	0.488	0.029	0.5	0.005 J	0.97	0.00372
SEEPE	6/15/2015	SEEPE-MW15	N	1.29	0.055	0.21	0.501	0.045	0.45	0.005 J	1.48	0.00161
SEEPF	6/15/2015	SEEPF-MW15	N	1.24	0.052	0.19 J	0.534	0.04	0.46	0.005 J	2.05	0.00135
SEEPG	6/15/2015	SEEPG-MW15	N	1.5	0.089	0.34	0.596	0.047	0.49	0.01 J	0.71	0.00147

Notes:
[a] Only detected concentrations are included
FD - field duplicate
ID - Identification
J - The result is an estimated concentration
µg/L - microgram per liter
N - normal environmental sample
No. - number

Table H-9. Metals Analysis Results for Area 8 Seeps and Marine Water

Sampling Station ID	Dissolved Arsenic (µg/L)		Dissolved Cadmium (µg/L)		Dissolved Chromium, Total (µg/L)		Dissolved Copper (µg/L)		Dissolved Lead (µg/L)		Dissolved Nickel (µg/L)		Dissolved Silver (µg/L)		Dissolved Zinc (µg/L)		Dissolved Mercury (µg/L)	
	Seep	MW	Seep	MW	Seep	MW	Seep	MW	Seep	MW	Seep	MW	Seep	MW	Seep	MW	Seep	MW
SEEPA	1.26	**1.37**	**45.7**	1.57	**9.68**	0.46	**1.88**	0.614	0.047	**0.099**	**1.65**	0.75	**0.057**	0.009 J	**1.63**	0.76 J	**0.00849**	0.00099
SEEPB	**1.44**	1.24	**0.321**	0.145	**2.61**	0.86	**1.13**	0.843	0.026	**0.047**	0.93	**1.01**	**0.021**	0.014 J	1.24	**3.59**	0.001	**0.00127**
SEEPC	**1.55**	1.27	**2.41**	0.551	**1.21**	0.43	**0.687**	0.635	**0.089**	0.056	**1.81**	0.6	**0.016** J	0.008 J	**1.43**	0.94	**0.00866**	0.00248
SEEPD	0.71	**1.32**	0.003 U	**0.041**	0.42	**0.58**	0.132 U	**0.488**	0.01 U	**0.029**	**0.53**	0.5	0.003 J	**0.005** J	**1.38**	0.97	**0.00589**	0.00372
SEEPE	**1.76**	1.29	0.015 J	**0.055**	0.2 J	**0.21**	0.345	**0.501**	0.027	**0.045**	**0.53**	0.45	0.003 J	**0.005** J	0.54 U	**1.48**	**0.0141**	0.00161
SEEPF	**2.51**	1.24	0.038 J	**0.052**	**0.34** J	0.19 J	0.492	**0.534**	0.028 J	**0.04**	**0.78**	0.46	**0.013** J	0.005 J	1.49 J	**2.05**	**0.00256**	0.00135
SEEPG	**2.28**	1.5	0.044	**0.089**	0.25	**0.34**	0.438	**0.596**	0.017 J	**0.047**	**0.96**	0.49	0.008 J	**0.01** J	**1.24**	0.71	0.00129	**0.00147**

Notes:
Bold indicates which concentration is higher, comparing seep and marine water.
ID - identification
J - The result is an estimated concentration
µg/L - microgram per liter
MW - marine water
No. - number
U - The compound was analyzed for, but was not detected ("nondetect") at or above the method reporting limit/method detection limit

Table H-10. Metals Analysis Results for Building 98 Water

Sampling Station ID	Sample Date	Sample No.	Sample Type	Arsenic (μg/L)	Cadmium (μg/L)	Chromium, Total (μg/L)	Copper (μg/L)	Lead (μg/L)	Nickel (μg/L)	Silver (μg/L)	Zinc (μg/L)	Mercury (μg/L)
B98	6/21/2016	B98-Potable [a]	N	0.3 J	0.037	0.3 U	7.56	1.07	2.42	0.008 UJ	81.2	0.00074
B98	6/21/2016	B98-Tank [b]	N	0.3 U	7.4	0.72	5.47	0.476	1.7	0.004 UJ	597	0.05 U
B98	6/21/2016	B98-Tank-F [a]	N	0.2 J	6.14	0.55	2.98	0.026 U	1.58	0.01 U	521	0.00093

Notes:
[a] Field filtered for dissolved metals analysis
[b] Total metals analysis
ID - Identification
J - The result is an estimated concentration.
μg/L - microgram per liter
N - normal environmental sample
No. - number
U - The compound was analyzed for, but was not detected ("nondetect") at or above the limit of detection

Table H-11. Metals, Ammonia, and Sulfide Results for Seep Water for Area 8

Transect	Sampling Station ID	Sample Date	Sample No.	Sample Type	Ammonia (mg/L)	Sulfide (mg/L)	Arsenic (mg/L)	Cadmium (mg/L)	Chromium (mg/L)	Copper (mg/L)	Lead (mg/L)	Nickel (mg/L)	Silver (mg/L)	Zinc (mg/L)	Mercury (mg/L)
Transect 8	SEEPC	6/5/2019	DUP-SW19	FD	0.30 U	1.9 U	0.0045	0.028	0.0084	0.0024	0.00060 U	0.0019 J	0.000087 J	0.0023 J	0.00020 U
Transect 8	SEEPC	6/5/2019	SEEPC-SW19	N	0.30 U	0.80 J	0.0047	0.028 J	0.0079	0.0010 J	0.00060 U	0.0016 J	0.000076 J	0.0037 J	0.00020 U

FD field duplicate sample
ID identification
J estimated result
mg/L milligram per liter
N normal environmental sample
No. number
U The compound was analyzed for, but was not detected ("nondetect") at or above the reported detection limit

Table H-12. Metals, Ammonia, Sulfide Results for Seep Water for Reference Area

Sampling Station ID	Sample Date	Sample No.	Sample Type	Ammonia (mg/L)	Sulfide (mg/L)	Arsenic (mg/L)	Cadmium (mg/L)	Chromium (mg/L)	Copper (mg/L)	Lead (mg/L)	Nickel (mg/L)	Silver (mg/L)	Zinc (mg/L)	Mercury (mg/L)
PPSP-1	6/5/2019	DUP2-SW19	FD	0.30 U	1.9 U	0.0062	0.0015 U	0.00088 J	0.0075 U	0.0030 U	0.0014 J	0.00035 U	0.020 U	0.00020 U
PPSP-1	6/5/2019	PPSP01SEEP-SW19	N	0.30 U	1.9 U	0.0057	0.0015 U	0.00091 J	0.0075 U	0.0030 U	0.0017 J	0.00035 U	0.020 U	0.00020 U

FD field duplicate sample
ID identification
J estimated result
mg/L milligram per liter
N normal environmental sample
No. number
U The compound was analyzed for, but was not detected ("nondetect") at or above the reported detection limit

Table H-13. PCB Results for Seep Water for Reference Area

Sampling Station ID	Sample Date	Sample No.	Sample Type	Aroclor-1016 (µg/L)	Aroclor-1221 (µg/L)	Aroclor-1232 (µg/L)	Aroclor-1242 (µg/L)	Aroclor-1248 (µg/L)	Aroclor-1254 (µg/L)	Aroclor-1260 (µg/L)	Total PCBs (µg/L)
PPSP-1	6/5/2019	DUP2-SW19	FD	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U
PPSP-1	6/5/2019	PPSP01SEEP-SW19	N	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U

µg/L microgram per liter
FD field duplicate sample
ID identification
N normal environmental sample
No. number
PCB polychlorinated biphenyl
U The compound was analyzed for, but was not detected ("nondetect") at or above the reported detection limit

Table H-14. SVOC/PAH Results for Seep Water for Reference Area

Sample No. Sample Type Sample Date	DUP2-SW19 FD 6/5/2019	PPSP01SEEP-SW19 N 6/5/2019
Analyte (µg/L)		
1,2,4-Trichlorobenzene	0.15 U	0.15 U
1,2-Dichlorobenzene	0.30 U	0.29 U
1,4-Dichlorobenzene	0.15 U	0.15 U
2,4-Dimethylphenol	3.0 U	2.9 U
2-Methylnaphthalene	0.15 U	0.15 U
2-Methylphenol	0.30 U	0.29 U
3 & 4 Methylphenol	0.49 U	0.49 U
Acenaphthene	0.30 U	0.29 U
Acenaphthylene	0.30 UJ	0.29 UJ
Anthracene	0.30 UJ	0.29 UJ
Benzo[a]anthracene	0.30 U	0.29 U
Benzo[a]pyrene	0.49 UJ	0.49 UJ
Benzo[g,h,i]perylene	0.30 U	0.29 U
Benzofluoranthene	0.30 U	0.29 U
Benzoic acid	3.2 UJ	3.1 UJ
Benzyl alcohol	1.4 J	1.6 UJ
Bis(2-ethylhexyl) phthalate	R	R
Butyl benzyl phthalate	0.79 U	0.78 U
Carbazole	0.3 UJ	0.29 UJ
Chrysene	0.49 U	0.49 U
Dibenz(a,h)anthracene	0.30 U	0.29 U
Dibenzofuran	0.15 U	0.15 U
Diethyl phthalate	1.6 U	1.6 U
Dimethyl phthalate	0.30 U	0.29 U
Di-n-butyl phthalate	1.6 U	1.6 U
Di-n-octyl phthalate	0.49 U	0.49 U
Fluoranthene	0.30 U	0.29 U
Fluorene	0.30 U	0.29 U
Hexachlorobenzene	0.30 U	0.29 U
Hexachlorobutadiene	0.30 U	0.29 U
Indeno[1,2,3-cd]pyrene	0.15 U	0.15 U
Naphthalene	0.30 U	0.29 U
N-Nitrosodiphenylamine	0.30 UJ	0.29 UJ
Pentachlorophenol	5.9 U	5.9 U
Phenanthrene	0.30 U	0.29 U
Phenol	0.79 U	0.78 U
Pyrene	0.30 U	0.29 U

µg/L	microgram per liter
FD	field duplicate sample
ID	identification
J	estimated result
N	normal environmental sample
No.	number
R	rejected
U	The compound was analyzed for, but was not detected ("nondetect") at or above the reported detection limit

Table H-15. Metals, Ammonia, and Sulfide Results for Sediment for Area 8

Transect	Sampling Station ID	Sample Date	Sample No.	Sample Depth (cm)	Sample Type	Ammonia (mg/kg)	Sulfide	Arsenic (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Nickel (mg/kg)	Silver (mg/kg)	Zinc (mg/kg)	Mercury (mg/kg)
Transect 2 & 8	S.Station64	6/4/2019	SS64-SD19	0-10	N	36 U	11 UJ	2.6	4.3	20	13	5.7	17	0.31	43	0.051
Transect 8	S.Station03-C	6/4/2019	DUP-SD19	0-10	N	39 U	140 J	3.2	8.4	44	13	5.1	20	0.34	37	0.13
Transect 8	S.Station03-C	6/4/2019	SS03-C-SD19	0-10	N	38 U	84 J	2.7	15	42	11	4	20	0.41	32	0.16
Transect 8	S.Station50	6/4/2019	SS50-SD19	0-10	N	32 U	11 UJ	2.1	4.9	35	15	10	28	0.35	44	0.058
Transect 8	S.Station51	6/4/2019	SS51-SD19	0-10	N	30 U	11 UJ	2.5	4.8	37	30	82	29	0.13	130	0.075
Transect 3	SEEPA	6/4/2019	SEEPA-SD19	0-10	N	37 U	64 J	2.4	8.5	42	11	3.6	20	0.36	32	0.29
Transect 9	OF03703	6/4/2019	OF03703-SD19	0-10	N	34 U	11 UJ	3	1.8	68	22	12	25	6.1	55	0.24
Transect 9	S.Station70	6/4/2019	SS70-SD19	0-10	N	34 U	11 UJ	2	1.4	47	99	43	26	1.3	120	0.25

cm	centimeter
ID	identification
J	estimated result
mg/kg	milligram per kilogram
N	normal environmental sample
No.	number
U	The compound was analyzed for, but was not detected ("nondetect") at or above the reported detection limit

Table H-16. TOC, Total Solids, and Grain Size Results for Sediment for Area 8

Transect	Sampling Station ID	Sample Date	Sample No.	Sample Depth (cm)	Sample Type	TOC (mg/kg)	Total Solids (%)	Total Solids @ 70 (%)	Clay (%)	Cobbles (%)	Gravel (%)	Sand (%)	Silt (%)
Transect 2 & 8	S.Station64	6/4/2019	SS64-SD19	0-10	N	30,000	80.6	83	3.4	0	42	48	7.1
Transect 8	S.Station03-C	6/4/2019	DUP-SD19	0-10	N	29,000	75.1	79	2.3	0	29	61	7.4
Transect 8	S.Station03-C	6/4/2019	SS03-C-SD19	0-10	N	21,000	74.1	78	1.8	0	33	60	5
Transect 8	S.Station50	6/4/2019	SS50-SD19	0-10	N	15,000	88	87	2.1	0	27	66	5.2
Transect 8	S.Station51	6/4/2019	SS51-SD19	0-10	N	29,000	87.4	86	2.4	0	40	54	4.1
Transect 3	SEEPA	6/4/2019	SEEPA-SD19	0-10	N	15,000	72.5	75	1.9	0	32	61	5.6
Transect 9	OF03703	6/4/2019	OF03703-SD19	0-10	N	15,000	86.4	88	1.5	0	24	71	3.7
Transect 9	S.Station70	6/4/2019	SS70-SD19	0-10	N	11,000	85.9	85	2.4	0	52	40	5.1

%	percent
cm	centimeter
ID	identification
mg/kg	milligram per kilogram
N	normal environmental sample
No.	number
TOC	total organic carbon
U	The compound was analyzed for, but was not detected ("nondetect") at or above the reported detection limit

Table H-17. SVOC/PAH Results for Sediment for Area 8

Sample No.	SS64-SD19
Sample Type	N
Sample Date	6/4/2019
Transect	Transect 2 & 8
Sample Depth (cm)	0-10
Analyte (µg/kg)	
1,2,4-Trichlorobenzene	45 UJ
1,2-Dichlorobenzene	89 UJ
1,4-Dichlorobenzene	89 UJ
2,4-Dimethylphenol	89 UJ
2-Methylnaphthalene	89 UJ
2-Methylphenol	89 UJ
3 & 4 Methylphenol	89 UJ
Acenaphthene	45 UJ
Acenaphthylene	45 UJ
Anthracene	45 UJ
Benzo[a]anthracene	45 UJ
Benzo[a]pyrene	89 UJ
Benzo[g,h,i]perylene	89 UJ
Benzofluoranthene	89 UJ
Benzoic acid	4700 UJ
Benzyl alcohol	R
Bis(2-ethylhexyl) phthalate	590 UJ
Butyl benzyl phthalate	360 UJ
Carbazole	89 UJ
Chrysene	89 UJ
Dibenz(a,h)anthracene	89 UJ
Dibenzofuran	45 UJ
Diethyl phthalate	590 UJ
Dimethyl phthalate	89 UJ
Di-n-butyl phthalate	360 UJ
Di-n-octyl phthalate	360 UJ
Fluoranthene	45 UJ
Fluorene	45 UJ
Hexachlorobenzene	89 UJ
Hexachlorobutadiene	89 UJ
Indeno[1,2,3-cd]pyrene	45 UJ
Naphthalene	45 UJ
N-Nitrosodiphenylamine	89 UJ
Pentachlorophenol	1200 UJ
Phenanthrene	89 UJ
Phenol	150 UJ
Pyrene	45 UJ

µg/kg	microgram per kilogram
cm	centimeter
FD	field duplicate sample
ID	identification
J	estimated result
N	normal environmental sample
No.	number
R	rejected
U	The compound was analyzed for, but was not detected ("nondetect") at or above the reported detection limit

Table H-18. PCB Results for Sediment for Area 8

Transect	Sampling Station ID	Sample Date	Sample No.	Sample Depth (cm)	Sample Type	Aroclor-1016 (µg/kg)	Aroclor-1221 (µg/kg)	Aroclor-1232 (µg/kg)	Aroclor-1242 (µg/kg)	Aroclor-1248 (µg/kg)	Aroclor-1254 (µg/kg)	Aroclor-1260 (µg/kg)	Total PCBs (µg/kg)
Transect 2 & 8	S.Station64	6/4/2019	SS64-SD19	0-10	N	1.2 U	1.8 U	1.2 U	1.2 U	0.72 U	1.8 U	1.2 U	1.8 U

µg/kg	microgram per kilogram
cm	centimeter
ID	identification
N	normal environmental sample
No.	number
PCB	polychlorinated biphenyl
U	The compound was analyzed for, but was not detected ("nondetect") at or above the reported detection limit

Table H-19. Pesticides Results for Sediment for Area 8

Transect	Sampling Station ID	Sample Date	Sample No.	Sample Depth (cm)	Sample Type	2,4-DDD (µg/kg)	2,4-DDE (µg/kg)	2,4-DDT (µg/kg)	4,4-DDD (µg/kg)	4,4-DDE (µg/kg)	4,4-DDT (µg/kg)	beta-BHC (µg/kg)	Dieldrin (µg/kg)	Endrin ketone (µg/kg)
Transect 2 & 8	S.Station64	6/4/2019	SS64-SD19	0-10	N	0.40 U	0.40 U	0.40 U	0.15 U	0.15 U	R	0.055 U	0.15 UJ	0.15 UJ

µg/kg	microgram per kilogram
BHC	benzene hexachloride
cm	centimeter
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
ID	identification
J	estimated result
N	normal environmental sample
No.	number
U	The compound was analyzed for, but was not detected ("nondetect") at or above the reported detection limit

Table H-20. Metals, Ammonia, and Sulfide Results for Sediment for Reference Area

Sampling Station ID	Sample Date	Sample No.	Sample Depth (cm)	Sample Type	Ammonia (mg/kg)	Sulfide (mg/kg)	Arsenic (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Nickel (mg/kg)	Silver (mg/kg)	Zinc (mg/kg)	Mercury (mg/kg)
PPSP-1	6/6/2019	PPSP01-SD19	0-10	N	36 U	12 U	1.7	0.067 J	15	6.5	1.6	17	0.015 J	20	0.019 U
PPSP-2	6/6/2019	DUP02-SD19	0-10	N	36 U	13 U	2.1	0.072 J	13	5.5	1.2	15	0.015 J	98 J	0.020 U
PPSP-2	6/6/2019	PPSP02-SD19	0-10	N	39 U	13 U	1.6	0.071 J	13	5.5	1.2	13	0.022 J	19 J	0.022 U
PPSP-4	6/6/2019	PPSP04-SD19	0-10	N	33 U	13 U	1.7	0.059 J	15	5.5	1.4	13	0.017 J	18	0.021 U

cm centimeter
ID identification
J estimated result
mg/kg milligram per kilogram
N normal environmental sample
No. number
U The compound was analyzed for, but was not detected ("nondetect") at or above the reported detection limit

Table H-21. TOC, Total Solids, and Grain Size Results for Sediment for Reference Area

Sampling Station ID	Sample Date	Sample No.	Sample Depth (cm)	Sample Type	Total Organic Carbon (mg/kg)	Total Solids (%)	Total Solids @ 70°C (%)	Clay (%)	Cobbles (%)	Gravel (%)	Sand (%)	Silt (%)
PPSP-1	6/6/2019	PPSP01-SD19	0-10	N	5,500	78.8	77	1.2	0	35	62	1.8
PPSP-2	6/6/2019	DUP02-SD19	0-10	N	5,800	76.1	81	1.1	0	40	56	2.8
PPSP-2	6/6/2019	PPSP02-SD19	0-10	N	4,100	76.3	83	1.2	0	35	61	3.1
PPSP-4	6/6/2019	PPSP04-SD19	0-10	N	3,300	77.3	80	1.2	0	37	58	3.6

%	percent
cm	centimeter
ID	identification
mg/kg	milligram per kilogram
N	normal environmental sample
No.	number
U	The compound was analyzed for, but was not detected ("nondetect") at or above the reported detection limit

Table H-22. PCB Results for Sediment for Reference Area

Sampling Station ID	Sample Date	Sample No.	Sample Depth (cm)	Sample Type	Aroclor-1016 (µg/kg)	Aroclor-1221 (µg/kg)	Aroclor-1232 (µg/kg)	Aroclor-1242 (µg/kg)	Aroclor-1248 (µg/kg)	Aroclor-1254 (µg/kg)	Aroclor-1260 (µg/kg)	Total PCBs (µg/kg)
PPSP-1	6/6/2019	PPSP01-SD19	0-10	N	1.1 U	1.7 U	1.1 U	1.1 U	0.67 U	1.7 U	1.1 U	1.7 U
PPSP-2	6/6/2019	DUP02-SD19	0-10	N	1.2 U	1.7 U	1.2 U	1.2 U	0.69 U	1.7 U	1.2 U	1.7 U
PPSP-2	6/6/2019	PPSP02-SD19	0-10	N	1.2 U	1.8 U	1.2 U	1.2 U	0.74 U	1.8 U	1.2 U	1.8 U
PPSP-4	6/6/2019	PPSP04-SD19	0-10	N	1.1 U	1.7 U	1.1 U	1.1 U	0.68 U	1.7 U	1.1 U	1.7 U

µg/kg microgram per kilogram
cm centimeter
ID identification
N normal environmental sample
No. number
PCB polychlorinated biphenyl
U The compound was analyzed for, but was not detected ("nondetect") at or above the reported detection limit

Table H-23. SVOC/PAH Results for Sediment for Reference Area

Sampling Station ID	PPSP-1	PPSP-2	PPSP-2	PPSP-4
Sample No.	PPSP01-SD19	DUP02-SD19	PPSP02-SD19	PPSP04-SD19
Sample Date	6/6/2019	6/6/2019	6/6/2019	6/6/2019
Sample Type	N	N	N	N
Sample Depth (cm)	0-10	0-10	0-10	0-10
Analyte (µg/kg)				
1,2,4-Trichlorobenzene	8.2 U	8.6 U	9.5 U	9.0 U
1,2-Dichlorobenzene	16 U	17 U	19 U	18 U
1,4-Dichlorobenzene	16 U	17 U	19 U	18 U
2,4-Dimethylphenol	16 U	17 U	19 U	18 U
2-Methylnaphthalene	16 U	17 U	19 U	18 U
2-Methylphenol	16 U	17 U	19 U	18 U
3 & 4 Methylphenol	12 J	17 U	19 U	18 U
Acenaphthene	8.2 U	8.6 U	9.5 U	9.0 U
Acenaphthylene	8.2 U	8.6 U	9.5 U	9.0 U
Anthracene	8.2 U	8.6 U	9.5 U	9.0 U
Benzo[a]anthracene	8.2 U	8.6 U	9.5 U	9.0 U
Benzo[a]pyrene	16 U	17 U	19 U	18 U
Benzo[g,h,i]perylene	16 U	17 U	19 U	18 U
Benzofluoranthene	16 U	17 U	19 U	18 U
Benzoic acid	880 UJ	910 U	1000 U	960 U
Benzyl alcohol	110 U	110 U	130 U	120 U
Bis(2-ethylhexyl) phthalate	110 U	110 U	130 U	120 U
Butyl benzyl phthalate	66 U	68 U	76 U	72 U
Carbazole	16 U	17 U	19 U	18 U
Chrysene	16 U	17 U	19 U	18 U
Dibenz(a,h)anthracene	16 U	17 U	19 U	18 U
Dibenzofuran	8.2 U	8.6 U	9.5 U	9.0 U
Diethyl phthalate	110 U	110 U	130 U	120 U
Dimethyl phthalate	16 U	17 U	19 U	18 U
Di-n-butyl phthalate	66 U	68 U	76 U	72 U
Di-n-octyl phthalate	66 U	68 U	76 U	72 U
Fluoranthene	8.2 U	8.6 U	9.5 U	9.0 U
Fluorene	8.2 U	8.6 U	9.5 U	9.0 U
Hexachlorobenzene	16 U	17 U	19 U	18 U
Hexachlorobutadiene	16 U	17 U	19 U	18 U
Indeno[1,2,3-cd]pyrene	8.2 U	8.6 U	9.5 U	9.0 U
Naphthalene	8.2 U	8.6 U	9.5 U	9.0 U
N-Nitrosodiphenylamine	16 U	17 U	19 U	18 U
Pentachlorophenol	220 U	230 U	250 U	240 U
Phenanthrene	16 U	17 U	19 U	18 U
Phenol	130 J	26 J	27 J	30 U
Pyrene	8.2 U	8.6 U	9.5 U	9.0 U

µg/kg	microgram per kilogram
cm	centimeter
ID	identification
J	estimated result
N	normal environmental sample
No.	number
R	rejected
U	The compound was analyzed for, but was not detected ("nondetect") at or above the reported detection limit

Table H-24. Pesticides Results for Sediment for Reference Area

Sampling Station ID	Sample Date	Sample No.	Sample Depth (cm)	Sample Type	2,4-DDD (µg/kg)	2,4-DDE (µg/kg)	2,4-DDT (µg/kg)	4,4-DDD (µg/kg)	4,4-DDE (µg/kg)	4,4-DDT (µg/kg)	beta-BHC (µg/kg)	Dieldrin (µg/kg)	Endrin ketone (µg/kg)
PPSP-1	6/6/2019	PPSP01-SD19	0-10	N	1.1 U	1.1 U	1.1 U	0.42 U	0.42 U	0.42 U	0.15 U	0.42 U	0.42 U
PPSP-2	6/6/2019	DUP02-SD19	0-10	N	1.1 U	1.1 U	1.1 U	0.43 U	0.43 U	0.43 U	0.16 U	0.43 U	0.43 U
PPSP-2	6/6/2019	PPSP02-SD19	0-10	N	1.2 U	1.2 U	1.2 U	0.46 U	0.46 U	0.46 U	0.17 U	0.46 U	0.46 U
PPSP-4	6/6/2019	PPSP04-SD19	0-10	N	1.1 U	1.1 U	1.1 U	0.42 U	0.42 U	0.42 U	0.15 U	0.42 U	0.42 U

µg/kg	microgram per kilogram
BHC	benzene hexachloride
cm	centimeter
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
ID	identification
N	normal environmental sample
No.	number
U	The compound was analyzed for, but was not detected ("nondetect") at or above the reported detection limit

Table H-25. Comparison of Historical Data Used to Select Sediment Bioassay Test Locations to 2019 Metals Data for Sediment

Sampling Station	Sample	Sample ID	Site Sediment Concentrations Cd (mg/kg)	Site Sediment Concentrations Hg (mg/kg)	Site Sediment Concentrations Ag (mg/kg)	Rationale and Results *
	Sediment Benchmark:	SCO	5.1	0.41	6.1	
		CSL	6.7	0.59	6.1	
S.STATION03 (Seep C)	6/16/2015	SS03-SD15	**11.4**	0.074	0.433	Maximum cadmium sediment concentration; confirmation of prior bioassay results (where applicable)
SS03-C	6/4/2019	SS03-C-SD19	**15**	0.16	0.41	Higher Cd concentration, no seep toxicity, abnormal bivalve development in sediment, reduced growth in polychaetes
SS03-C Dup	6/4/2019	DUP01-SD19	**8.4**	0.13	0.34	Duplicate
S.STATION50	6/15/2015	SS50-SD15	**8.84 J**	0.308	0.469	Mid-range cadmium sediment concentration
	6/4/2019	SS50-SD19	4.9	0.058	0.35	No SMS criteria exceedances, no toxicity
S.STATION51	6/15/2015	SS51-SD15	**10.2 J**	**2.42**	0.099	Second highest cadmium and highest mercury; synergistic effects with mercury
	6/4/2019	SS51-SD19	4.8	0.075	0.13	No SMS criteria exceedances, no toxicity
SEEP A (Sediment)	6/15/2015	SEEPC-SD15	**6.8 J**	0.133	0.299	Mid-range cadmium concentration
	6/4/2019	SEEPA-SD19	**8.5**	0.29	0.36	Mid-range cadmium concentration, abnormal bivalve development, reduced growth in polychaetes
S.STATION64	6/21/2016	SS64-CL16	2.71	0.082	0.208	Low cadmium sediment concentration, but maximum cadmium tissue concentration
	6/4/2019	SS64-SD19	4.3	0.051	0.31	Low cadmium sediment concentration, but historical maximum cadmium tissue concentration; reduced growth in polychaetes
S.STATION70	6/21/2016	SS70-SD16	3.18 J	**0.491**	**7.75 J**	Low cadmium sediment concentration, but cadmium tissue accumulation, mercury above SCO and high silver concentration; silver tissue concentration of 0.463 mg/kg exceeds background of 0.009 mg/kg; near dry outfall
	6/4/2019	SS70-SD19	1.4	0.25	1.3	No SMS criteria exceedances, no toxicity
OF03703	6/16/2015	OF03703-SD15	3.93	**0.627**	1.98	Exceeds mercury CSL and elevated cadmium tissue concentration
	6/4/2019	OF03703-SD19	1.8	0.24	6.1	At silver CSO/CSL, but no toxicity

Notes:

Bold - exceeds SCO.

Bold and yellow-highlight - exceeds CSL

The seep benchmarks is the National Ambient Water Quality Criterion.

*No toxicity was observed in the sediment amphipod bioassay and the seep bivalve bioassay.

Ag	silver
Cd	cadmium
CSL	SMS Cleanup Screening Level
Hg	mercury
ID	identification
J	The result is an estimated concentration
mg/kg	milligram per kilogram
SCO	SMS Sediment Cleanup Objective
SMS	Sediment Management Standards, Washington State Dept. of Ecology

Table H-26. Soil Vapor Sample Results (ug/m^3)

	Location Name	OU2A8-SV-1	OU2A8-SV-2	OU2A8-SV-3	OU2A8-SV-3	OU2A8-SV-4	OU2A8-SV-5	OU2A8-SV-5	OU2A8-SV-6
	Sample Name	OU2A8-SV-1-5.0	OU2A8-SV-2-5.0	OU2A8-SV-3-5.0	OU2A8-SV-3-8.0	OU2A8-SV-4-5.0	OU2A8-SV-5-5.0	OU2A8-SV-7-5.0	OU2A8-SV-6-5.0
	Sample Type	N	N	N	N	N	P	FD	N
Analyte	**PAL**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
1,1,2-Trichloroethane	6.67	6.2 U	**7.7** U	1.6 U	1.5 U	1.5 U	1.5 U	1.5 U	1.6 U
1,1-Dichloroethene	6,667	4.2 J	4.8 J	1.6 U	1.5 U	1.5 U	5.5	5.3	3
1,4-Dioxane	167	6.2 U	7.7 U	1.6 U	1.5 U	1.5 U	1.5 U	1.5 U	1.6 U
Benzene	107	6 U	7.6 U	0.63 J	1.5 J	3.4	2.1	4.7	1.5 U
Carbon Tetrachloride	139	6 U	7.6 U	1.6 U	1.5 U	33	1.5 U	1.5 U	1.5 U
cis-1,2-Dichloroethene	NE	38 J	7.7 U	1.6 U	0.94 J	0.83 J	1.5 U	1.5 U	1.6 U
Ethylbenzene	33,333	6 U	7.6 U	1.6 U	1.5 U	1.5 U	1.5 U	0.95 J	1.5 U
Tetrachloroethene	1,333	150 J	**1,500**	16	22	5.9	3.4	3.5	0.58 J
trans-1,2-Dichlorothene	2,000	**5,300** J	240	0.82 J	1.5 U	1.5 U	1.5 U	1.5 U	1.6 U
Trichloroethene	66.7	**1,300** J	**1,200**	**73**	**140**	**290** D	41	41	16
Vinyl Chloride	93.3	5.9 U	7.4 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U
Helium	NE	180,000	7,900	20,000	1,300 U	1,300 U	1,300 U	1,300 U	1,300 U

Notes:

Volatile organic compounds analyzed by EPA Method TO 15
Helium analyzed by EPA Method 3C Modified
Bold text indicates that the result or the reporting limit exceeds the PAL.
D - Result is from a laboratory diluted sample
P - Parent sample
FD - Field Duplicate
J - Result is an estimated value
N - Native sample
NE - Not established
PAL - Project action limit as established in the sampling and analysis plan
U - Analyte not detected at the indicated reporting limit
ug/m^3 - micrograms per cubic meter

Table H-27. Outdoor/Ambient Air Sampling Results at Area 8

ANALYTE_NAME					Tetrachloroethene	Trichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	1,1-Dichloroethene	Vinyl chloride
PAL Air - Indoor (µg/m^3)					40	2	NE	60	200	2.8
LOCATION_NAME	SAMPLE_NAME	SAMPLE_TYPE	COLLECT_DATE	Description	Result (µg/m^3)	Result (µg/m^3)	Result (µg/m^3)	Result (µg/m^3)	Result (µg/m^3)	Result (µg/m^3)
Apr-19										
Area8-OA-1	Area8-OA-1-190415	P	4/15/2019	Air - Outdoor	0.11 J	0.032 J	0.015 U	0.012 U	0.014 U	0.012 U
Area8-OA-4	Area8-OA-4-190415	FD	4/15/2019	Air - Outdoor	0.31 J	0.038 J	0.016 U	0.013 U	0.015 U	0.013 U
Area8-OA-2	Area8-OA-2-190415	N	4/15/2019	Air - Outdoor	0.028 J	0.012 U	0.013 U	0.01 U	0.012 U	0.01 U
Area8-OA-3	Area8-OA-3-190415	N	4/15/2019	Air - Outdoor	0.028 J	0.013 U	0.014 U	0.011 U	0.013 U	0.011 U
Area8-OA-5	Area8-OA-5-190416	P	4/16/2019	Air - Outdoor	0.037	0.012 U	0.013 U	0.032 J	0.012 U	0.011 U
Area8-OA-6	Area8-OA-6-190416	FD	4/16/2019	Air - Outdoor	0.034 J	0.012 U	0.013 U	0.033 J	0.012 U	0.011 U
Jul-19										
Area8-OA-1	Area8-OA-1-190723	N	7/23/2019	Air - Outdoor	0.027 J	0.029 U	0.029 U	0.14	0.029 U	0.029 U
Area8-OA-2	Area8-OA-2-190723	P	7/23/2019	Air - Outdoor	0.029 J	0.029 U	0.029 U	0.28	0.029 U	0.029 U
Area8-OA-4	Area8-OA-4-190723	FD	7/23/2019	Air - Outdoor	0.028 J	0.029 U	0.029 U	0.28	0.029 U	0.029 U
Area8-OA-3	Area8-OA-3-190723	N	7/23/2019	Air - Outdoor	0.033 J	0.029 U	0.029 U	0.44	0.029 U	0.029 U

NOTES:

FD - Field Duplicate

P - Parent

N - Normal (no field duplicate)

U - Undetected at the limit of detection shown

J - The result is an estimated concentration that is less than the LOQ but greater than or equal to the MDL.

April Samples:

OA-4 is FD of OA-1

OA-5/OA-6 location is same as OA-2 location

July Samples:

OA-4 is FD of OA-2

Table H-28. Vapor Intrusion Sampling Results at Area 8 - Building 82

ANALYTE_NAME					Tetrachloroethene		Trichloroethene		cis-1,2-Dichloroethene		trans-1,2-Dichloroethene		1,1-Dichloroethene		Vinyl chloride	
PAL Air - Indoor ($\mu g/m^3$)					40		2		NE		60		200		2.8	
PAL Soil Gas - Subslab ($\mu g/m3$)					1330		66.7		NE		2000		6670		93.3	
LOCATION_NAME	SAMPLE_NAME	SAMPLE_TYPE	COLLECT_DATE	Description	Result ($\mu g/m^3$)		Result ($\mu g/m^3$)		Result ($\mu g/m^3$)		Result ($\mu g/m^3$)		Result ($\mu g/m^3$)		Result ($\mu g/m^3$)	
April																
Area8-B82-IA-1	Area8-B82-IA-1-190415	N	4/15/2019	Air - Indoor	3.6		1.3		0.013	U	0.53		0.012	U	0.011	U
Area8-B82-SS-1	Area8-B82-SS-1-190416	N	4/16/2019	Soil Gas - Subslab	410	J	**3600**		0.62	J	51		7		0.22	U
Area8-B82-SS-8	Area8-B82-SS-8-190416	FD	4/16/2019	Soil Gas - Subslab	300	J	**3500**		0.62	J	53		6.8		0.23	U
				Air - Indoor- Correctec	3.49		1.268	J	0.013	U	0.53		0.012	U	0.011	U
Area8-B82-IA-2	Area8-B82-IA-2-190415	N	4/15/2019	Air - Indoor	0.18	J	0.18	J	0.028	J	0.21	J	0.013	U	0.012	U
Area8-B82-IA-8	Area8-B82-IA-8-190415	FD	4/15/2019	Air - Indoor	0.32	J	0.31	J	0.014	J	0.35	J	0.013	U	0.012	U
Area8-B82-SS-2	Area8-B82-SS-2-190416	N	4/16/2019	Soil Gas - Subslab	140		**260**		0.29	U	0.37	J	0.29	U	0.22	U
				Air - Indoor- Correctec	0.21		0.278	J	0.028	J	0.35		0.013	U	0.012	U
Area8-B82-IA-3	Area8-B82-IA-3-190415	N	4/15/2019	Air - Indoor	0.27		0.26		0.013	U	0.53		0.012	U	0.011	U
Area8-B82-SS-3	Area8-B82-SS-3-190416	N	4/16/2019	Soil Gas - Subslab	330		**3100**		0.93	J	2.1		2.1		0.22	U
				Air - Indoor- Correctec	0.16		0.228	J	0.013	U	0.53		0.012	U	0.011	U
Area8-B82-IA-4	Area8-B82-IA-4-190415	N	4/15/2019	Air - Indoor	0.25		0.24		0.014	U	0.53		0.013	U	0.012	U
Area8-B82-SS-4	Area8-B82-SS-4-190416	N	4/16/2019	Soil Gas - Subslab	0.38	J	11		0.45	J	0.29	U	0.75	J	0.22	U
				Air - Indoor- Correctec	0.14		0.208	J	0.014	U	0.53		0.013	U	0.012	U
Area8-B82-IA-5	Area8-B82-IA-5-190415	N	4/15/2019	Air - Indoor	0.13		0.49		0.014	U	0.47		0.014	U	0.012	U
Area8-B82-SS-5	Area8-B82-SS-5-190416	N	4/16/2019	Soil Gas - Subslab	0.82	J	3.5		0.32	U	0.32	U	0.32	U	0.25	U
				Air - Indoor- Correctec	0.02		0.458	J	0.014	U	0.47		0.014	U	0.012	U
Area8-B82-IA-6	Area8-B82-IA-6-190415	N	4/15/2019	Air - Indoor	0.11		0.66		0.015	U	0.75		0.014	U	0.013	U
Area8-B82-SS-6	Area8-B82-SS-6-190416	N	4/16/2019	Soil Gas - Subslab	2.5		**120**		0.3	U	0.29	U	0.29	U	0.23	U
				Air - Indoor- Correctec	0		0.628	J	0.015	U	0.75		0.014	U	0.013	U
Area8-B82-IA-7	Area8-B82-IA-7-190415	N	4/15/2019	Air - Indoor	0.2		0.19		0.014	U	0.43		0.013	U	0.011	U
Area8-B82-SS-7	Area8-B82-SS-7-190416	N	4/16/2019	Soil Gas - Subslab	1.1	J	**97**		0.3	U	1.5	J	0.3	U	0.23	U
				Air - Indoor- Correctec	0.09		0.158	J	0.014	U	0.43		0.013	U	0.011	U
Area8-OA-1	Area8-OA-1-190415	N	4/15/2019	Air - Outdoor	0.11	J	0.032	J	0.015	U	0.012	U	0.014	U	0.012	U
Area8-OA-4	Area8-OA-4-190415	FD	4/15/2019	Air - Outdoor	0.31	J	0.038	J	0.016	U	0.013	U	0.015	U	0.013	U
July																
Area8-B82-IA-1	Area8-B82-IA-1-190723	N	7/23/2019	Air - Indoor	0.26		0.17		0.056		33		0.033	U	0.033	U
Area8-B82-IA-8	Area8-B82-IA-8-190723	FD	7/23/2019	Air - Indoor	0.25		0.17		0.057		36		0.027	U	0.027	U
Area8-B82-SS-1	Area8-B82-SS-1-190724	N	7/24/2019	Soil Gas - Subslab	400		**3300**	J	3.4	U	34		3.4	U	3.4	U
Area8-B82-SS-8	Area8-B82-SS-8-190724	FD	7/24/2019	Soil Gas - Subslab	480		**4400**	J	2.8	U	39		1.7	J	2.8	U
				Air - Indoor- Correctec	0.233	J	0.17		0.057		35.86		0.027	U	0.027	U
Area8-B82-IA-2	Area8-B82-IA-2-190723	N	7/23/2019	Air - Indoor	0.12		0.062		0.31		**180**		0.03	U	0.03	U
Area8-B82-SS-2	Area8-B82-SS-2-190724	N	7/24/2019	Soil Gas - Subslab	210		**360**		0.66	U	0.66	U	0.66	U	0.66	U
				Air - Indoor- Correctec	0.093	J	0.062		0.31		**179.86**		0.03	U	0.03	U
Area8-B82-IA-3	Area8-B82-IA-3-190723	N	7/23/2019	Air - Indoor	0.082		0.081		0.33		**190**		0.033	U	0.033	U
Area8-B82-SS-3	Area8-B82-SS-3-190724	N	7/24/2019	Soil Gas - Subslab	380		**2700**		2.4	U	2.4	J	2.4	U	2.4	U
				Air - Indoor- Correctec	0.055	J	0.081		0.33		**189.86**		0.033	U	0.033	U
Area8-B82-IA-4	Area8-B82-IA-4-190723	N	7/23/2019	Air - Indoor	0.053		0.027	J	0.32		**180**		0.03	U	0.03	U
Area8-B82-SS-4	Area8-B82-SS-4-190724	N	7/24/2019	Soil Gas - Subslab	1.6	J	7.1		0.66	U	0.66	U	0.66	U	0.66	U
				Air - Indoor- Correctec	0.026	J	0.027	J	0.32		**179.86**		0.03	U	0.03	U
Area8-B82-IA-5	Area8-B82-IA-5-190723	N	7/23/2019	Air - Indoor	0.048		0.18		0.56		**330**		0.031	U	0.031	U
Area8-B82-SS-5	Area8-B82-SS-5-190724	N	7/24/2019	Soil Gas - Subslab	71		29		1.8	J	0.68	U	1.1	J	0.68	U
				Air - Indoor- Correctec	0.021	J	0.18		0.56		**329.86**		0.031	U	0.031	U
Area8-B82-IA-6	Area8-B82-IA-6-190723	N	7/23/2019	Air - Indoor	0.047		0.25		0.71		**340**		0.013	J	0.031	U
Area8-B82-SS-6	Area8-B82-SS-6-190724	N	7/24/2019	Soil Gas - Subslab	2.2	J	**150**		0.75	U	0.49	J	0.75	U	0.75	U
				Air - Indoor- Correctec	0.02	J	0.25		0.71		**339.86**		0.013	J	0.031	U
Area8-B82-IA-7	Area8-B82-IA-7-190723	N	7/23/2019	Air - Indoor	0.082		0.057		1.8		**980**		0.037	J	0.031	U
Area8-B82-SS-7	Area8-B82-SS-7-190724	N	7/24/2019	Soil Gas - Subslab	1.7	J	**140**		0.68	U	1.4	J	0.68	U	0.68	U
				Air - Indoor- Correctec	0.055	J	0.057		1.8		**979.86**		0.037	J	0.031	U
Area8-OA-1	Area8-OA-1-190723	N	7/23/2019	Air - Outdoor	0.027	J	0.029	U	0.029	U	0.14		0.029	U	0.029	U

NOTES:
Bold - exceeds PAL
FD - Field Duplicate
P - Parent
N - Normal (no field duplicate)
U - Undetected at the limit of detection shown
J - The result is an estimated concentration that is less than the LOQ but greater than or equal to the MDL.

Table H-29. Vapor Intrusion Sampling Results at Area 8 - Building 85

ANALYTE_NAME					Tetrachloroethene	Trichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	1,1-Dichloroethene	Vinyl chloride
PAL Air - Indoor (μg/m^3)					40	2	NE	60	200	2.8
PAL Soil Gas - Subslab (μg/m3)					1330	66.7	NE	2000	6670	93.3
LOCATION_NAME	SAMPLE_NAME	SAMPLE_TYPE	COLLECT_DATE	Description	Result (μg/m^3)	Result (μg/m^3)	Result (μg/m^3)	Result (μg/m^3)	Result (μg/m^3)	Result (μg/m^3)
Apr-19										
Area8-B85-IA-1	Area8-B85-IA-1-190415	N	4/15/2019	Air - Indoor	0.029 J	0.014 U	0.015 U	0.012 U	0.014 U	0.012 U
Area8-B85-SS-1	Area8-B85-SS-1-190416	N	4/16/2019	Soil Gas - Subslab	45	17	0.29 U	0.28 U	0.28 U	0.22 U
Area8-B85-SS-3	Area8-B85-SS-3-190416	FD	4/16/2019	Soil Gas - Subslab	37	17	0.28 U	0.28 U	0.28 U	0.21 U
				Air - Indoor- Corrected	0.001 J	0.014 U	0.015 U	0.012 U	0.014 U	0.012 U
Area8-B85-IA-2	Area8-B85-IA-2-190415	N	4/15/2019	Air - Indoor	0.098	0.047	0.014 U	0.011 U	0.013 U	0.011 U
Area8-B85-IA-3	Area8-B85-IA-3-190415	FD	4/15/2019	Air - Indoor	0.094	0.045 J	0.02 U	0.016 U	0.019 U	0.016 U
Area8-B85-SS-2	Area8-B85-SS-2-190416	N	4/16/2019	Soil Gas - Subslab	1300	**640**	0.28 U	0.28 U	1.7 J	0.21 U
				Air - Indoor- Corrected	0.07 J	0.047	0.014 U	0.011 U	0.013 U	0.011 U
Area8-OA-2	Area8-OA-2-190415	N	4/15/2019	Air - Outdoor	0.028 J	0.012 U	0.013 U	0.01 U	0.012 U	0.01 U
Jul-19										
Area8-B85-IA-1	Area8-B85-IA-1-190723	N	7/23/2019	Air - Indoor	0.035 J	0.034 U	0.034 U	0.3	0.034 U	0.034 U
Area8-B85-SS-1	Area8-B85-SS-1-190724	N	7/24/2019	Soil Gas - Subslab	74	33	0.66 U	0.66 U	0.66 U	0.66 U
				Air - Indoor- Correctec	0.006	0.034 U	0.034 U	0.02	0.034 U	0.034 U
Area8-B85-IA-2	Area8-B85-IA-2-190723	N	7/23/2019	Air - Indoor	0.11	0.064	0.031 U	0.25	0.031 U	0.031 U
Area8-B85-IA-3	Area8-B85-IA-3-190723	FD	7/23/2019	Air - Indoor	0.11	0.059	0.031 U	0.25	0.031 U	0.031 U
Area8-B85-SS-2	Area8-B85-SS-2-190724	N	7/24/2019	Soil Gas - Subslab	**3100**	**1400**	5 U	5 U	5 U	5 U
Area8-B85-SS-3	Area8-B85-SS-3-190724	FD	7/24/2019	Soil Gas - Subslab	**2500**	**1100**	1.8 U	1.8 U	1.8 U	1.8 U
				Air - Indoor- Correctec	0.081	0.064	0.031 U	0	0.031 U	0.031 U
Area8-OA-2	Area8-OA-2-190723	N	7/23/2019	Air - Outdoor	0.029 J	0.029 U	0.029 U	0.28	0.029 U	0.029 U
Area8-OA-4	Area8-OA-4-190723	FD	7/23/2019	Air - Outdoor	0.028 J	0.029 U	0.029 U	0.28	0.029 U	0.029 U

NOTES:

Bold - exceeds PAL

FD - Field Duplicate

P - Parent

N - Normal (no field duplicate)

U - Undetected at the limit of detection shown

J - The result is an estimated concentration that is less than the LOQ but greater than or equal to the MDL.

Table H-30. Vapor Intrusion Sampling Results at Area 8 - Building 98

ANALYTE_NAME					Tetrachloroethene		Trichloroethene		cis-1,2-Dichloroethene		trans-1,2-Dichloroethene		1,1-Dichloroethene		Vinyl chloride	
PAL Air - Indoor (μg/m^3)					40		2		NE		60		200		2.8	
PAL Soil Gas - Subslab (μg/m3)					1330		66.7		NE		2000		6670		93.3	
LOCATION_NAME	SAMPLE_NAME	SAMPLE_TYPE	COLLECT_DATE	Description	Result (μg/m^3)		Result (μg/m^3)		Result (μg/m^3)		Result (μg/m^3)		Result (μg/m^3)		Result (μg/m^3)	
Apr-19																
Area8-B98-IA-1	Area8-B98-IA-1-190416	N	4/16/2019	Air - Indoor	0.69		0.48		0.018	J	0.81		0.012	U	0.011	U
Area8-B98-SS-1	Area8-B98-SS-1-190417	N	4/17/2019	Soil Gas - Subslab	4.4		15		1.5	J	1.6	J	0.41	U	0.31	U
				Air - Indoor- Corrected	0.662	J	0.48		0.018	J	0.778		0.012	U	0.011	U
Area8-B98-IA-2	Area8-B98-IA-2-190416	N	4/16/2019	Air - Indoor	0.64		0.49		0.021	J	2.2		0.013	U	0.011	U
Area8-B98-SS-2	Area8-B98-SS-2-190417	N	4/17/2019	Soil Gas - Subslab	8.8		15		0.43	U	0.92	J	0.43	U	0.33	U
				Air - Indoor- Corrected	0.612	J	0.49		0.021	J	2.168		0.013	U	0.011	U
Area8-B98-IA-3	Area8-B98-IA-3-190415	N	4/15/2019	Air - Indoor	0.091		0.18		0.019	J	7.4		0.013	U	0.012	U
Area8-B98-SS-3	Area8-B98-SS-3-190417	N	4/17/2019	Soil Gas - Subslab	0.69	U	4.3	J	0.75	U	27		0.74	U	0.57	U
Area8-B98-SS-13	Area8-B98-SS-13-190417	FD	4/17/2019	Soil Gas - Subslab	0.71	U	5.8		0.77	U	25		0.76	U	0.58	U
				Air - Indoor- Corrected	0.063	J	0.18		0.019	J	7.368		0.013	U	0.012	U
Area8-B98-IA-4	Area8-B98-IA-4-190416	N	4/16/2019	Air - Indoor	0.84		0.69		0.027	J	2.2		0.015	J	0.011	U
Area8-B98-SS-4	Area8-B98-SS-4-190417	N	4/17/2019	Soil Gas - Subslab	2.6	J	**150**		0.44	U	16		0.43	U	0.33	U
				Air - Indoor- Corrected	0.812	J	0.69		0.027	J	2.168		0.015	J	0.011	U
Area8-B98-IA-5	Area8-B98-IA-5-190415	N	4/15/2019	Air - Indoor	0.95		0.88		0.014	U	0.89		0.098		0.012	U
Area8-B98-SS-5	Area8-B98-SS-5-190417	N	4/17/2019	Soil Gas - Subslab	11		31		0.46	U	1.1	J	0.45	U	0.35	U
				Air - Indoor- Corrected	0.922	J	0.88		0.014	U	0.858		0.098		0.012	U
Area8-B98-IA-6	Area8-B98-IA-6-190415	N	4/15/2019	Air - Indoor	0.12		0.27		0.014	U	1.5		0.013	U	0.012	J
Area8-B98-SS-6	Area8-B98-SS-6-190417	N	4/17/2019	Soil Gas - Subslab	31		18		0.72	U	8.4		0.71	U	0.54	U
				Air - Indoor- Corrected	0.092	J	0.27		0.014	U	1.468		0.013	U	0.012	J
Area8-B98-IA-7	Area8-B98-IA-7-190416	N	4/16/2019	Air - Indoor	0.59		0.54		0.021	J	1.7		0.012	U	0.011	U
Area8-B98-SS-7	Area8-B98-SS-7-190417	N	4/17/2019	Soil Gas - Subslab	82		**500**		1.6	J	47		0.7	U	0.54	U
				Air - Indoor- Corrected	0.562	J	0.54		0.021	J	1.668		0.012	U	0.011	U
Area8-B98-IA-8	Area8-B98-IA-8-190415	N	4/15/2019	Air - Indoor	0.13		0.26		0.033	J	0.71		0.014	U	0.012	U
Area8-B98-SS-8	Area8-B98-SS-8-190417	N	4/17/2019	Soil Gas - Subslab	350		**1000**		200		9		1.2	U	0.95	U
				Air - Indoor- Corrected	0.102	J	0.26		0.033	J	0.678		0.014	U	0.012	U
Area8-B98-IA-9	Area8-B98-IA-9-190415	N	4/15/2019	Air - Indoor	0.15		0.35		0.014	U	0.91		0.013	U	0.012	U
Area8-B98-SS-9	Area8-B98-SS-9-190417	N	4/17/2019	Soil Gas - Subslab	14		**100**		0.42	U	6.7		0.41	U	0.32	U
				Air - Indoor- Corrected	0.122	J	0.35		0.014	U	0.878		0.013	U	0.012	U
Area8-B98-1A-10	Area8-B98-1A-10-190416	N	4/16/2019	Air - Indoor	2.2		1.1		0.027	J	1.5		0.014	J	0.011	U
Area8-B98-1A-15	Area8-B98-1A-15-190416	FD	4/16/2019	Air - Indoor	2.1		1.1		0.026	J	1.5		0.015	J	0.011	U
Area8-B98-SS-10	Area8-B98-SS-10-190417	N	4/17/2019	Soil Gas - Subslab	**1900**		**1500**		22		31		1.6	U	1.3	U
				Air - Indoor- Corrected	2.172	J	1.1		0.027	J	1.468		0.015	J	0.011	U
Area8-B98-1A-11	Area8-B98-1A-11-190416	N	4/16/2019	Air - Indoor	2.1		1.1		0.027	J	1.3		0.015	J	0.011	U
Area8-B98-SS-11	Area8-B98-SS-11-190417	N	4/17/2019	Soil Gas - Subslab	410		**1500**		17		11	J	1.9	U	1.5	U
				Air - Indoor- Corrected	2.072	J	1.1		0.027	J	1.268		0.015	J	0.011	U
Area8-B98-IA-12	Area8-B98-IA-12-190415	N	4/15/2019	Air - Indoor	0.38		0.43		0.015	J	1.6		0.012	U	0.011	U
Area8-B98-IA-14	Area8-B98-IA-14-190415	FD	4/15/2019	Air - Indoor	0.39		0.45		0.015	J	1.6		0.014	U	0.012	U
Area8-B98-SS-12	Area8-B98-SS-12-190417	N	4/17/2019	Soil Gas - Subslab	110		60		0.58	J	21		0.43	U	0.33	U
				Air - Indoor- Corrected	0.362	J	0.45		0.015	J	1.568		0.012	U	0.012	U
Area8-B98-IA-13	Area8-B98-IA-13-190415	N	4/15/2019	Air - Indoor	0.082		0.078		0.33		**140**		0.012	U	0.011	U
				Air - Indoor- Corrected	0.054	J	0.078		0.33		**139.968**		0.012	U	0.011	U
Area8-OA-2	Area8-OA-2-190415	N	4/15/2019	Air - Outdoor	0.028	J	0.012	U	0.013	U	0.01	U	0.012	U	0.01	U
Area8-OA-5	Area8-OA-5-190416	N	4/16/2019	Air - Outdoor	0.037		0.012	U	0.013	U	0.032	J	0.012	U	0.011	U
Area8-OA-6	Area8-OA-6-190416	FD	4/16/2019	Air - Outdoor	0.034	J	0.012	U	0.013	U	0.033	J	0.012	U	0.011	U

Table H-30. Vapor Intrusion Sampling Results at Area 8 - Building 98

ANALYTE_NAME					Tetrachloroethene	Trichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	1,1-Dichloroethene	Vinyl chloride
PAL Air - Indoor (µg/m^3)					**40**	**2**	**NE**	**60**	**200**	**2.8**
PAL Soil Gas - Subslab (µg/m3)					**1330**	**66.7**	**NE**	**2000**	**6670**	**93.3**
LOCATION_NAME	**SAMPLE_NAME**	**SAMPLE_TYPE**	**COLLECT_DATE**	**Description**	**Result (µg/m^3)**	**Result (µg/m^3)**	**Result (µg/m^3)**	**Result (µg/m^3)**	**Result (µg/m^3)**	**Result (µg/m^3)**
Jul-19										
Area8-B98-IA-1	Area8-B98-IA-1-190723	N	7/23/2019	Air - Indoor	0.03 J	0.015 J	0.023 J	9.5	0.031 U	0.031 U
Area8-B98-SS-1	Area8-B98-SS-1-190724	N	7/24/2019	Soil Gas - Subslab	7.1	17	0.72 U	1.2 J	0.72 U	0.72 U
				Air - Indoor- Corrected	0.001 J	0.015 J	0.023 J	9.22	0.031 U	0.031 U
Area8-B98-IA-2	Area8-B98-IA-2-190723	N	7/23/2019	Air - Indoor	0.028 J	0.031 U	0.031 U	2.7	0.031 U	0.031 U
Area8-B98-SS-2	Area8-B98-SS-2-190724	N	7/24/2019	Soil Gas - Subslab	12	20	0.68 J	0.56 J	0.7 U	0.7 U
				Air - Indoor- Corrected	0 J	0.031 U	0.031 U	2.42	0.031 U	0.031 U
Area8-B98-IA-3	Area8-B98-IA-3-190723	N	7/23/2019	Air - Indoor	0.031 J	0.024 J	0.028 J	15	0.031 U	0.031 U
Area8-B98-SS-3	Area8-B98-SS-3-190724	N	7/24/2019	Soil Gas - Subslab	1.8 J	16	0.73 U	7.3	0.73 U	0.73 U
Area8-B98-SS-13	Area8-B98-SS-13-190724	FD	7/24/2019	Soil Gas - Subslab	1.2 J	17	0.66 U	7.7	0.66 U	0.66 U
				Air - Indoor- Corrected	0.002 J	0.024 J	0.028 J	14.72	0.031 U	0.031 U
Area8-B98-IA-4	Area8-B98-IA-4-190723	N	7/23/2019	Air - Indoor	0.039 J	0.061	0.021 J	7.7	0.035 U	0.035 U
Area8-B98-SS-4	Area8-B98-SS-4-190724	N	7/24/2019	Soil Gas - Subslab	4	**170**	0.65 U	5.3	0.65 U	0.65 U
				Air - Indoor- Corrected	0.01 J	0.061	0.021 J	7.42	0.035 U	0.035 U
Area8-B98-IA-5	Area8-B98-IA-5-190723	N	7/23/2019	Air - Indoor	1	0.15	0.031 J	13	0.15	0.036 U
Area8-B98-SS-5	Area8-B98-SS-5-190724	N	7/24/2019	Soil Gas - Subslab	6.4	17	0.68 U	1.5 J	0.68 U	0.68 U
				Air - Indoor- Corrected	0.971	0.15	0.031 J	12.72	0.15	0.036 U
Area8-B98-IA-6	Area8-B98-IA-6-190723	N	7/23/2019	Air - Indoor	0.054	0.14	0.75	**280**	0.031 U	0.031 U
Area8-B98-SS-6	Area8-B98-SS-6-190724	N	7/24/2019	Soil Gas - Subslab	25	15	0.62 U	5.5	0.62 U	0.62 U
				Air - Indoor- Corrected	0.025	0.14	0.75	**280**	0.031 U	0.031 U
Area8-B98-IA-7	Area8-B98-IA-7-190723	N	7/23/2019	Air - Indoor	0.079	0.16	0.82	**310**	0.03 U	0.03 U
Area8-B98-SS-7	Area8-B98-SS-7-190724	N	7/24/2019	Soil Gas - Subslab	72	**280**	0.66 J	45	0.66 U	0.66 U
				Air - Indoor- Corrected	0.05	0.16	0.82	**310**	0.03 U	0.03 U
Area8-B98-IA-8	Area8-B98-IA-8-190723	N	7/23/2019	Air - Indoor	0.21	0.12	0.031 J	13	0.032 U	0.032 U
Area8-B98-SS-8	Area8-B98-SS-8-190724	N	7/24/2019	Soil Gas - Subslab	430	**970**	220	8.3	0.65 U	0.65 U
				Air - Indoor- Corrected	0.181	0.12	0.031 J	12.72	0.032 U	0.032 U
Area8-B98-IA-9	Area8-B98-IA-9-190723	N	7/23/2019	Air - Indoor	0.042	0.065	0.043	22	0.031 U	0.031 U
Area8-B98-SS-9	Area8-B98-SS-9-190724	N	7/24/2019	Soil Gas - Subslab	32	**190**	0.65 U	6.2	0.65 U	0.65 U
				Air - Indoor- Corrected	0.013	0.065	0.043	21.72	0.031 U	0.031 U
Area8-B98-1A-10	Area8-B98-1A-10-190723	N	7/23/2019	Air - Indoor	0.058	0.066	0.067	30	0.036 U	0.036 U
Area8-B98-SS-10	Area8-B98-SS-10-190725	N	7/25/2019	Soil Gas - Subslab	**2300**	**1700**	21	18	3.7 U	3.7 U
				Air - Indoor- Corrected	0.029	0.066	0.067	29.72	0.036 U	0.036 U
Area8-B98-1A-11	Area8-B98-1A-11-190723	N	7/23/2019	Air - Indoor	0.041	0.11	0.067	25	0.033 U	0.033 U
Area8-B98-SS-11	Area8-B98-SS-11-190725	N	7/25/2019	Soil Gas - Subslab	520	**1600**	16	9.5 J	3.5 U	3.5 U
				Air - Indoor- Corrected	0.012	0.11	0.067	24.72	0.033 U	0.033 U
Area8-B98-IA-12	Area8-B98-IA-12-190723	N	7/23/2019	Air - Indoor	0.092	0.15	0.14	**110**	0.031 U	0.031 U
Area8-B98-SS-12	Area8-B98-SS-12-190725	N	7/25/2019	Soil Gas - Subslab	150	**74**	0.4 J	13	0.71 U	0.71 U
				Air - Indoor- Corrected	0.063	0.15	0.14	**109.72**	0.031 U	0.031 U
Area8-B98-IA-13	Area8-B98-IA-13-190723	N	7/23/2019	Air - Indoor	0.041	0.017 J	0.63	**440**	0.031 U	0.031 U
Area8-B98-IA-14	Area8-B98-IA-14-190723	FD	7/23/2019	Air - Indoor	0.042	0.032 J	0.65	**480**	0.034 U	0.034 U
				Air - Indoor- Corrected	0.013	0.032 J	0.65	**479.72**	0.034 U	0.034 U
Area8-OA-2	Area8-OA-2-190723	N	7/23/2019	Air - Outdoor	0.029 J	0.029 U	0.029 U	0.28	0.029 U	0.029 U
Area8-OA-4	Area8-OA-4-190723	FD	7/23/2019	Air - Outdoor	0.028 J	0.029 U	0.029 U	0.28	0.029 U	0.029 U

NOTES:

Bold - exceeds PAL

FD - Field Duplicate

P - Parent

N - Normal (no field duplicate)

U - Undetected at the limit of detection shown

J - The result is an estimated concentration that is less than the LOQ but greater than or equal to the MDL.

Table H-31. Vapor Intrusion Sampling Results at Area 8 - Building 1074

ANALYTE_NAME					Tetrachloroethene		Trichloroethene		cis-1,2-Dichloroethene		trans-1,2-Dichloroethene		1,1-Dichloroethene		Vinyl chloride	
PAL Air - Indoor (µg/m^3)					40		2		NE		60		200		2.8	
PAL Soil Gas - Subslab (µg/m3)					1330		66.7		NE		2000		6670		93.3	
LOCATION_NAME	SAMPLE_NAME	SAMPLE_TYPE	COLLECT_DATE	Description	Result (µg/m^3)		Result (µg/m^3)		Result (µg/m^3)		Result (µg/m^3)		Result (µg/m^3)		Result (µg/m^3)	
Apr-19																
Area8-B1074-IA-1	Area8-B1074-IA-1-190415	N	4/15/2019	Air - Indoor	0.083		0.032	J	0.016	U	0.013	U	0.015	U	0.014	U
Area8-B1074-SS-1	Area8-B1074-SS-1-190416	N	4/16/2019	Soil Gas - Subslab	0.55	J	1.4	J	0.29	U	0.29	U	0.29	U	0.22	U
				Air - Indoor- Corrected	0.055	J	0.032	J	0.016	U	0.013	U	0.015	U	0.014	U
Area8-B1074-IA-2	Area8-B1074-IA-2-190415	N	4/15/2019	Air - Indoor	0.08		0.034	J	0.014	U	0.011	U	0.013	U	0.012	U
Area8-B1074-SS-2	Area8-B1074-SS-2-190416	N	4/16/2019	Soil Gas - Subslab	0.82	J	9.8		0.29	U	0.29	U	0.29	U	0.22	U
Area8-B1074-SS-4	Area8-B1074-SS-4-190416	FD	4/16/2019	Soil Gas - Subslab	0.96	J	10		0.29	U	0.29	U	0.29	U	0.22	U
				Air - Indoor- Corrected	0.052	J	0.034	J	0.014	U	0.011	U	0.013	U	0.012	U
Area8-B1074-IA-3	Area8-B1074-IA-3-190415	N	4/15/2019	Air - Indoor	0.083		0.034	J	0.015	U	0.012	U	0.014	U	0.013	U
Area8-B1074-IA-4	Area8-B1074-IA-4-190415	FD	4/15/2019	Air - Indoor	0.094		0.037	J	0.015	U	0.012	U	0.014	U	0.012	U
Area8-B1074-SS-3	Area8-B1074-SS-3-190416	N	4/16/2019	Soil Gas - Subslab	0.57	J	3.8		0.29	U	0.29	U	0.29	U	0.22	U
				Air - Indoor- Corrected	0.066	J	0.037	J	0.015	U	0.012	U	0.014	U	0.013	U
Area8-OA-3	Area8-OA-3-190415	N	4/15/2019	Air - Outdoor	0.028	J	0.013	U	0.014	U	0.011	U	0.013	U	0.011	U
Jul-19																
Area8-B1074-IA-1	Area8-B1074-IA-1-190723	N	7/23/2019	Air - Indoor	0.056		0.028	U	0.028	U	0.36		0.028	U	0.028	U
Area8-B1074-SS-1	Area8-B1074-SS-1-190724	N	7/24/2019	Soil Gas - Subslab	0.63	U	1.7	J	0.63	U	0.63	U	0.63	U	0.63	U
				Air - Indoor- Corrected	0.023	J	0.028	U	0.028	U	0		0.028	U	0.028	U
Area8-B1074-IA-2	Area8-B1074-IA-2-190723	N	7/23/2019	Air - Indoor	0.048		0.028	U	0.028	U	0.31		0.028	U	0.028	U
Area8-B1074-IA-4	Area8-B1074-IA-4-190723	FD	7/23/2019	Air - Indoor	0.043		0.028	U	0.028	U	0.32		0.028	U	0.028	U
Area8-B1074-SS-2	Area8-B1074-SS-2-190724	N	7/24/2019	Soil Gas - Subslab	0.86	J	10	J	0.67	U	0.67	U	0.67	U	0.67	U
Area8-B1074-SS-4	Area8-B1074-SS-4-190724	FD	7/24/2019	Soil Gas - Subslab	3.7		6	J	0.65	U	0.65	U	0.65	U	0.65	U
				Air - Indoor- Corrected	0.015	J	0.028	U	0.028	U	0		0.028	U	0.028	U
Area8-B1074-IA-3	Area8-B1074-IA-3-190723	N	7/23/2019	Air - Indoor	0.039		0.031	U	0.031	U	0.31		0.031	U	0.031	U
Area8-B1074-SS-3	Area8-B1074-SS-3-190724	N	7/24/2019	Soil Gas - Subslab	0.51	J	4.9		0.71	U	0.71	U	0.71	U	0.71	U
				Air - Indoor- Corrected	0.006	J	0.031	U	0.031	U	0		0.031	U	0.031	U
Area8-OA-3	Area8-OA-3-190723	N	7/23/2019	Air - Outdoor	0.033	J	0.029	U	0.029	U	0.44		0.029	U	0.029	U

NOTES:
Bold - exceeds PAL
FD - Field Duplicate
P - Parent
N - Normal (no field duplicate)
U - Undetected at the limit of detection shown
J - The result is an estimated concentration that is less than the LOQ but greater than or equal to the MDL.

APPENDIX I
SITE INSPECTION CHECKLISTS

Fifth Five-Year Review
NBK Keyport
Keyport, WA

SITE INSPECTION CHECKLIST

I. SITE INFORMATION

Site name: Naval Base Kitsap Keyport	**Date of inspection:** September 19, 2019
Location and Region: Keyport, WA; Region 10	**EPA ID:** WA1170023419
Agency, office, or company leading the five-year review: U.S. Navy; Battelle	**Weather/temperature:** ~65 degrees F; clear; slight breeze

Remedy Includes: (Check all that apply)

- ■ Landfill cover/containment
- ■ Access controls
- ■ Land use controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatement
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls
- ■ Other: OU 1 - landfill cover, access controls, LUCs, phytoremediation, LTM, tide gate upgrade, sediment removal, and contigency actions; OU 2 - access controls, LUCs, LTM, HHRA and ERA (Area 8 only), soil removal (Area 8 only), and contingency actions (Area 8 only).

Attachments:

- ☐ Inspection team roster attached
- ☐ Site map attached

Inspection team roster and site maps are included in Section 4.0 of Report.

II. INTERVIEWS

(Please see Appendix B)

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**

■ O&M manual	■ Readily available	■ Up to date	☐ NA
■ As-built drawings	■ Readily available	■ Up to date	☐ NA
■ Maintenance logs	■ Readily available	■ Up to date	☐ NA
■ Health & Safety Plans	■ Readily available	■ Up to date	☐ NA

Remarks: On file at NAVFAC Northwest and reviewed as part of this FYR.

2. **Land Use Controls Inspection Records** ■ Readily available ■ Up to date ☐ NA

Remarks: On file at NAVFAC Northwest and reviewed and presented as part of this FYR.

IV. O&M COSTS

1. **O&M Organization**

- ☐ State in-house
- ☐ PRP in-house
- ☐ Federal Facility in-house
- ☐ Other:
- ☐ Contractor for State
- ☐ Contractor for PRP
- ■ Contractor for Federal Facility

2. **O&M Cost Records**

- ■ Up to date
- ■ Readily available
- ■ Funding mechanism/agreement in place

Original O&M cost estimate: $251,552.00 ☐ Breakdown attached

Total annual cost by year for review period (if available):

From (Date)	To (Date)	(Total cost)	
FY 2015		$187,588.66	☐ Breakdown attached
FY 2016		$219,912.27	☐ Breakdown attached
FY 2017		$145,137.07	☐ Breakdown attached
FY 2018		$239,712.07	☐ Breakdown attached
FY 2019		$204,929.19	☐ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**
Describe costs and reasons: None. O&M costs are primarily due to LTM at OU 1, ranging from 75% to 92% of the total O&M costs per FY.

V. ACCESS AND LAND USE CONTROLS

☐ NA ■ Applicable

A. OU 1

1. **Access to landfill and plantations controlled?** ■ Yes ☐ No ☐ NA
Remarks: See Section 4.3.1 of FYR Report for additional information.

2. **Groundwater wells installed?** ☐ Yes ■ No ☐ NA
Remarks: See Section 4.3.1 of FYR Report for additional information. Groundwater monitoring wells are installed as part of LTM Program, but no wells have been installed for drinking water or other purposes besides remediation.

3. **Any activities that could interfere with remedy or monitoring?** ☐ Yes ■ No ☐ NA
Remarks: See Section 4.3.1 of FYR Report for additional information.

4. **Any permanent workers on landfill?** ☐ Yes ■ No ☐ NA
Remarks: See Section 4.3.1 of FYR Report for additional information.

5. **Any digging in landfill without dig permit?** ☐ Yes ■ No ☐ NA
Remarks: See Section 4.3.1 of FYR Report for additional information.

6. **Any disturbance to wetlands?** ☐ Yes ■ No ☐ NA
Remarks: See Section 4.3.1 of FYR Report for additional information.

B. OU 2

1. **Access to Areas 2 and 8 controlled?** ■ Yes ☐ No ☐ NA
Remarks: See Section 4.3.1 of FYR Report for additional information.

2. **Groundwater wells installed?** ☐ Yes ■ No ☐ NA
Remarks: See Section 4.3.1 of FYR Report for additional information. Groundwater monitoring wells are installed as part of LTM Program, but no wells have been installed for drinking water or other purposes besides remediation.

3. **Any digging without dig permit?** ☐ Yes ■ No ☐ NA
Remarks: See Section 4.3.1 of FYR Report for additional information.

4. **Any land use change?** ☐ Yes ■ No ☐ NA
Remarks: See Section 4.3.1 of FYR Report for additional information. Remains for industrial/commercial land use.

C. Land Use Controls (LUCs)

1. **Implementation and enforcement**
Site conditions imply properly implemented ■ Yes ☐ No ☐ NA
Site conditions imply fully enforced ■ Yes ☐ No ☐ NA

Type of monitoring (e.g., self-reporting, drive by) Drive-by, site walk
Frequency Annual
Responsible party NAVFAC Northwest
Contact Carlotta Cellucci | Remedial Project Manager | (360) 396-1518
Name | *Title* | *Phone no.*

Reporting is up-to-date ■ Yes ☐ No ☐ NA
Specific requirements in decision documents have been met ■ Yes ☐ No ☐ NA
Violations have been reported ☐ Yes ☐ No ■ NA
Other problems or suggestions: See Section 4.3.1 of FYR Report, potential maintenance/repairs to the landfill cover at OU 1. ☐ Report attached

2. **Adequacy** ■ Adequate ☐ Inadequate
Remarks: Based on annual inspections and FYR site inspection, LUCs are adequete, being properly implemented and maintained at OU 1 and OU 2.

VI. REMEDY COMPONENTS

A. Paved Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ Settlement not evident
Areal extent ~10 x ~10 ft Depth ~1 inch
Remarks: Several ponding/settlement areas observed north of South Plantation or southern portion of Central Landfill, see Appendix J - Photographic Log.

2. **Cracks** ☐ Location shown on site map ☐ Cracking not evident
Lengths 200+ feet each Widths <1 inch Depths NM
Remarks: Several long cracks transversing east-west through the asphalt pavement in the Central Landfill, see Appendix J - Photographic Log.

3. **Erosion** ☐ Location shown on site map ■ Erosion not evident
Areal extent ______ Depth ______
Remarks: ______

4. **Holes** ☐ Location shown on site map ■ Holes not evident
Areal extent ______ Depth ______
Remarks: ______

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

6. **Alternative Cover (armored rock, concrete, etc.)** ■ NA
Remarks: ______

7. **Bulges** ☐ Location shown on site map ☐ Bulges not evident
Areal extent ~10 x ~20 feet Height ~6 inches
Remarks: Tree roots causing bulges of asphalt pavement outside southeast corner of North Plantation, see Appendix J - Photographic Log.

8. **Wet Areas/Water Damage** ☐ Wet areas/water damage not evident
- ☐ Wet areas ☐ Location shown on site map Areal extent
- ■ Ponding ☐ Location shown on site map Areal extent Several areas ~10 x ~10 ft each
- ☐ Seeps ☐ Location shown on site map Areal extent
- ☐ Soft subgrade ☐ Location shown on site map Areal extent

Remarks: Several ponding/settlement areas observed north of South Plantation or southern portion of Central Landfill, see Appendix J - Photographic Log.

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

10. **Monitoring Wells** (within surface area of landfill)
Remarks: Based on 2018 LTM Report, monitoring wells MW1-14 and MW1-41 need their locks replaced.
- ■ Functioning
- ■ Routinely sampled
- ☐ Needs Maintenance
- ■ Good condition
- ☐ Properly secured/locked
- ☐ Evidence of leakage at penetration

B. Surface Water Structures at Paved Landfill

1. **Siltation** ☐ Location shown on site map ■ No evidence of siltation
Areal extent Depth
Remarks:

2. **Vegetative Growth** ☐ Location shown on site map ■ Vegetation does not impede flow
Areal extent Type Brush and Alder Trees
Remarks: Several brush and Alder tree penetrations through asphalt pavement along foundations of former buildings in southern portion of Central Landfill, see Appendix J - Photographic Log.

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

4. **Discharge Structure** ■ Functioning ☐ NA
Remarks:

C. Phytoremediation

1. **Condition of Trees** ☐ Excellent health ☐ Some apparent health stress ■ Severe stress observed

Area of most stress: Both the North and South Plantations are exhibiting stress; however, the North Plantation is exhibiting more stress.

Remarks: Leaf curl and burn observed and low leaf density, see Appendix J - Photographic Log.

2. **Performance Monitoring**

Type of monitoring Groundwater elevation measurements and monitoring.

Frequency Groundwater elevation measurements collected every two years; groundwater samples collected concurrently with LTM Program.

Remarks: Various groundwater monitoring wells sampled in 2015, 2016, 2017, 2018, and 2019 (see Appendix C).

3. **Effectiveness**

☐ Data indicate effective uptake and metabolism of COCs
☐ Data indicate not effective
■ Data inconclusive

Remarks: Chlorinated VOC concentrations not decreasing at appreciable rate, but phytoremediation may be controlling contaminant migration. Several investigations have been conducted during this FYR period to better understand site conditions, the CSM - see Sections 4.0, 5.0, and 6.0 of FYR Report.

D. Groundwater, Sediment, and Shellfish Monitoring

1. **Monitoring Wells**

Remarks: Monitoring wells at OU 1 and OU 2 (both Area 2 and Area 8) are sampled regularly, as part of their respective LTM Programs. LTM Program at OU 1 was suspended in 2018, conducting re-characterization activities.

■ Functioning
■ Routinely sampled
☐ Needs Maintenance
■ Good condition
☐ Properly secured/locked
☐ All required wells located

2. **Monitoring**

Types of monitoring being conducted: Groundwater, surface water, seep water, tissue, and sediment at OU 1; groundwater at OU 2 Area 2; and groundwater, seep water, surface water, and sediment at OU 2 Area 8.

Frequency: LTM is conducted on an annual basis or less frequently, depending on media, location, and/or analyte.

Remarks: LTM Program, including media, locations, analytes, and/or frequency have varied during this FYR period.

3. **Data Trends**

Describe results and trends: See Section 4.0 of FYR Report.

E. Other Remedy Components

1. **Soil and Sediment Excavations** ■ Completed ☐ Not Completed

Remarks: OU 1 - Sediment removal; OU 2 Area 8 - Soil excavation.

2. **Contingent Remedial Action Plan** ■ Completed ☐ Not Completed

Remarks: For OU 1, dated February 29, 2012.

3. **Tide Gate Upgrade** ■ Completed ☐ Not Completed

Remarks: Conducted as part of OU 1 remedy.

VII. OVERALL OBSERVATIONS

A. Implementation of the Remedy

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

See Section 4.0 (Data Review), 5.0 (Technical Assessment), and 6.0 (Issues and Recommendations) of FYR Report.

B. Adequacy of O&M

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

See Section 4.0 (Data Review), 5.0 (Technical Assessment), and 6.0 (Issues and Recommendations) of FYR Report.

C. Early Indicators of Potential Remedy Problems

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

See Section 4.0 (Data Review), 5.0 (Technical Assessment), and 6.0 (Issues and Recommendations) of FYR Report.

D. Opportunities for Optimization

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

See Section 4.0 (Data Review), 5.0 (Technical Assessment), and 6.0 (Issues and Recommendations) of FYR Report.

APPENDIX J
SITE INSPECTION PHOTOGRAPHIC LOG

File Name: NBK_K_09-19-19_68.jpg **Date Taken:** September 19, 2019	**Photo 1 - Description:** OU 1, View of tide gate and tide flats from SE towards NW.

File Name: NBK_K_09-19-19_81.jpg **Date Taken:** September 19, 2019	**Photo 2 - Description:** OU 1, View of North Plantation in foreground and South Plantation in distant background.

File Name: NBK_K_09-19-19_78.jpg **Date Taken:** September 19, 2019	**Photo 3 - Description:** OU 1, North Plantation view from N to S.

File Name: NBK_K_09-19-19_57.jpg **Date Taken:** September 19, 2019	**Photo 4 - Description:** OU 1, Leaf curl and burn on trees in South Plantation.

File Name: NBK_K_09-19-19_32.jpg **Date Taken:** September 19, 2019	**Photo 5 - Description:** OU 1, Cracks in asphalt pavement in Central Landfill, view from W to E (1 of 2).

File Name: NBK_K_09-19-19_46.jpg **Date Taken:** September 19, 2019	**Photo 6 - Description:** OU 1, Cracks in asphalt pavement in Central Landfill, view from W to E (2 of 2).

File Name: NBK_K_09-19-19_29.jpg **Date Taken:** September 19, 2019	**Photo 7 - Description:** OU 1, Bulging and cracking of asphalt pavement due to tree roots, outside southeast corner of North Plantation.

File Name: NBK_K_09-19-19_61.jpg **Date Taken:** September 19, 2019	**Photo 8 - Description:** OU 1, Water ponding in southern portion of Central Landfill (1 of 2).

File Name: NBK_K_09-19-19_33.jpg **Date Taken:** September 19, 2019	**Photo 9 - Description:** OU 1, Water ponding in southern portion of Central Landfill (2 of 2).

File Name: NBK_K_09-19-19_43 (1).jpg **Date Taken:** September 19, 2019	**Photo 10 - Description:** OU 1, Water ponding and significant vegetative growth through the asphalt pavement in Central Landfill.

File Name: NBK_K_09-19-19_35.jpg **Date Taken:** September 19, 2019	**Photo 11 - Description:** OU 1, Evidence of tree growth through the asphalt pavement cover of Central Landfill.

File Name: NBK_K_09-19-19_70.jpg **Date Taken:** September 19, 2019	**Photo 12 - Description:** OU 1, Berm/hill at north end of site boundary, in vicinity of elevated PCB concentrations.

File Name: NBK_K_09-19-19_43 (2).jpg **Date Taken:** September 19, 2019	**Photo 13 - Description:** OU 1, View of marsh pond from NNW to SSE.

File Name: NBK_K_09-19-19_14.jpg **Date Taken:** September 19, 2019	**Photo 14 - Description:** OU 2 Area 2, Van Meter Road area, view towards wetlands.

File Name: NBK_K_09-19-19_18.jpg **Date Taken:** September 19, 2019	**Photo 15 - Description:** OU 2 Area 2, Monitoring well 2MW-6, demonstrating elevated vinyl chloride concentrations.

File Name: NBK_K_09-19-19_19.jpg **Date Taken:** September 19, 2019	**Photo 16 - Description:** OU 2 Area 2, Monitoring well 2MW-1 located in SW corner of Former Building 957 Drum Storage Area.

File Name: NBK_K_09-19-19_36.jpg **Date Taken:** September 19, 2019	**Photo 17 - Description:** OU 2 Area 2, Monitoring well MW2-8 located in SE corner of Former Building 957 Drum Storage Area.

File Name: NBK_K_09-19-19_26.jpg **Date Taken:** September 19, 2019	**Photo 18 - Description:** OU 2 Area 2, Monitoring well MW2-8, view towards SE corner of Former Building 957 Drum Storage Area.

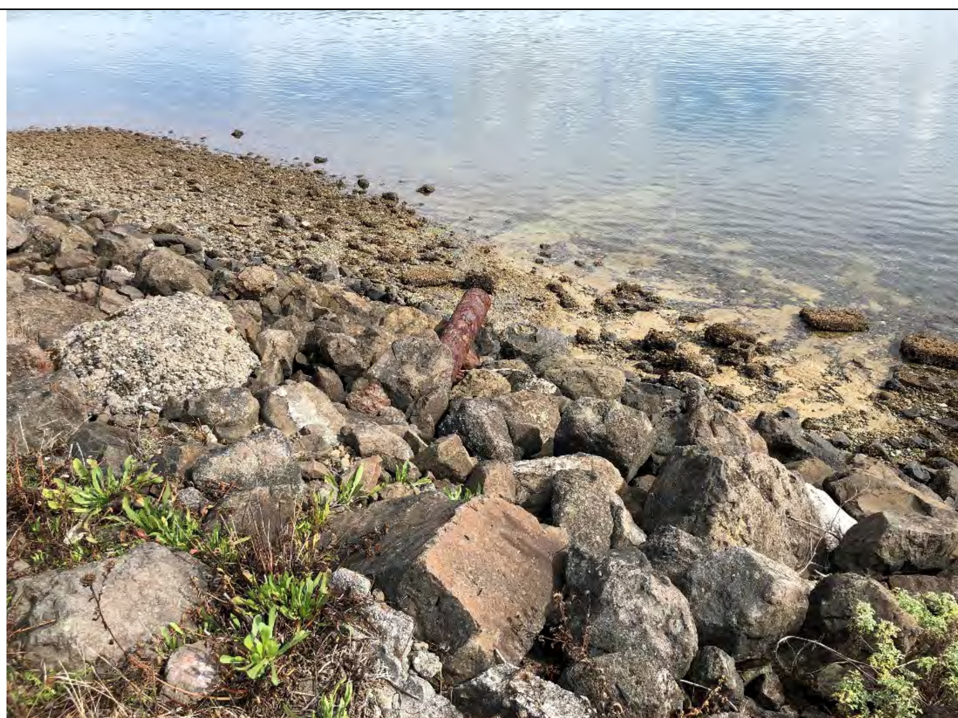
File Name: NBK_K_09-19-19_24.jpg **Date Taken:** September 19, 2019	**Photo 19 - Description:** OU 2 Area 8, View E to W south of Building 98 – pavement intact.

File Name: NBK_K_09-19-19_10.jpg **Date Taken:** September 19, 2019	**Photo 20 - Description:** OU 2 Area 8, Monitoring well MW8-11 and location of Former Building 72 – pavement intact.

File Name: NBK_K_09-19-19_23.jpg **Date Taken:** September 19, 2019	**Photo 21 - Description:** OU 2 Area 8, View of H Street from NNE to SSW, along with evidence of recent utility trench.

File Name: NBK_K_09-19-19_11.jpg **Date Taken:** September 19, 2019	**Photo 22 - Description:** OU 2 Area 8, Recent utility trench box in H Street.

File Name: NBK_K_09-19-19_05.jpg **Date Taken:** September 19, 2019	**Photo 23 - Description:** OU 2 Area 8, View along Groner Street from S to N, along with evidence of recent utility trench.



File Name: NBK_K_09-19-19_12.jpg **Date Taken:** September 19, 2019	**Photo 24 - Description:** OU 2 Area 8, Outfall 03-706 along SE boundary of site.

File Name: NBK_K_09-19-19_03.jpg **Date Taken:** September 19, 2019	**Photo 25 - Description:** OU 2 Area 8, Intertidal zone along SE boundary of site.

File Name: NBK_K_09-19-19_06.jpg **Date Taken:** September 19, 2019	**Photo 26 - Description:** OU 2 Area 8, Offshore view of site from WNW to ESE.

APPENDIX K
RESPONSES TO COMMENTS ON DRAFT DOCUMENT

EPA Review Comments

Date of Review:	**9/14/2020**		Page 1 of	
Project Title: **Draft Fifth Five Year Review, NBK Keyport**		Reviewer:	**Harry Craig, Cal Baier-Anderson**	
		Code:	**U.S. EPA**	
Project Number:		Phone:		

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION* *(Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
1	General	EPA is focusing the Keyport Five Year Review comments on the overall conclusions and protectiveness determinations for the relevant Operable Units, and consistency with applicable guidance on Five Year Reviews rather than detailed editorial comments. Some specific recommendations based on best operating practices for FYRs related to emerging contaminants are listed below in the Specific Comments.	Noted. The Navy is already aware of the best practice recommendations provided by EPA in the original comments file.	N/A
2	General	OU-1: Based on the monitoring data and additional site characterization data conducted between the 2015 and 2020 FYRs, EPA has concluded that the combined phytoremediation and intrinsic bioremediation technologies for OU-1 are not sufficiently effective to ensure that the groundwater at the point of compliance at the edge of the waste management area (landfill) or in surface water consistently meets the OU-1 ROD Remediation Goals (RGs) and there is little evidence that this condition would change in the near future. Significant additional sources of CVOCs were identified in the Central Landfill and the Southern Landfill groundwater, which would be expected to remain in groundwater above the ROD RGs for an extended period of time. In addition, emerging contaminants such as 1,4-dixoane and PFAS have been identified in groundwater, but the full extent of contamination for the surface water/sediment/marine tissue exposure pathway has not been determined, nor has the risks for this new exposure pathway been identified. For these reasons, EPA does not concur with the Navy's proposed Protective Determination of "Short Term Protective" for OU-1 given the OU-1 ROD exceedances for CVOCs in groundwater and surface water, and that full extent of contamination and relevant exposure pathways for emerging contaminants (1,4-dioxane and PFAS) have not been completed. Based on the 2012 EPA FYR Guidance, EPA believes a "Protectiveness Deferred" determination would be more appropriate for OU-1.	The Navy concurs with EPA's statements regarding cVOCs concentration and extent revealed by the additional site characterization data collected during this FYR period. A risk assessment is underway, in collaboration with the Project Team, to determine whether these new data indicate a change in the risk determinations made in the ROD. Unless and until an unacceptable risk is demonstrated, the remedy established in the ROD is considered to be protective, which is why the Navy has selected "short-term protective." Selecting "protectiveness deferred" would only have the effect of putting an unattainable 1-year deadline on the on-going investigation and risk assessment work and delaying project work while a FYR addendum is developed and produced. Selecting "protectiveness deferred" also gives the impression to the public that this FYR has identified previously unknown conditions impacting protectiveness that now must be quickly investigated and addressed. However, the risk assessments will identify conditions impacting protectiveness, if present, investigations are being conducted under a comprehensive and collaborative process with the Project Team, and the path forward is clearly established. The presence or absence of a new~~, unregulated~~ contaminant, such as PFAS, does not impact the protectiveness of the remedy selected in the ROD for established COCs. The CERCLA process now underway for PFAS will result in a determination of	No

EPA Review Comments

Date of Review:	9/14/2020			Page 2 of	
Project Title: **Draft Fifth Five Year Review, NBK Keyport**			Reviewer:	**Harry Craig, Cal Baier-Anderson**	
			Code:	**U.S. EPA**	
Project Number:			Phone:		

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION* *(Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
			acceptable or unacceptable risks for PFAS, and the Navy will take any appropriate remedial actions per a future ROD. Also, additional investigations are planned to determine if new pathways/receptors exist at the site; however, no new pathways/receptors have been ~~confirmed at this time~~identified. Therefore at this time there remains no known on-going exposure, so no identified unacceptable risks are known to be currently present at the site Therefore, the Navy respectfully declines to change the protectiveness determination and stands by the determination of "short term protective" for OU 1.	
3	General	OU 2, Area 8 – Based on the monitoring data and additional site characterization conducted between the 2015 and 2020 FYRs, the ecological risk assessment conducted for OU2, Area 8 shows elevated ecological risk in the marine environment due to groundwater discharge of metals. This risk necessitates the need for additional groundwater source controls actions to mitigate groundwater discharges into surface water and sediments. A RI or Feasibility Study of groundwater remediation options has not been initiated, selected, or implemented. In addition, PFAS has been detected in groundwater, but the full extent of contamination for the surface water/sediment/marine tissue exposure pathway has not been determined, nor has the risks for this new exposure pathway been determined. For these reasons, EPA does not concur with the Navy's proposed Protectiveness Determination of "Will Be Protective" for OU-2, Area 8, as no contingency groundwater remedy has been selected or implemented and that the full extent of contamination and relevant exposure pathways for emerging contaminants (PFAS) has not been completed. Based on the 2012 EPA FYR Guidance, EPA believes a "Not Protective" determination would be more appropriate for OU-2, Area 8.	Because the risk assessment shows unacceptable risk at OU 2 Area 8, ~~which kicks in~~triggering groundwater controls under the ROD, and the contingent groundwater control remedy ~~for that~~ has not been selected and is not in progress, the remedy at the site is currently not protective. The ROD includes five remedial options for the contingent remedy, but none are feasible at this site, so the Navy is currently evaluating additional remedial options. The protectiveness statement for OU 2, Area 8 will be changed to "Not Protective."~~The risk and protectiveness implications of the data collected between 2015 and 2020 are discussed and evaluated in Section 5.3 of the FYR and the elevated ecological risk is acknowledged. As documented in Table 2-1 of the FYR, the risk assessment completed during this FYR period is a component of the selected remedy under the OU 2 ROD, as is implementation of contingent remedial actions based on the conclusions of the risk assessment. The supplemental RI now being undertaken by the Navy to select the contingent remedy is therefore part of the on-going effort to fully~~	Yes

EPA Review Comments

Date of Review:	9/14/2020			Page 3 of	
Project Title: **Draft Fifth Five Year Review, NBK Keyport**			Reviewer:	**Harry Craig, Cal Baier-Anderson**	
			Code:	**U.S. EPA**	
Project Number:			Phone:		

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION* *(Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
			~~implement the original remedy in the OU 2 ROD. When a remedy is in progress and the final remedy is expected to address the RAOs, the FYR concludes that the remedy "will be protective" when the remedy is fully implemented.~~ ~~As indicated above, the presence or absence of a new, unregulated contaminant, such as PFAS, does not impact the protectiveness of the remedy selected in the ROD for established COCs. The CERCLA supplemental RI process now underway will include characterization of the magnitude and extent of PFAS, and the human health and ecological risk assessment addendum planned for 2022 will determine if unacceptable risks from PFAS are present at the site. If an unacceptable risk is identified through the on-going CERCLA process, the Navy will select a remedy in collaboration with the Project Team that, by definition, "will be protective" once implemented.~~ ~~Therefore, the Navy respectfully declines to change the protectiveness determination and stands by the determination of "will be protective" for OU 2 Area 8.~~	

EPA Review Comments

Date of Review:	9/14/2020			Page 4 of	
Project Title: **Draft Fifth Five Year Review, NBK Keyport**			Reviewer:	**Harry Craig, Cal Baier-Anderson**	
			Code:	**U.S. EPA**	
Project Number:			Phone:		

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION* *(Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
Specific Comments				
1		While the report references PFOA and PFOS, which have a health advisory for drinking water, it does not mention PFBS, which is included in the EPA RSL table. Please include PFBS in all PFAS discussions that mention specific PFAS. Please also confirm that PFBS was not found above screening levels.	~~We will add~~ PFBS will be added to the discussion in Sections 4.2.3, 5.1, ~~and~~ 5.3, and 5.4.2.	Yes
2		It would be helpful to include a map of the location of PFAS sampling, along with a brief rationale for the location of sampling to date. This can be used to support the assertion that PFAS contamination does not affect current protectiveness.	PFAS sampling results for OU 1 are included in Table D-28. OU 1 wells where PFAS samples were collected will be identified on Figures 4-5 and 4-8. A brief discussion of the rationale for the PFAS sampling to date will be added to page 5-3, lines 91-95. PFAS sampling results for OU 2 Area 8 are included in Table G-5. OU 2 Area 8 wells where PFAS samples were collected will be identified on Figure 4-17. A brief discussion of the rationale for the PFAS sampling to date will be added to page 5-5, lines 218-222.	Yes
3		Please include in the text references to the PFAS analytical reports that are the source of data summaries.	Citations of the report containing the OU 1 PFAS data will be added to page 4-28, line 313. Citations of the reports containing the OU 2 Area 8 PFAS data will be added to page 4-48, line 29.	Yes
4		Please include need to complete PFAS PA/SI be included in Issues and Recommendations, with target completion date.	A Sitewide finding and recommendation will be added to Table 6-2 as follows: Finding: PFAS compounds have been detected in groundwater samples from existing monitoring wells at OU 1 and OU 2. Recommendation: Include PFAS in the supplemental remedial investigations currently underway at OU 1 and OU 2 Area 8. The timeline for the supplemental RIs is included on Figure 7-1.	Yes

Ecology Review Comments

Date of Review:	**9/11/2020**			Page 5 of	
Project Title: **Draft Fifth Five Year Review, NBK Keyport**			Reviewer:	**Mahbub Alam, John Evered, Bonnie Brooks**	
			Code:	**Washington State Department of Ecology**	
Project Number:			Phone:		

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION (Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
General Comments				
1	Protectiveness determination of OU 2 Area 8	Ecology does not agree with the Navy on the protectiveness determination of OU 2 Area 8. The Navy's protectiveness determination "Will Be Protective" is not supported by the EPA guidance (EPA, 2012). "Will Be Protective" determination may be appropriate for remedies where construction activities are ongoing and human and ecological exposures are under control and no unacceptable risks are occurring. In addition, the remedy under construction is anticipated to be protective upon completion (See page 3 of the 2012 EPA guidance memo). For OU 2 Area 8, the Navy concluded – "acute and chronic exposure to accumulated contaminants in sediment pose a current potential hazard to benthic organisms based on the bioassay results/endpoints." [page 5-5]; "Therefore, the ERA concluded that the existing remedy is not protective of ecological receptors."[page 3-8], and it affects current protectiveness [page 6-2]. As such, the Navy identified in the protectiveness statement the need for a supplemental RI and focused FS to address the unacceptable risk to ecological receptors [page 7-1]. Remedial action, which would make the case for "Will Be Protective" comes after selection of remedy (typically memorialized in a ROD amendment). Since the RA is yet to be identified, let alone its implementation, it is premature to state protectiveness determination as "Will Be Protective" at this stage of the process.	Because the risk assessment shows unacceptable risk at OU 2 Area 8, triggering groundwater controls under the ROD, and the contingent groundwater control remedy has not been selected and is not in progress, the remedy at the site is currently not protective. The ROD includes five remedial options for the contingent remedy, but none are feasible at this site, so the Navy is currently evaluating additional remedial options. The protectiveness statement for OU 2, Area 8 will be changed to "Not Protective."~~The EPA guidance from 2012 is misleading. The finding of "will be protective" is typically used when remedy implementation is in progress at the time of a FYR and site conditions have not changed since the time of remedy selection. In these cases, the remedy is expected to be protective once fully implemented. EPA's 2001 guidance, Exhibit 4-5 is slightly more clear in this regard. At any CERCLA site, between the time that a remedy is selected and fully implemented, an unacceptable risk exists (without unacceptable risk, there would be no need for a remedy). Although it is possible to control human exposures during this timeframe through institutional or engineering controls, the ecological risks remain until the remedy can be fully implemented. In these cases, the remedy "will be protective" once fully implemented but is not currently protective during this timeframe because an unacceptable risk exists.~~ ~~As documented in Table 2-1 of the FYR, the risk assessment completed during this FYR period is a component of the selected remedy under the OU 2 ROD, as is implementation of contingent remedial actions based on the conclusions of the risk assessment. The supplemental RI now being undertaken by the Navy in support of contingent remedy selection is therefore part of the on-going effort to fully implement the original remedy in the OU 2 ROD. When a remedy is in progress and the final remedy is expected to address the RAOs, the FYR concludes that the remedy~~	Yes

Ecology Review Comments

Date of Review:	**9/11/2020**		Page 6 of
Project Title: **Draft Fifth Five Year Review, NBK Keyport**	Reviewer:	**Mahbub Alam, John Evered, Bonnie Brooks**	
	Code:	**Washington State Department of Ecology**	
Project Number:	Phone:		

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION (Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
2			~~"will be protective" when the remedy is fully implemented.~~ ~~Given that the OU 2 ROD remains the subject of the FYR and the site is still operating under the specifications in the ROD, the Navy respectfully declines to change the protectiveness determination and stands by the determination of "will be protective" for OU 2 Area 8.~~	
2	Determination of Protectiveness of OU 2 Area 8 as "Not Protective"	Ecology believes the protectiveness determination should be "Not Protective". Per the EPA memo (page 5), this OU falls into these example scenarios, which make the case for "Not Protective" determination. • *Migration of contaminants is uncontrolled and poses an unacceptable risk to human health and the environment,* and • *Potential or actual exposure is clearly present or there is evidence of exposure* The results of the recently completed risk assessment for OU Area 8 provides evidence to the above scenarios. See the references to FYR text in the previous general comment #1. Therefore, Ecology is asking the Navy to reconsider its protectiveness determination in the light of the EPA guidance.	Please see the response to General Comment 1. ~~The Navy respectfully declines to change the protectiveness determination and stands by the determination of "will be protective" for OU 2 Area 8.~~	Yes
3	Protectiveness determination of OU 1	Ecology does not agree with the Navy on the protectiveness determination of OU 1. The Navy's protectiveness determination "Short-Term Protective" is not supported by the EPA guidance (EPA, 2012). In order to be "Short-Term Protective", per the memo, answers to Questions A, B, and C provide sufficient data and documentation to conclude that the "…..the human and ecological exposures are currently under control and no unacceptable risks are occurring."[page 3 of the EPA memo]. Does the Navy have sufficient data to show the following?	The Navy concurs that the additional site characterization data collected during this FYR period warrant a re-evaluation of sites risks. A risk assessment is underway, in collaboration with the Project Team, to determine whether these new data indicate a change in the risk determinations made in the ROD. Unless and until an unacceptable risk is demonstrated, the remedy established in the ROD is considered to be protective, which is why the Navy has selected "short-term protective." The Navy respectfully declines to change the protectiveness	No

Ecology Review Comments

Date of Review:	9/11/2020			Page 7 of	
Project Title: **Draft Fifth Five Year Review, NBK Keyport**			Reviewer:	**Mahbub Alam, John Evered, Bonnie Brooks**	
			Code:	**Washington State Department of Ecology**	
Project Number:			Phone:		

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION (Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
		1. There are no unacceptable risk to ecological receptors specifically burrowing animal in the landfill area due to high levels of PCBs and TPH in the shallow soil [page 4-29]. There are no unacceptable risks to aquatic organisms in the marsh pond and specifically in the creek preceding the marsh pond due to the contaminant transport through groundwater and seeps. The Navy stated in Page 5-2, "*Exposure point cVOC concentrations for ecological receptors in surface water in the wetland south of the south plantation are orders of magnitude higher than known at the time of the ROD, so this exposure assumption is no longer valid*". 3. There are no unacceptable risk to Tribal (Suquamish) fishery due to consumption of seafood. The Navy stated in Page 5-2, "*PCB sediment data indicate the potential for adverse risk/effects to human health and the benthic community*". Clearly, the Navy doesn't have sufficient data to conclude that the human and ecological exposures are currently under control and no unacceptable risks are occurring. As shown above, the limited data suggest the opposite; there may be adverse effects to ecological and human receptor. Therefore, Ecology does not agree on "Short-Term Protective" determination.	determination and stands by the determination of "short term protective" for OU 1.	
4	Ecology's Determination of Protectiveness of OU 1 as "Protectiveness Deferred"	Per the EPA guidance memo (page 4), it seems most appropriate for the OU 1 site protectiveness determination as "Protectiveness Deferred". The following example scenarios make the case for this determination. 1. *A new exposure pathway has been identified and*	Selecting "protectiveness deferred" would only have the effect of putting an unachievable 1-year deadline on the on-going investigation and risk assessment work and delaying project work while a FYR addendum is developed and produced. Selecting "protectiveness deferred" also gives the impression to the public that this FYR has identified previously unknown conditions	No

Ecology Review Comments

Date of Review:	9/11/2020			Page 8 of	
Project Title: **Draft Fifth Five Year Review, NBK Keyport**			Reviewer:	**Mahbub Alam, John Evered, Bonnie Brooks**	
			Code:	**Washington State Department of Ecology**	
Project Number:			Phone:		

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION (Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
		additional data are required to determine if unacceptable risk is occurring – Exposure to ecological receptors due to high levels of PCBs and TPH in the shallow soil [page 4-29] and there may be other contaminants such as metals, PAH and Dioxins in the area. 2. *An emerging contaminant is present and the current risk has not been evaluated* – Two emerging contaminants (1,4- Dioxane and PFAS) have been detected at the site. Nature and extent of contamination and associated risk (including cumulative) have not been evaluated. 3. *An ecological risk assessment has never been adequately addressed at the site* – The Navy has started the process of updating/encompassing both ecological and human health risk assessment at OU1. 4. *The toxicity value has changed and it is unclear whether the current remedy at a site is protective or whether the selected remedy can achieve the new risk-based cleanup level* – Table 5-2 of the document shows new lower RGs, if established today, for most COCs at OU1. In addition, the Navy answered "no" on Question B (page 5-2). In the light of these instances and other examples/issues that are present at the site (e.g., preliminary findings from the 2019 source investigations); Ecology believes the protectiveness determination for OU 1 should be as "Protectiveness Deferred".	impacting protectiveness that now must be quickly investigated and addressed. In addition: 1. Currently, no new exposure pathways or receptors have been confirmed at OU 1. Ongoing investigations will determine if new pathways may exist and a risk assessment is underway, in collaboration with the Project Team, to determine whether the new data collected to date, in addition to the results of planned work, indicate a change in the risk determinations made in the ROD. Unless and until an unacceptable risk is demonstrated, the remedy established in the ROD is considered to be protective, which is why the Navy has selected "short-term protective." However, the ongoing risk assessments will identify conditions impacting protectiveness, if present, investigations are being conducted under a comprehensive and collaborative process with the Project Team, and the path forward is clearly established. 2. The presence or absence of a new, ~~unregulated~~ contaminant, such as PFAS, and emerging contaminants, such as 1,4-dioxane, do not impact the protectiveness of the remedy selected in the ROD for established COCs. The CERCLA process now underway will include both PFAS and 1,4-dioxane, will result in a determination of acceptable or unacceptable risks for the site, and the Navy will take any appropriate remedial actions per a future ROD. 3. As indicated, the Navy is in the process of conducting a human health and ecological risk assessment for the site under a comprehensive and collaborative process with the Project Team. 4. Additional investigations are planned to determine if new pathways/receptors exist at the site and the ongoing risk assessment will determine if unacceptable risk exists at	

Ecology Review Comments

Date of Review:	**9/11/2020**			Page 9 of	
Project Title: **Draft Fifth Five Year Review, NBK Keyport**			Reviewer:	**Mahbub Alam, John Evered, Bonnie Brooks**	
			Code:	**Washington State Department of Ecology**	
Project Number:			Phone:		

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION (Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
			the site, based on current toxicological information. However, no new pathways/receptors have been confirmed to date. So, although toxicity values have changed, the site continues to be managed under the existing ROD, and at this time there are no known on-going exposures that were not present at the time the ROD was signed. So, no identified unacceptable risks are known to be currently present at the site. Therefore, the Navy respectfully declines to change the protectiveness determination and stands by the determination of "short term protective" for OU 1.	

Ecology Review Comments

Date of Review:	9/11/2020			Page 10 of	
Project Title: **Draft Fifth Five Year Review, NBK Keyport**			Reviewer:	**Mahbub Alam, John Evered, Bonnie Brooks**	
			Code:	**Washington State Department of Ecology**	
Project Number:			Phone:		

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION (Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
5	Sitewide Protectiveness Statement	The sitewide protectiveness determination as "Will Be Protective" does not seem correct in the light of EPA guidance. As stated before, "Will Be Protective" is referred during "remedy under construction" (Page 3 of the 2012 EPA guidance memo). Since we don't have a selected remedy under new circumstances and there is ongoing unacceptable risk as OU 2 Area 8 and remedy failure at OU 1, Ecology believes the best determination should be "Not Protective".	The sitewide protectiveness determination will be changed to "Not Protective.".~~Please see the response to General Comment 1. The Navy respectfully declines to change the protectiveness determination and stands by the determination of "will be protective" for the site.~~	Yes
6	Oversight Party	Review the oversight party for Keyport. Ecology is the lead regulatory agency for Keyport per the 2000 EPA-Ecology MOA. Ecology was listed as the oversight party in the last fourth FYR (page vi).	The oversight party will be changed to Ecology.	Yes
7	Statement about "Lack of Ecology Comments"	In general, if there is no comment from Ecology, there may be a number of reasons why Ecology did not comment. It may be Ecology did not find anything to comment. It can also mean something was not reviewed. However, it does not indicate approval of an issue. The language in page 3-4, item #2 "The lack of Ecology comments regarding the trend analyses in these reports indicates that the revised approach meets Ecology's guidance and expectations." is not acceptable and needs to change. If there is a question that needs Ecology's input, The Navy is requested to ask Ecology for specific input and not assume Ecology's position on the issue. On this particular "trend analysis" issue, see Ecology's response below in "Specific Comments" section (comment #7).	Understood, thank you. The language in page 3-4, item #2 will be removed.	Yes

Ecology Review Comments

Date of Review:	**9/11/2020**			Page 11 of	
Project Title: **Draft Fifth Five Year Review, NBK Keyport**			Reviewer:	**Mahbub Alam, John Evered, Bonnie Brooks**	
			Code:	**Washington State Department of Ecology**	
Project Number:			Phone:		

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION (Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
Specific Comments				
1	Page 1-2, Line 57-60, Figure 1-2 Section 2.1.1 Line 48	Figure 1-2 also shows IC only sites not subject to FYR. It is not clear why IC only sites would not be subject to FYR. If there is LUC for site 23, it should be subject to FYR process.	In accordance with CERCLA § 121(c), the NCP, and Navy and EPA guidance, FYRs are performed for sites covered under CERCLA RODs. The IC-only sites at NBK Keyport are not included in either CERCLA ROD.	Yes
2	Figure 1-6	No activities/events are shown from 2010 to 2020, which is misleading especially a lot of activities happened in the last FYR. The Figure should be updated with major efforts/projects happened during this time.	Figure 1-6 is depicting CERCLA milestone events for the site, not comprehensively documenting all site activities. No changes are proposed.	Yes
3	Page 2-2,	Last bullet states the upgraded asphalt landfill cover will prevent exposure to vapors. Unless there was something other than the asphalt placed there, the asphalt alone would not prevent exposure to vapors, only direct contact via ingestion or dermal contact. Can you please clarify what is meant by this or delete the reference to vapors.	The reference to vapors will be deleted.	Yes
4	Page 2-6, Section 2.1.3 Line 263-265	What is the depth of screen for the PUD well and the Navy supply well #5? What are the decision criteria for the CRA monitoring plan?	The PUD well is screened using a V-slot stainless steel screen from 702 to 741 feet below ground surface (bgs). Navy Well 5 is constructed with three slotted-screen intervals in the depth range 725 feet bgs to 802 feet bgs. The decision criteria in the CRA plan consist of concentration values for specific chemicals in specific wells triggering a tiered series of actions. A reference to the 2003 CRA plan will be added to this portion of the FYR text.	Yes
5	Page 2-12, Section 2.2.2 Lines 456 to 464	Add a figure depicting what wells were included in the tidal lag study USGS conducted and refer to it in the text of this section.	Wells included in the tidal lag study will be identified on existing Figure 2-3, and a callout to that figure will be added to this portion of the text.	Yes
6	Page 3-4 Table 3-2	*"The trend analysis presented in OU 1 LTM reports prepared during this FYR period utilize a value of half of the reporting limit when analytes are not detected. The spring 2016 LTM report cites*	~~This statement is from Section 7.1, the last sentence of the first paragraph, on page 7-1 of the *Final Spring 2016 LTM Report, Operable Unit 1*, dated August 22, 2017. Note that revising this~~	Yes

Ecology Review Comments

Date of Review:	9/11/2020			Page 12 of	
Project Title: **Draft Fifth Five Year Review, NBK Keyport**			Reviewer:	**Mahbub Alam, John Evered, Bonnie Brooks**	
			Code:	**Washington State Department of Ecology**	
Project Number:			Phone:		

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION (Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
		Ecology guidance as the basis for this approach." – This does not seem correct. Cite that section of the report. Artificial substitution is not acceptable as it produces invasive data, results in poor estimates and incorrect statistical tests and may depict a trend that is not present.	~~approach in collaboration with Ecology is included as the first finding for OU 1 in Table 6-2.~~ The Ecology guidance was cited in error in the last sentence of the first paragraph, on page 7-1 of the *Final Spring 2016 LTM Report, Operable Unit 1*, dated August 22, 2017. The statistical approach for depicting contaminant trends in LTM reports still needs to be addressed. Revising this approach in collaboration with Ecology is included as the first finding for OU 1 in Table 6-2 and the FYR will be updated to indicate that this recommendation from the Fourth FYR has not been completed.	
7	Page 3-4 Table 3-2	"*The lack of Ecology comments regarding the trend analyses in these reports indicates that the revised approach meets Ecology's guidance and expectations.*" - This is incorrect. Ecology comments on 2018 LTM report for OU 2 Area 8 asked the Navy to do statistical trend analysis. See appendix F of Final 2018 LTM report. Ecology again commented on 2019 LTM report (Ecology comment email dated 8/18/2020). I was not personally aware of this recommendation in the previous 4th FYR during commenting; otherwise, I would have mentioned this recommendation in the comments.	This sentence will be removed and the following sentence will replace it: "The Navy is currently revising the LTM QAPP in collaboration with the project team. Trend analyses methods will be revised to a method approved by Ecology during this process."	Yes
8	Page 3-6 Table 3-2	Were the PCB data collected in 2019 outside of the review window? If so state here. How does this reconcile with the PCBs sediment sampling results described on page 4-10, that describe an SQS exceedance in the 2019 sampling.	The phrase "outside of the data review window for this FYR" will be added to the last sentence of the Status text for item 6. The 2019 SQS exceedance noted on page 4-10 is from a different station than the exceedance in 2017. As will be discussed in the forthcoming report covering the 2019 additional investigation work, the variability in PCB concentrations in sediment from the same stations at different times continues to point to a strong spatial variability in sediment PCB concentration, confounding efforts to establish meaningful temporal trends or reliable mean exposure point concentrations for use in risk assessment. As discussed in the meeting held on 10/1/2020, the method of sediment sampling for PCBs will be changed to ISM to allow for better, more repeatable sample data.	Yes

Ecology Review Comments

Date of Review:	9/11/2020			Page 13 of	
Project Title: **Draft Fifth Five Year Review, NBK Keyport**			Reviewer:	**Mahbub Alam, John Evered, Bonnie Brooks**	
			Code:	**Washington State Department of Ecology**	
Project Number:			Phone:		

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION (Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
9	Page 3-6 Table 3-2	MA19 could not be found on the figure 2-1. Which Figure shows MA19?	MA19 is shown on Figure 4-10, which is specific to the PCB congener results. The specific station names will be removed from Table 3-2, to reduce confusion. Specific data discussions are provided in Section 4.	Yes
10	Page 3-7 Table 3-2	Remove the word “conservative” from the 2nd paragraph when speaking of VI screening levels.	The Navy’s extensive analysis of building-specific attenuation factors in the Area 8 VI study report provides ample evidence that the default attenuation factors, and therefore the default screening levels, are indeed conservative for this site. The Navy stands by the use of the qualifier “conservative” in this case.	Yes
11	Page 4-6 Figure 4-1	Arrows indicating groundwater flow are difficult to see since they are the same color as groundwater elevation contours. Change them to a contrasting color that is easier to pick out? Also, show flow direction in southern plantation. In addition, clarify in the Figure title that it is shallow groundwater flow. Ecology’s understanding is that the deeper groundwater moves in the northwest direction.	The arrow colors will be changed as suggested, and a flow direction arrow will be added in the South Plantation. The figure title will be changed to “OU 1 Shallow Groundwater Potentiometric Head Contours and Groundwater Flow September 2018.”	Yes
12	Page 4-5 Section 4.2.1 Line 37	FYR text states deeper upper aquifer groundwater flow is to northwest beneath landfill. Earlier text states shallow groundwater at the north end of the landfill is northwest towards tide flats and at south of landfill is to west to southwest towards the marsh pond. Provide another figure that depicts groundwater flow in the deeper aquifer and provide additional clarification in the text.	An arrow depicting deeper groundwater flow to the northwest will be added to Figure 4-1. The following additional explanatory text will be added starting on Line 38, page 4-5. “This hydrogeological model of multiple superimposed groundwater flow components within an aquifer system is consistent with the standard models of flow systems within regional drainage basins (see Figure 6.4, Fetter, 1980). At sites like OU 1 with substantial local relief and high annual precipitation, local groundwater flow systems become superimposed on the regional flow system. Local, near-surface flow systems are driven by recharge at local topographic highs and discharge at topographic lows. At OU 1, the effect of this local flow system is movement of shallow groundwater and contaminants from the landfill footprint into adjacent surface water, with groundwater flow vectors roughly normal to the flowline of Marsh Creek and the ephemeral stream	Yes

Ecology Review Comments

Date of Review:	9/11/2020			Page 14 of	
Project Title: **Draft Fifth Five Year Review, NBK Keyport**			Reviewer:	**Mahbub Alam, John Evered, Bonnie Brooks**	
			Code:	**Washington State Department of Ecology**	
Project Number:			Phone:		

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION (Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
			south of the South Plantation. Because the flowlines of these surface water features vary from east-west to south-north, very localized groundwater flow vectors are observed, ranging from nearly due south in the eastern portion of the South Plantation to due west across much of the Central Landfill. Deeper in the aquifer, below the influence of local topographic relief, the regional flow direction to the northwest dominates, probably enhanced by paleotidal and paleofluvial channeling in the Olympia Formation."	
13	Page 4-7 Lines 63 to 64	Include the proper chemical names for each contaminant. Some are listed with the proper name and the abbreviated name, but some are only listed with the abbreviated name.	This represents the typical editorial practice of defining abbreviations and acronyms upon first use in the text. Abbreviations are used here when the chemical has already been used in the text previously and the abbreviation defined. In cases where this is the first use of the chemical name in text, the full name is used and the abbreviation identified.	Yes

Ecology Review Comments

Date of Review:	**9/11/2020**			Page 15 of	
Project Title: **Draft Fifth Five Year Review, NBK Keyport**			Reviewer:	**Mahbub Alam, John Evered, Bonnie Brooks**	
			Code:	**Washington State Department of Ecology**	
Project Number:			Phone:		

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION (Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
14	Pages 4-7 to4-8 |Section 4.2.1 Figure 4-2	Figure 4-2 contains a lot of information and is difficult to interpret, but does provide valuable information. Create multiple figures for each contaminant/group of contaminants instead of having them all listed on one figure.	This figure is meant to convey the overall data generated through the LTM program during the review period. More recent and comprehensive data collected through the additional investigations performed in 2017 and 2019 are not included, and therefore meaningful interpretations of contaminant extent or trends cannot be derived from this figure. Therefore, the Navy believes this summary depiction of LTM data meets the needs of the FYR report and respectfully declines to prepare additional, more focused depictions of these data.	Yes
15	Page 4-8 Figure 4-2	The Vinyl chloride (detected above RG) in MW1-39 is at least two orders of magnitude higher than MW1-38. Both wells seemed to be located nearby (may be less than 10 feet). It is interesting to note the opposite for 1,4- dioxane where concentration in MW1-38 is higher than MW1-39. What are the screen interval of these wells? Also, note that these wells are outside the base boundary and the Vinyl chloride and 1,4-dioxane are detected above RG in these wells.	This is a well pair with one shallow screen (MW1-39, screened from 27.5 ft bgs to 32.5 feet bgs) and one deep screen (MW1-38, screened from 44 feet bgs to 49 feet bgs). These wells have been the subject of substantial discussion over the years, including detailed assessment by USGS (2002). Standard transport conceptual site models and numeric models do not account for the patterns of contamination in these two wells. The Navy is currently using environmental sequence stratigraphy and plans to use geophysics (to map stratigraphy beneath the tide flats and the temporal variation in the saltwater/freshwater interface) to better understand the transport pathway from the site to these wells.	Yes
16	Page 4-9 Section 4.2.1 Line 123	Clarify what monitoring wells were sampled for 1,4-dioxane by creating individual figures for each contaminant as suggested in an earlier comment and refer to the figure instead of writing them all out in the text. Doing this for all contaminants would make the report more concise and make it easier to interpret the data.	This discussion is specific to the sampling performed under the LTM program, which is why Figure 4-2 is referenced in particular. Wells with results for 1,4-dioxane from the LTM program are shown on Figure 4-2. Wells shown with an "NS" result indicate that these wells were not samples for 1,4-dioxane. The 1,4-dioxane results for samples collected from the additional investigation conducted in 2017 will be added to Figures 4-5 and 4-8. Initial results for 1,4-dioxane sampling in 2019 are contoured on Figure 4-12. The Navy believes that it is more appropriate to include the chemical-specific maps requested, along with appropriate data interpretation, in the upcoming Source Investigation report documenting the results of the 2019 investigation. Therefore, the Navy respectfully declines to	Yes

Ecology Review Comments

Date of Review:	9/11/2020			Page 16 of	
Project Title: **Draft Fifth Five Year Review, NBK Keyport**			Reviewer:	**Mahbub Alam, John Evered, Bonnie Brooks**	
			Code:	**Washington State Department of Ecology**	
Project Number:			Phone:		

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION (Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
			produce additional chemical-specific maps for this FYR.	
17	Page 4-9 Section 4.2.1 Line 131	Clarify what monitoring wells and piezometers were sampled for PCBs (MW1-02, MW1-14, PI-01) by creating individual figures for each contaminant as suggested in an earlier comment and refer to the figure instead of writing them all out in the text. Doing this for all contaminants would make the report more concise and make it easier to interpret the data. For PCBs, include both Aroclor and congener data on the same figure.	PCBs as Aroclors and as summed congeners will be added to Figure 4-2 for the three wells analyzed for PCBs as part of the LTM program.	Yes
18	Pages 4-7 to 4-63 Sections 4.2.1, 4.2.2, 4.2.3	Include the specific table number where the data referred to is located in addition to referring to the appendix C, D, E, F, G and H. It is very difficult to find the specific data. In general, the data tables should be presented in the main text, not just the summary statistics. For PCBs/Dioxins and Furans, the total summation of congeners should be provided in the main text but the individual congener results can be in the appendix.	The specific appendix table number callouts will be added to the text. Unfortunately, placing the data tables from the appendices into the body of the report would decrease readability, due to the number of the tables. Therefore, the Navy respectfully declines to place the data tables into the text.	Yes
19	Page 4-9 Section 4.2.1 Line 140	Make a separate figure that only includes surface water and seep samples. This will make it easier to evaluate the data. Figure 2-1 which includes all of the samples can also be referenced as well.	The Navy will create the requested figure, showing the surface water and seep data from the LTM program during this FYR period.	Yes
20	Page 4-10 Section 4.2.1 Lines 143 to 146	Provide a note that these RGs were set at the time of ROD and are no longer current (refer to Table 5-2 in section 5.4, as appropriate). In addition, there are detections of contaminants in surface water without any RGs. Clarify this in the text. These detections should be considered in the context of potential risk in the ongoing risk assessment.	As a point of clarification, the RGs have not changed, but the underlying ARAR values supporting the RGs selected in the ROD have changed since the time of the ROD. A sentence will be added to state, "Note that the ARAR values upon which these RGs were based have changed since the time of the ROD. See Section 5.4 for additional explanation." The FYR evaluates the ROD and the ROD-selected COCs. However, all detected chemicals at the site will be included in the ongoing risk assessment.	Yes

Ecology Review Comments

Date of Review:	9/11/2020			Page 17 of	
Project Title: **Draft Fifth Five Year Review, NBK Keyport**			Reviewer:	**Mahbub Alam, John Evered, Bonnie Brooks**	
			Code:	**Washington State Department of Ecology**	
Project Number:			Phone:		

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION (Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
21	Page 4-17 Section 4.2.1 Lines 54 to 65	It appears from porewater data contamination extends to the other side of the creek (see stations PW1-3, PW1-4 in Figure 4-6). Is there an explanation regarding this data? Is this discussed later in the report?	In the vicinity of these porewater samples there is no clearly defined flow channel, but rather a low, broad area of saturated wetland sediment. The flow channel shown starting to the west of the area of these sample locations is ephemeral, only flowing with seasonal precipitation. Contaminated groundwater appears to be daylighting in saturated sediment in this area. Additional sample locations from 2019 delimit the lateral extent of this daylighting. The Navy proposes no changes to the FYR based on this comment.	Yes
22	Page 4-23 Section 4.2.1 Lines 169 to 176	PCBs results in sediment were compared to sediment cleanup objectives (ARAR). However, PCB results in groundwater, porewater, and surface water were not compared to RGs or ARARs. Note that all surface water PCB results failed to meet Washington's surface water quality standards for protection of human health (ARAR for the ROD).	The decision rules established for PCBs in the 2017 investigation were focused on establishing current conditions with regard to PCBs in sediment, and the decision rules for the 2019 investigation expanded to include investigating a potential PCB source area. The report covering the 2019 data collection will include a comparison of the PCB results in aqueous media to the ROD RGs and current ARARs, and these data will be included in the ongoing risk assessment. A recommendation will be added to compare future surface water data to the current ARAR for human health exposure pathways (including incidental ingestion and fin-fish and shellfish consumption), given that the concentration can now be achieved by the laboratories using congener analysis.	Yes
23	Page 4-28 Section 4.2.1 Lines 279 to 319	When some details regarding the 2019 sampling event are provided, it would be helpful to have figures with sample locations and data similar to what was suggested in the comment regarding pages 4-7 to 4-8, Section 4.2.1, Figure 4-2. Create multiple figures for each contaminant/group of contaminants instead of having them all listed on one figure. If the data has been validated, they can be presented. Ecology understands these data have not been incorporated into a report yet.	Thank you for these suggestions. The requested figures will be produced during preparation of the data report covering the 2019 data collection event. The validated 2019 data were provided to Ecology on August 13, 2020.	Yes

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION (Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
24	Page 4-29 Section 4.2.1 Lines 347 to 350	Given degradation of Aroclors, it is very difficult to measure or fingerprint PCBs as Aroclor in water samples (e.g., groundwater or surface water) unless the concentration is significantly high. “PCBs as congeners were detected” provide the justification that such analysis is warranted, specifically in the water phase.	Understood.	N/A
25	Page 4-29 Section 4.2.1 Lines 355 to 359	It should be noted that PAL for PCBs in groundwater was based on groundwater RGs, however, if there is a groundwater to surface water pathway, surface water quality must also be protected in addition to sediment. The data so far shows transport of PCBs may be impacting sediment quality above benthic SCO only in certain locations but sediment quality to protect human health is also affected because these sediment results are above Puget sound natural background. In addition, exceedance of surface water quality standards for human health protection (an ARAR of ROD) is more widespread than previously understood. Add surface water PCB data to the analysis and discuss in the CSM for PCBs.	The requested analysis of surface water PCB data will be included in the CSM update being prepared based on the 2019 data and will be included in the risk assessment.	Yes
26	Page 4-33 Section 4.2.1 Lines 469 to 488 and associated table	Create a figure of the wells listed in the table coded to reflect the different categories in the table.	The requested figure will be added. Please see the table at the end of these responses for a cross walk between figure numbers and titles in the Draft and Draft Final versions of the FYR.	Yes
27	Page 4-35 Section 4.2.1 Lines 487 to 489	I think there may be some words missing from this sentence.	This sentence will be revised to read, “Sampling schedules for the six wells where groundwater levels were only minimally influenced by tides need not be constrained by tidal conditions.”	Yes
28	Page 4-35 Section 4.2.1 Lines 495 to 498	Was this also the case for immediately influenced wells such as MW1-38 and MW1-39?	Based on the currently available data, yes. However, this recommendation may change after additional specific conductance data are evaluated. The Navy proposes no change to the FYR based on this comment.	Yes

Ecology Review Comments

Date of Review:	**9/11/2020**			Page 19 of	
Project Title: **Draft Fifth Five Year Review, NBK Keyport**			Reviewer:	**Mahbub Alam, John Evered, Bonnie Brooks**	
			Code:	**Washington State Department of Ecology**	
Project Number:			Phone:		

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION (Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
29	Page 4-35 Section 4.2.2 Line 517-523	Remedial goal for vinyl chloride is 0.5 µg/L in OU 1. In 2012, the RG in OU 2 Area 2 was updated to 0.029 µg/L based on MTCA method B update. What was the process to update the RG in OU 2 Area 2? Why wasn't the RG for vinyl chloride updated for OU 1, which is still based on PQL (current PQL is lower). Note RG for vinyl chloride in surface water has also changed to 0.02 ug/L in freshwater.	Because the RGs can only be changed through an ESD or ROD amendment, the FYRs typically carefully weigh the value of going through that process each time numeric standards in ARARs change, versus tracking the latest ARARs through the FYR and LTM process. FYRs typically recommend executing an ESD or ROD amendment only if a CERCLA milestone is imminent (e.g., deciding to cease monitoring for a COC or remove a LUC). In the case of vinyl chloride, the third FYR recommended using a SIM analysis for this analyte at OU 2 Area 2 because the detected concentrations were dropping below the RG but remained above the current ARAR value. This was to ensure that any decisions (such as cessation of monitoring) were based on data that could be compared to the most recent numeric standard, regardless of the RG. At OU 1, the third FYR made the following observation, "For vinyl chloride, because the majority of the groundwater data still significantly exceeds even the ROD value (Table 6-1), concerns about achieving lower PQLs are premature." Based on this observation, the third FYR did not recommend running SIM analysis to achieve a lower reporting limit for OU 1 samples. ~~The RGs for OU 1 will be reviewed and updated as appropriate following the completion of the risk assessment update and any subsequent ROD amendment.~~ A recommendation will be added to compare vinyl chloride results to current ARARs, including analyzing surface water samples for vinyl chloride using ~~a~~ SIM analysis to achieve a lower reporting limit.	Yes
30	Page 4-41 Section 4.2.3 Page 5-14 Section 5.4.1	The following are data gaps for OU 2 Area 8: The ROD did not establish a RG for TCE degradation product vinyl chloride (VC) and it was not measured in the LTM. Ecology has pointed this out in the past and the Navy had agreed to do sampling for VC. Although this is okay for LTM but it does not establish a RG for the decision documents, such as ROD. Add a recommendation in this FYR to	In Table 6-2, on page 6-4, the first finding for OU 2, Area 8 will be revised to read, "During this FYR period, several COCs (including 1,1-DCE, 1,1,1-TCA, arsenic, lead, mercury, thallium, and zinc) in groundwater, seep water, and surface water samples were consistently, or more frequently than not, detected below their RGs. In addition, no RG was established in the ROD for	Yes

Ecology Review Comments

Date of Review:	9/11/2020			Page 20 of	
Project Title: **Draft Fifth Five Year Review, NBK Keyport**			Reviewer:	**Mahbub Alam, John Evered, Bonnie Brooks**	
			Code:	**Washington State Department of Ecology**	
Project Number:			Phone:		

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION (Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
		characterize VC in the LTM program and establish a RG, as necessary, when the Navy amends the ROD for groundwater control as part of contingent remedial action.	vinyl chloride, which is a breakdown product of the chlorinated solvent COCs present at the site." This change will ensure that vinyl chloride is one of the chemicals that should be considered for addition to the list of COCs as part of the supplemental RI. With regard to surface water, a recommendation will be ~~added~~included to add vinyl chloride to the LTM analyte list and compare results to current ARARs to evaluate the magnitude and extent of this contaminant at the site.	
31	Page 4-42 Section 4.2.3 Table 4-3	Add the RGs to this table along with the basis of the RG.	These additions will be made to the table.	Yes
32	Page 4-45 Section 4.2.3 Table 4-4	Add the RGs to this table along with the basis of the RG.	These additions will be made to the table.	Yes
33	Page 2-11, Line 428-431; Page 4-57 Section 4.2.3 Lines 1 to 2	The SMS does not explicitly require the collection of bioassay samples if health numbers are exceeded, rather allows for the override of samples that exceed benthic criteria, but pass bioassays. Bioassays were requested by Ecology due to the repeated assertion that AVS/SEM is not a good predictor of bioavailability.	The sentence on Page 4-57, lines 1 to 2 will be revised to read, "Ecology's SMS regulation (i.e., an ARAR under the OU 2 ROD) allows the use of bioassay analysis in cases where chemical concentrations in sediment samples exceed the published numeric standards. Samples that pass the bioassay analysis are considered to not pose an unacceptable risk to benthic organisms." A similar change will be made to the equivalent text on page 2-11.	Yes
34	Page 5-1 Section 5.0 Table 5-1 Page 5-3 Section 5.1 Line 87 to 89	OU 1 Question C. Ecology believes the answer to this Question should be "yes" due to detection of PFAS in site groundwater. Even though the limited data show PFOS and PFOA were below EPA human health advisory levels (LHA) for the drinking water pathway, there is significant uncertainty associated with this evaluation. The evaluation lacks the following information: • nature and extent of the contamination • effect on ecological receptors • effect on and seafood consumption pathway • presence of other PFAS compounds • cumulative risks from combined exposure to all PFAS as well as from other COCs	The Navy's position is that the presence or absence of a new~~,~~ ~~unregulated~~ contaminant, such as PFAS, does not impact the protectiveness of the remedy selected in the ROD for established COCs. The CERCLA process now underway will include PFAS and will support the risk assessment addendum planned for 2022, which will result in a determination of acceptable or unacceptable risks for the site. The Navy will then take any appropriate remedial actions per a future negotiated ROD. Additional ~~discussion~~text will be added to the PFAS discussion in Section 5.4.2.4, which supports the response to Question B, regarding what is known and unknown about PFAS nature and extent, migration pathways, exposure, and effects on receptors. The	Yes

Ecology Review Comments

Date of Review:	**9/11/2020**			Page 21 of	
Project Title: **Draft Fifth Five Year Review, NBK Keyport**			Reviewer:	**Mahbub Alam, John Evered, Bonnie Brooks**	
			Code:	**Washington State Department of Ecology**	
Project Number:			Phone:		

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION (Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
		Ecology believes the best answer should be "yes".	discussion will refer to the CERCLA process now underway, which will be addressing these open questions. Please s~~S~~ee also the response to t~~T~~he Suquamish Tribe's Comment #6.	
35	Page 5-1 Section 5.0 Table 5-1 Page 5-3 Section 5.2 Line 123 to 124	OU 2 Area 2 Question B. Ecology believes the answer to this Question should be "no" since the cleanup level for vinyl chloride has changed since the issuance of ROD (See Table 5-3).	The answer to Question B will be changed to "no." In addition, the OU 2, Area 2 protectiveness will be changed to "Short-Term Protective." The Navy plans to complete a thorough review of current cleanup levels and to propose~~d~~ updated cleanup levels for discussion and approval by the stakeholders in the process of updating the existing RODs. This process may be expedited by the production of an Explanation of Significant Differences (ESD), if consensus can be reached with the project team regarding the limits of the ESD. ~~The Navy respectfully disagrees. Although ARAR values have changed, ROD RGs remain the same. ROD RGs can only be changed through the use of an ESD or ROD amendment. Therefore, as with the Fourth FYR, the answer to Question B is yes, because the ARARs, exposure assumptions, toxicity data, and RAOs are still valid and protective of human health and the environment. For vinyl chloride, the ROD RG was the MTCA Method B value of 0.023 µg/L. However, in the past, analytical methods could not achieve this value and the PQL of 1 µg/L was used. The current MTCA Method B value has increased slightly to 0.029 µg/L. Using Ecology's methodology to assess the protectiveness, the risk of the vinyl chloride PQL of 1 is 3 x 10-5, which is just above the ROD target risk goals and within EPA's target risk range of 10-4 and 10-6. Laboratories can currently achieve a PQL of 0.02 µg/L using EPA Method 8260C SIM analysis and can currently achieve the ROD RG value and will be recommended.~~	Yes
36	Page 5-1 Section 5.0 Table 5-1 Page 5-5	OU 2 Area 8 Question C. Ecology believes the answer to this Question should be "yes" due to the detection of PFAS compounds in the site groundwater. 2018 data show, PFOS and PFOA were	The Navy's position is that that the presence or absence of a new ~~,~~ ~~unregulated~~ contaminant, such as PFAS, does not impact the protectiveness of the remedy selected in the ROD for established	Yes?

Ecology Review Comments

Date of Review:	9/11/2020			Page 22 of	
Project Title: **Draft Fifth Five Year Review, NBK Keyport**			Reviewer:	**Mahbub Alam, John Evered, Bonnie Brooks**	
			Code:	**Washington State Department of Ecology**	
Project Number:			Phone:		

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION (Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
	Section 5.3 Line 214 to 216	above EPA LHA, but 2019 data show they were below LHA. However, the drinking water pathway is not the only concern for PFAS; there are many unknowns in this regard as explained in previous comment # 34 and copied in below. There is significant uncertainty associated with this evaluation. The evaluation lacks the following information: • nature and extent of the contamination • effect on ecological receptors • effect on and seafood consumption pathway • presence of other PFAS compounds • cumulative risks from combined exposure to all PFAS as well as from other COCs Ecology believes the best answer should be “yes”.	COCs. The CERCLA process now underway will include PFAS and will support the risk assessment addendum planned for 2022, which will result in a determination of acceptable or unacceptable risks for the site. The Navy will then take any appropriate remedial actions per a future negotiated ROD.	
37	Page 5-6 Section 5.4.1	Since the cleanup levels in CLARC have changed since the last FYR, they should be added as a bullet point. Note CLARC is a compendium of technical information related to calculating cleanup levels under Washington's Cleanup Rule, MTCA.	The changes to the CLARC cleanup levels will be added as a bullet point.	Yes
38	Page 5-6 Section 5.4.1 Lines 257 - 260	Include the SMS as well as MTCA that allows for the use of background and PQL.	We will also reference the SMS in this paragraph.	Yes

Ecology Review Comments

Date of Review:	9/11/2020			Page 23 of	
Project Title: **Draft Fifth Five Year Review, NBK Keyport**			Reviewer:	**Mahbub Alam, John Evered, Bonnie Brooks**	
			Code:	**Washington State Department of Ecology**	
Project Number:			Phone:		

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION (Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
39	Page 5-7 Section 5.4.1 Line 286 to 293	First, whenever there is a mention of CERCLA acceptable risk range (10^{-4} to 10^{-6}), there must be a mention of the ARAR of MTCA risk range (10^{-5} to 10^{-6}) and whether that is met. Again, there are limitations of using CERCLA 10^{-4} risk (e.g., it may not consider subsistence users) and MTCA 10^{-5} risk. Second, there should be a recommendation in this FYR to address the proper RG for vinyl chloride. It needs to account for new levels, the surface water pathway, and PQL. It appears the PQL cannot be used as a basis for a RG anymore.	The MTCA risk range will be added throughout the document. A recommendation will be added to compare any vinyl chloride concentrations obtained to the updated ARAR for vinyl chloride and use an appropriate method to achieve that ARAR. The RG for vinyl chloride will be included as part of the Navy's plans to complete a thorough review of current cleanup levels and to propose~~d~~ updated cleanup levels for discussion and approval by the stakeholders in the process of updating the existing RODs. This process may be expedited by the production of an Explanation of Significant Differences (ESD), if consensus can be reached with the project team regarding the limits of the ESD.~~the expected ESDs and/or the upcoming ROD amendments planned for both OU 1 and OU 2 as a result of the additional ongoing investigations wills. However, in the interim, the Navy will compare any vinyl chloride concentrations obtained to the updated ARAR for vinyl chloride and use an appropriate analytical method to achieve that ARAR concentration.~~	Yes
40	Page 5-8 Table 5-2	Ecology does not agree with the PQL for PCBs as listed in the Table 5-2. First, this PQL was based on PCB analyzed as Aroclor and Labs can currently achieve lower PQL as shown in column 6. Second, much lower PQL can be obtained if PCBs are analyzed with method 1668. Since the surface water criteria (ARAR) as shown in column 11 and 12 are very low, there is a need to use method 1668 to verify compliance. It may be possible that the compliance for total PCBs would default to PQL but that PQL would be orders of magnitude lower than what was shown in column 13. Also, note the discrepancy of column 6 and 13 about PCB PQL. Therefore, the comment "No" in column 14 is not valid anymore. Revise the PQL for PCBs or make a recommendation in the FYR to develop a PQL for total PCBs based on method 1668 analysis.	The PQL in Table 5-2 will be revised to reflect a PQL for total PCB congeners and the comment "No" will be changed to "Yes."	Yes

Ecology Review Comments

Date of Review:	9/11/2020			Page 24 of	
Project Title: **Draft Fifth Five Year Review, NBK Keyport**			Reviewer:	**Mahbub Alam, John Evered, Bonnie Brooks**	
			Code:	**Washington State Department of Ecology**	
Project Number:			Phone:		

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION (Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
		Ecology is willing to provide guidance to calculate a PQL for total PCB congeners.		
41	Page 5-9, Section 5.4.1 Line 6 to 14	Regardless of the outcome of Federal NTR changes, the TCE criteria (either 0.86 or 0.7 ug/L) would be lower than MTCA method B value of 13 ug/L. Note that the current August 2020 MTCA method B number for TCE has changed to 4.9 ug/L based on new toxicity data; the 13 ug/L was based on old toxicity data.	Understood. As noted on Line 30, TCE in surface water continues to exceed even the higher RG value, so the revised lower ARAR value does not affect current decision making at the site.	Yes.
42		Ecology appreciates Navy's thoughts on PCBs RG and PQL. However, as stated in specific comment # 40 , Ecology believes the analysis of PCBs as congeners by method 1668 is more accurate and representative of total PCBs than Aroclor analysis which is based on identification of a particular Aroclor signature which may have changed due to environmental degradation. Therefore, if there are non-detects in the Aroclor analysis, method 1668 congener analysis must be conducted to determine compliance.	~~The Navy stands by the assertion in the text that using a method to achieve a lower PQL is premature at this time because PCB concentrations remain above the RG. Once concentrations reduce below the PQL, or an ESD or ROD amendment is prepared, the RG can be changed to a total congeners RG and the analytical method revised to meet the new RG.~~A recommendation will be added to compare future surface water data to the current ARAR, given that the concentration can now be achieved by the laboratories using congener analysis.	Yes
43		Ecology does not agree with the short term protectiveness argument as presented in the section. See general comment #3. Revise the language per EPA guidance memo (EPA, 2012) on protectiveness determination.	The Navy respectfully declines to change the protectiveness determination and stands by the protectiveness statement, as articulate in the response to General Comment 3.	No
44		As explained in comment # 40, Ecology believes when there is a non- detect in Aroclor data, that indicates a specific Aroclor signature is absent. There may still be PCB congeners present that do not form a specific signature of Aroclor due to environmental degradation. Therefore, PCB congener analysis by method 1668 is necessary to verify compliance.	For tissue, the Aroclor analysis provides reporting limits that are below the RG. ~~and therefore congener analysis is not required to achieve a lower reporting limit.~~ The Navy is currently performing congener analysis in tissue and concentrations are being compared to the revised ARAR. The revised ARAR for PCBs will be included in the Navy's plans to complete a thorough review of current cleanup levels and to propose~~d~~ updated cleanup levels for discussion and approval by the stakeholders in the process of updating the existing RODs. This process may be expedited by the production of an Explanation of Significant Differences (ESD), if consensus can be reached with the project team regarding the limits of the ESD.	Yes

Ecology Review Comments

Date of Review:	**9/11/2020**			Page 25 of	
Project Title: **Draft Fifth Five Year Review, NBK Keyport**			Reviewer:	**Mahbub Alam, John Evered, Bonnie Brooks**	
			Code:	**Washington State Department of Ecology**	
Project Number:			Phone:		

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION (Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
45	Page 5-11 Section 5.4.1 Line 134 to 135	It is correct that the revised RG cannot be compared with historical data as data was obtained through Aroclor analysis. Ecology believes compliance can be measured with EPA method 1668, which has quantitation level at parts per trillion level. The revised RG is in ppb level.	Understood.	N/A
46	Page 5-12 Section 5.4.1 Line 156 to 161	Was surface water pathway a concern during RI/ROD for OU 2 Area 2? If data were non-detect due to analytical method or the surface water RG for both TCE and vinyl chloride was quite high at the time of ROD and therefore, the surface water pathway was not a concern, then the current situation warrants checking the surface water pathway. Include this investigation in the proposed data gap investigation and corresponding recommendation in this FYR.	The risk assessment for OU 2, Area 2 considered a future use scenario of human recreational exposure to surface water in the lagoon and found risks to be acceptable (Table 7-3 of the OU 2 ROD). No unacceptable ecological risks were found for exposures in the creek at the site or the lagoon downstream. If the data gaps investigation shows a complete pathway from groundwater to surface water, then surface water will also be investigated.	Yes
47	Page 5-12 Section 5.4.1 Line 175 to 181	What was the decision/path forward regarding hexavalent chromium value and question on protectiveness? What did the Navy do about this?	No action was or is required because the selected remedy, LUCs, prevents residential exposure regardless of the lower ARAR value. Action would be needed in the future if the land was to be converted to residential land use, and a process is in place through LUC management to trigger such action. This explanation will be included in the FYR text for clarity.	Yes
48	Page 5-15 Section 5.4.1 Lines 53-55	See comment 33 above. Bioassays were collected to assess bioavailability of contaminants in areas with benthic exceedances.	The text will be revised in a manner similar to that described in the response to Comment 33.	Yes
49	Page 6-3 Section 6.1 Table 6-2	Mention in the first recommendation that the risk level $2x10^{-5}$ exceeds MTCA allowable risk.	We will add this notation to the Finding.	Yes
50	Page 6-3 Section 6.1 Table 6-2	Update the second recommendation based on Ecology's general and specific comments on the trend analysis (General comment #7, specific comment # 6 and #7).	This recommendation will be revised to read, "In accordance with Ecology's comments on the recent LTM reports, present a statistical evaluation of contaminant concentration trends over time in each LTM report."	Yes
51	Page 6-3 Section 6.1 Table 6-2	Correct typo "Utilized".	Thank you, we will make this correction.	Yes

Ecology Review Comments

Date of Review:	9/11/2020			Page 26 of	
Project Title: **Draft Fifth Five Year Review, NBK Keyport**			Reviewer:	**Mahbub Alam, John Evered, Bonnie Brooks**	
			Code:	**Washington State Department of Ecology**	
Project Number:			Phone:		

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION (Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
52	Page 6-4 Section 6.1 Table 6-2	The second and third recommendation in this page appear to be same. One is outdated with redline strikeout.	Thank you, we will delete the redundant recommendation with the strikeout text.	Yes
53	Page 6-4 Section 6.1 Table 6-2	Update the fourth recommendation based on Ecology's comments on the draft VI report.	This recommendation will be revised to read, "Prepare a building inspection and monitoring plan based on the recommendations of the VI study report to ensure that the VI pathway remains incomplete. Include annual foundation inspections for Buildings 82, 85, and 98 and paired indoor air and subslab vapor monitoring every five years for Buildings 82 and 98. Add paired indoor air and subslab vapor monitoring every five years for Building 85 if warranted based on future changes in building use or occupancy."	Yes

Ecology Review Comments

Date of Review:	**9/11/2020**			Page 27 of	
Project Title: **Draft Fifth Five Year Review, NBK Keyport**			Reviewer:	**Mahbub Alam, John Evered, Bonnie Brooks**	
			Code:	**Washington State Department of Ecology**	
Project Number:			Phone:		

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION (Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
54	Appendix C Table C-1	It does not appear that data for monitoring well MW1-14 is included in Table C-1.	During this FYR period MW1-14 was sampled in 2018 and 2019, with samples analyzed for PCBs (2018) and 1,4-dioxane (2019). Both the PCB and 1,4-dioxane results are provided in Appendix C (Tables C-2, C-3 and C-4).	Yes
55	Appendix C Table C-4	Add footnotes to define lab identifiers.	We will add the lab qualifier definitions as requested.	Yes

References

EPA (2012). *Clarifying the Use of Protectiveness Determinations for Comprehensive Environmental Response, Compensation, and Liability Act Five-Year Reviews*. Memorandum from Director, Office of Superfund Remediation and Technology Innovation. Washington D.C. OSWER 9200.2-111.

Susquamish Tribe Review Comments

Date of Review:	**9/14/2020**			Page 28 of
Project Title: **Draft Fifth Five Year Review, NBK Keyport**		Reviewer:	**Denice Taylor**	
		Code:	**The Suquamish Tribe**	
Project Number:		Phone:		

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION (Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
Protectiveness Determinations				
1	OU 1	The Suquamish Tribe does not agree with a determination of "short-term protective" for OU 1 for the following reasons: • The remedy is not performing as expected, RAOs have not been achieved, and RGs are continually exceeded. • Re-characterization efforts have revealed a greater extent of contamination than addressed in the ROD. • Exposure pathways associated with the discharge of contaminated groundwater to aquatic environments have not been fully characterized or controlled. • Risks associated with 1,4-dioxane and PFAS have not been characterized or controlled. The Tribe believes a determination of "protectiveness deferred" is appropriate given that additional investigation is underway. However, if the Navy does not address potential risks associated with PFAS, a determination of "not protective" is recommended.	The Navy concurs that the additional site characterization data collected during this FYR period reveal a greater vertical extent of contamination that known at the time of the ROD, and higher concentrations of VOCs discharging to surface water at the south plantation. Surface water RGs continue to be exceeded, as they were at the time of the ROD when risks regarding this situation were determined to be acceptable and no new pathways or receptors have yet been identified. Understanding that the conceptual site model has changed since the time of the ROD, the Navy has initiated revision of the risk assessment, in collaboration with the Project Team, to determine whether these new data indicate a change in the risk determinations made in the ROD. Unless and until an unacceptable risk is demonstrated, the remedy established in the ROD is considered to be protective, which is why the Navy has selected "short-term protective." Selecting "protectiveness deferred" would only have the effect of putting an unattainable 1-year deadline on the on-going investigation and risk assessment work and delaying project work while a FYR addendum is developed and produced. Selecting "protectiveness deferred" also gives the impression to the public that this FYR has identified previously unknown conditions impacting protectiveness that now must be quickly investigated and addressed. However, the risk assessments will identify conditions impacting protectiveness, if present, investigations are being conducted under a comprehensive and collaborative process with the Project Team, and the path forward is clearly established. The presence or absence of a new ~~, unregulated~~ contaminant, such as PFAS, and emerging contaminants, such as 1,4-dioxane, do not impact the protectiveness of the remedy selected in the ROD for established COCs. The CERCLA process now underway will include both PFAS and 1,4-dioxane, will result in a determination of acceptable or unacceptable risks for the site, and the Navy will take any appropriate remedial actions per a future ROD.	No

Susquamish Tribe Review Comments

Date of Review:	**9/14/2020**			Page 29 of	
Project Title: **Draft Fifth Five Year Review, NBK Keyport**			Reviewer:	**Denice Taylor**	
			Code:	**The Suquamish Tribe**	
Project Number:			Phone:		

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION (Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
			Additional investigations are also planned to determine if new pathways/receptors exist at the site; however, no new pathways/receptors have yet been identified. Therefore at this time there remains no known on-going exposure, so no identified unacceptable risks are known to be currently present at the site. Therefore, the Navy respectfully declines to change the protectiveness determination and stands by the determination of “short term protective” for OU 1. On page 4-3 of the FYR, we will insert a statement that “~~a~~After reviewing the FYR, the Tribe provided input on the document. The Tribe does not agree with the Navy’s Short-Term Protective determination for OU 1 and feels that a protectiveness determination for OU 1 cannot be made at this time,~~-~~ ~~(~~believing a protectiveness statement of “protectiveness deferred” ~~would be~~ is more appropriate. However, the Tribe does concur with the “Short-Term Protective” and “Not Protective” determinations for OU 2 Areas 2 and 8, respectively. Detailed comments made by the Tribe are included in Appendix K.”	
2	OU 2 Area 2	Although there may be data gaps concerning the extent of the VOC plume, and the RG for vinyl chloride may need to be formally changed, the Suquamish Tribe agrees with the determination that the remedy is protective. If additional investigation regarding the VOC plume alters the existing CSM such that additional exposure pathways are identified, the next 5YR determination may change.	Understood, thank you.	N/A
3	OU 2 Area 8	The Suquamish Tribe does not agree with a finding of “will be protective” for the following reasons: • Ongoing ecological impacts have been documented and exposure pathways are not currently under control. • Based on the results of the most recent ecological risk assessment, additional groundwater remediation will be	Because the risk assessment shows unacceptable risk at OU 2 Area 8, triggering groundwater controls under the ROD, and the contingent groundwater control remedy has not been selected and is not in progress, the remedy at the site is currently not protective. The ROD includes five remedial options for the contingent remedy, but none are feasible at this site, so the Navy	Yes

Commented [DT1]: Please add statements to the Exec Summary and Section 7 stating that EPA, Ecology and the Suquamish Tribe do not concur with the Navy’s protectiveness determination for OU 1.

Susquamish Tribe Review Comments

Date of Review:	**9/14/2020**			Page 30 of	
Project Title: **Draft Fifth Five Year Review, NBK Keyport**			Reviewer:	**Denice Taylor**	
			Code:	**The Suquamish Tribe**	
Project Number:			Phone:		

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION (Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
		needed. • Potential human health and ecological risks associated with 1,4-dioxane and pfas have not been fully characterized and are not controlled. The Tribe believes that a finding of "not protective" is appropriate until risks associated with PFAS are addressed and additional groundwater remediation is underway.	is currently evaluating additional remedial options. The protectiveness statement for OU2, Area 8 will be changed to "Not Protective".~~As documented in Table 2-1 of the FYR, the risk assessment completed during this FYR period is a component of the selected remedy under the OU 2 ROD, as is implementation of contingent remedial actions based on the conclusions of the risk assessment. The supplemental RI now being undertaken by the Navy to select the contingent remedy is therefore part of the on-going effort to fully implement the original remedy in the OU 2 ROD. When a remedy is in progress and the final remedy is expected to address the RAOs, the FYR concludes that the remedy "will be protective" when the remedy is fully implemented.~~ ~~The Navy's position is that presence or absence of a new, unregulated contaminant, such as PFAS, and emerging contaminants, such as 1,4-dioxane, do not impact the protectiveness of the remedy selected in the ROD for established COCs. The CERCLA process now underway will include both PFAS and 1,4-dioxane, will result in a determination of acceptable or unacceptable risks for the site, and the Navy will take any appropriate remedial actions per a future ROD. Therefore at this time there is no known on-going exposure, so no identified unacceptable risks are known to be currently present at the site.~~ ~~The Navy respectfully declines to change the protectiveness determination and stands by the determination of "will be protective" for OU 2 Area 8.~~	
4	Sitewide	The Suquamish Tribe believes the sitewide determination of "will be protective" should be changed to "protectiveness deferred" or "not protective" to better reflect the recommended changes to the OU 1 and OU 2 Area 8 determinations.	The ~~Navy respectfully declines to change the~~ sitewide protectiveness determination will be changed to "Not Protective"~~and stands by the protectiveness determinations for OU 1, OU 2 Area 8, and the site as a whole.~~	Yes
5	Sitewide	In cases of "protectiveness deferred", new or additional information is typically submitted via an addendum prior to the	The Navy does not believe that an addendum to this FYR would add value to the investigations and risk assessments underway.	Yes?

Commented [DT2]: Yes and please note that based on project team discussions, findings of protectiveness deferred are not being considered, negating the need for any addendum to this 5YR.

Susquamish Tribe Review Comments

Date of Review:	9/14/2020			Page 31 of	
Project Title: **Draft Fifth Five Year Review, NBK Keyport**			Reviewer:	**Denice Taylor**	
			Code:	**The Suquamish Tribe**	
Project Number:			Phone:		

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION (Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
		next 5YR. The need for one or more addenda should be discussed with the project team once the protectiveness determinations are finalized.	The Navy is progressing down a path of remedy revisions at OU 1 and OU 2 Area 8 in collaboration with the project team at the best possible speed given the limitations of funding, the complexity of the sites, and the nature of the collaborative process itself. If an addendum to the FYR is required, it will delay progress of the work, simply to produce an addendum within the one-year time limit stating that information is being gathered, a risk assessment is underway, and protectiveness would remain deferred.	

Susquamish Tribe Review Comments

Date of Review:	9/14/2020			Page 32 of	
Project Title: **Draft Fifth Five Year Review, NBK Keyport**			Reviewer:	**Denice Taylor**	
			Code:	**The Suquamish Tribe**	
Project Number:			Phone:		

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION (Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
Technical Assessments				
6	OU 1	The answer to question C should be "yes". Recent data demonstrate that the CSM at the time of the ROD was inaccurate and/or incomplete regarding the nature and extent of contamination, potential ecological and human health exposures and risks, and estimated recovery timeframe. In addition, since the last 5YR, PFAS contamination has been identified as a concern although potential exposure and risks have not been evaluated.	Question C is meant to capture "other information" not otherwise discussed in the FYR that could affect protectiveness. The additional site characterization data and the impacts of those data on protectiveness are already captured by the discussion for Questions A and B and therefore are not required to be captured in Question C. PFAS is already discussed under Question C, and for the reasons stated does not impact protectiveness. See also the response to Ecology's Specific Comment 34 regarding the answer to Question C. With regard to PFAS and its impact on protectiveness, see the discussion under Question B in the FYR and the response to Ecology's Specific Comment 34.	Yes
7	Area 2 OU 2	The answer to question B should be "no". The RG for vinyl chloride has changed.	The answer to Question B will be changed to "no." In addition, the OU 2, Area 2 protectiveness will be changed to "Short-Term Protective." The Navy plans to complete a thorough review of current cleanup levels and to propose~~d~~ updated cleanup levels for discussion and approval by the stakeholders in the process of updating the existing RODs. This process may be expedited by the production of an Explanation of Significant Differences (ESD), if consensus can be reached with the project team regarding the limits of the ESD.	Yes
8	Area ~~2~~ 8 OU ~~8~~2	The answer to question C should be "yes". Since the last 5YR, impacts to benthic organisms have been documented, identifying the need for additional remediation to control exposure. In addition, potential ecological and human health exposures and risks have not been evaluated.	Question C is meant to capture "other information" not otherwise discussed in the FYR that could affect protectiveness. The risk assessment results and the impacts of those results on protectiveness are already captured in the discussion for Questions A and B and therefore are not required to also be capture in Question C. PFAS is already discussed in Question C, and for the reasons stated does not impact protectiveness.	Yes?
Issues/Recommendations				

Commented [DT3]: Yes

Susquamish Tribe Review Comments

Date of Review:	**9/14/2020**			Page 33 of	
Project Title: **Draft Fifth Five Year Review, NBK Keyport**			Reviewer:	**Denice Taylor**	
			Code:	**The Suquamish Tribe**	
Project Number:			Phone:		

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION (Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
9	General	The addition of CoCs and changes in RGs should be formally documented in the administrative record for each OU, typically through an ESD or RODA. Add recommendations where applicable.	~~Changes in the COC list and RGs will be captured in future ESDs and/or ROD amendments for OU 1 or OU 2 Area 8, if and when the remedies are revised. In most cases the administrative burden to execute ESDs and ROD amendments is not warranted for each ARAR change that could affect an RG, or each adjustment to the list of chemicals monitored during LTM. One use of the FYRs is to track ARAR changes and ensure that the LTM and any decision making is appropriately considering the latest ARARs and list of chemicals for monitoring, keeping in mind the legally binding COC list and RGs from the RODs. Any final decisions (such as considering the site UU/UE) would first require an ESD or ROD amendment to fully update the COC list and RGs, however ongoing ESDs and ROD amendments to capture these changes are not currently warranted.~~Recommendations will be added to the FYR to compare concentrations to current ARARs. The Navy plans to complete a thorough review of current cleanup levels and to propose~~d~~ updated cleanup levels for discussion and approval by the stakeholders in the process of updating the existing RODs. This process may be expedited by the production of an Explanation of Significant Differences (ESD), if consensus can be reached with the project team regarding the limits of the ESD.	Yes
10	General	According to the 2012 EPA guidance on protectiveness determinations, a finding of "protectiveness deferred" typically involves an addendum to the 5YR once ongoing investigations are complete. Add recommendations as appropriate for revised protectiveness determinations.	The Navy does not believe that an addendum to this FYR would add value to the investigations and risk assessments underway. The Navy is progressing down a path of remedy revisions at OU 1 and OU 2 Area 8 in collaboration with the project team at the best possible speed given the limitations of funding, the complexity of the sites, and the nature of the collaborative process itself. If an addendum to the FYR is required, it will delay progress of the work, simply to produce an addendum within the one-year time limit stating that information is being gathered, a risk assessment is underway, and protectiveness would remain deferred.	Yes?

Commented [DT4]: Yes and note that determinations of protectiveness deferred were not applied, which negates the need for any addendum to this 5YR.

Susquamish Tribe Review Comments

Date of Review:	9/14/2020			Page 34 of	
Project Title: **Draft Fifth Five Year Review, NBK Keyport**			Reviewer:	**Denice Taylor**	
			Code:	**The Suquamish Tribe**	
Project Number:			Phone:		

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION (Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
11	General	Add a recommendation to update the IC/LUC plan and include in Table 6-1. Because the Navy cites ICs/LUCs as necessary measures to reduce short-term exposures, this is an issue that affects protectiveness. In the update, clarify the status of fish and shellfish harvest advisories and identify the implementing agency. Note that the Suquamish Tribe has authority to determine harvest practices for tribal members. Include OU-specific updates as needed.	The only finding of the FYR regarding LUCs pertains to a LUC-only site, which is not strictly subject to the FYR process. No issues regarding the existing CERCLA-site LUCs or LUC management plan (except the naming convention of IC plan versus LUC plan) were identified by the FYR. Based on the follow-up comment from the Suquamish Tribe, the following changes to the FYR will be made: Page 5-2, line 69, "…closed by the Washington State Department of Health to harvesting and consuming shellfish by recreational or subsistence fishers; therefore, the remedy is protective in the short term. Note that the Suquamish tribe has treaty reserved rights to harvest and maintains the authority to determine harvest practices for tribal members." Page 5-9, line 30, "..closed by the Washington State Department of Health to harvesting and consuming shellfish by recreational or subsistence fishers. Note that the Suquamish tribe has treaty reserved rights to harvest and maintains the authority to determine harvest practices for tribal members." Page 5-10, line 80, "….not currently open by the Washington State Department of Health for harvesting and consuming shellfish by recreational or subsistence fishers; therefore, the remedy is protective in the short term. Note that the Suquamish tribe has treaty reserved rights to harvest and maintains the authority to determine harvest practices for tribal members." Page 5-11, line 121, "In the interim, the tide flats are currently not open by the Washington State Department of Health for harvesting and consuming shellfish by recreational or subsistence fishers; therefore, the remedy is protective in the short term. Note that the Suquamish tribe has treaty reserved rights to harvest and maintains the authority to determine harvest practices for tribal members."	Yes

Commented [DT5]: I think this comment and response needs some additional clarification. In multiple places in Section 5, the Navy states that the current harvest restrictions for the tide flats and Port Orchard Bay ensure that the OU 1 and Area 8 remedies are protective in the short term. Please clarify whether the harvest restrictions are ROD requirements or ICs. I suspect they are not. If they are not, identify WA DOH as the agency that has jurisdiction. I would also like it to be noted that the Suquamish Tribe has treaty reserved rights to harvest and maintain the authority to determine harvest practices for tribal members. If the harvest restrictions are ROD requirements/ICs, that needs to be clarified in this 5YR and probably in the IC/LUC plans, as commented. And the same note about Suquamish Tribe would apply.

Susquamish Tribe Review Comments

Date of Review:	9/14/2020			Page 35 of	
Project Title: **Draft Fifth Five Year Review, NBK Keyport**			Reviewer:	**Denice Taylor**	
			Code:	**The Suquamish Tribe**	
Project Number:			Phone:		

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION (Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
			Page 5-14, line 21, "Nevertheless, current Washington State Department of Health restrictions prohibit the harvesting of shellfish from Port Orchard Bay; therefore, the remedy remains protective. Note that the Suquamish tribe has treaty reserved rights to harvest and maintains the authority to determine harvest practices for tribal members." Page 5-16, line 108, "…currently Washington State Department of Health restrictions in place that prohibit the harvesting of shellfish from Port Orchard Bay; therefore, the remedy remains protective. Note that the Suquamish tribe has treaty reserved rights to harvest and maintains the authority to determine harvest practices for tribal members."	
12	OU 1, Table 6-1	The milestone date of December 2023 seems overly optimistic for the entirety of the first remedy performance recommendation. Establish achievable milestones for specific efforts or deliverables, in consultation with the project team.	A timeline showing expected completion of specific elements of this recommendation is provided in Figure 7-1. This recommendation expects that the Project Team will have completed items 1-3 and be able to make a decision regarding the need for early remedial actions or proceeding to an FS by the end of 2023. This timeline seems achievable as shown on Figure 7-1, so no change is proposed.	Yes
13	OU 1, Table 6-1	In the first performance recommendation, point 3 would typically be part of point 4, assuming an FFS is going to be completed. Recommend this be considered the same effort.	As discussed during the pilot program for Adaptive Site Management, the points of compliance and remedial action objectives are key elements for directing remedial action and an FFS. The Navy continues to believe that a focused discussion on these key elements is necessary prior to discussing potential remedy revision.	Yes
14	OU 1, Table 6-1	What types of early remedial actions are being considered? Consult with the project team to clarify this prior to revising the OU 1 recommendations.	The Navy is gathering information on potential new and innovative technologies that might be applicable to the site, but has not made any determination as to what revisions to the remedy might be appropriate. Selection of early actions or other revisions to the remedy will be made in consultation with the Project Team after clarification of the points of compliance and RAOs.	Yes

Susquamish Tribe Review Comments

Date of Review:	9/14/2020			Page 36 of	
Project Title: **Draft Fifth Five Year Review, NBK Keyport**			Reviewer:	**Denice Taylor**	
			Code:	**The Suquamish Tribe**	
Project Number:			Phone:		

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION (Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
15	OU 1, Table 6-2	The third recommendation in Table 6-2 regarding using the OU 2 Area 8 ERA to the extent possible in the OU 1 risk assessments should be deleted. While some assumptions may be appropriate to carry over, this will occur as part of the normal process. The OU 1 assessments need to be specific to OU 1; the Area 8 receiving environment is very different from OU1.	This finding is meant only to capture the successful process used at Area 8, not the site-specific information. However, this finding will be deleted as requested.	Yes
16	OU 2, Area 2, Table 6-2	Move the second recommendation to Table 6-1. The results of the investigation will either confirm or alter the CSM, which may affect the protectiveness determination in the next 5YR.	~~Although the Navy agrees that information from the planned data gaps investigation may change the protectiveness determination in the next FYR, there is currently no evidence that protectiveness is affected now or in the future. Moving this recommendation to Table 6-1 would require that the protectiveness of OU 2 Area 2 be changed to "short term protective," which doesn't seem appropriate as agreed in Suquamish Tribe Comment 2.~~Recommendation #2 on Table 6-2 will be moved to Table 6-1.	Yes

Susquamish Tribe Review Comments

Date of Review:	**9/14/2020**			Page 37 of	
Project Title: **Draft Fifth Five Year Review, NBK Keyport**			Reviewer:	**Denice Taylor**	
			Code:	**The Suquamish Tribe**	
Project Number:			Phone:		

ITEM NO.	*Pg #, Section, Line*	*COMMENTS*	*REVIEW ACTION (Provide explanation & location of changes as necessary)*	*Agency Concurrence (Yes/No)*
17	OU 2, Area 8, Table 6-1	In consultation with the project team, separate the remedy performance recommendation into specific efforts or deliverables with achievable milestones.	A timeline showing expected completion of specific elements of this recommendation is provided in Figure 7-1.	Yes
18	OU 2, Area 8, Table 6-1	Correct typos in the second recommendation.	The Navy assumes that this comment is referring to Table 6-2, not table 6-1. The recommendation with the strikeout text is an early version of the recommendation above and will be deleted.	Yes

End of Comments

Figure Crosswalk Table, Draft to Draft Final FYR

Draft Figure Number	Draft Final Figure Number	Changes from Draft to Draft Final
1-1	1-1	None
1-2	1-2	None
1-3	1-3	None
1-4	1-4	None
1-5	1-5	None
1-6	1-6	None
2-1	2-1	None
2-2	2-2	None
2-3	2-3	Tidal Lag study wells identified
4-1	4-1	Title Changed; deeper GW flow arrow added
4-2	4-2	PCB data added
-	4-3	New SW/seep data figure added
4-3	4-4	None; Figure number shifted
4-4	4-5	None; Figure number shifted
4-5	4-6	PFAS wells identified; 1,4-dioxane data added
4-6	4-7	None; Figure number shifted
4-7	4-8	None; Figure number shifted
4-8	4-9	PFAS wells identified; 1,4-dioxane data added
4-9	4-10	None; Figure number shifted
4-10	4-11	None; Figure number shifted
4-11	4-12	None; Figure number shifted
4-12	4-13	None; Figure number shifted
4-13	4-14	None; Figure number shifted
-	4-15	New Tidal Lag Ranges figure added
4-14	4-16	None; Figure number shifted
4-15	4-17	None; Figure number shifted
4-16	4-18	None; Figure number shifted
4-17	4-19	PFAS wells identified
4-18	4-20	None; Figure number shifted
4-19	4-21	None; Figure number shifted
4-20	4-22	None; Figure number shifted
4-21	4-23	None; Figure number shifted
7-1	7-1	None

From:	Alam, Mahbub (ECY)
To:	Denice Taylor; Cellucci, Carlotta CIV NAVFAC NW, EV31 (carlotta.cellucci@navy.mil)
Cc:	Harry Craig (Craig.Harry@epamail.epa.gov); Brooks, Bonnie (ECY); Evered, John (ECY); Meyer, Michael; JoAnn Grady (joanngrady@gmail.com)
Subject:	RE: Draft Final Keyport 5YR and revised RTCs
Date:	Friday, November 06, 2020 4:00:33 PM

Hi, Carlotta:
Ecology has reviewed the revised responses. We have the following notes.
1. Ecology specific comments #1 to 7 and the corresponding responses are missing in the revised RTC document. To note there were 7 general comments and 55 specific comments (62 in total). Specific comment #6 needed revised response.
2. I also agree with Denice that a statement be added to the Executive Summary and Section 7 explaining that EPA, Ecology and the Suquamish Tribe did not concur with the Navy's protectiveness determination for OU 1.

Thanks,

Mahbub Alam, PhD, PE
Environmental Engineer
(360) 407-6913; mala461@ecy.wa.gov

-----Original Message-----
From: Denice Taylor <dtaylor@suquamish.nsn.us>
Sent: Thursday, November 05, 2020 7:27 PM
To: Cellucci, Carlotta CIV NAVFAC NW, EV31 (carlotta.cellucci@navy.mil) <carlotta.cellucci@navy.mil>
Cc: Harry Craig (Craig.Harry@epamail.epa.gov) <Craig.Harry@epamail.epa.gov>; Alam, Mahbub (ECY) <MALA461@ECY.WA.GOV>; Brooks, Bonnie (ECY) <bobr461@ECY.WA.GOV>; Evered, John (ECY) <jeve461@ECY.WA.GOV>; Meyer, Michael (meyerm@battelle.org) <meyerm@battelle.org>; JoAnn Grady (joanngrady@gmail.com) <joanngrady@gmail.com>
Subject: Draft Final Keyport 5YR and revised RTCs

Carlotta,
Attached is the revised RTC table with my comments. I think comment 11 still needs some clarification. I would also like to see a statement added to the Executive Summary and Section 7 explaining that EPA, Ecology and the Suquamish Tribe did not concur with the Navy's protectiveness determination for OU 1. The rest are minor comments or confirmation of agreement.
I also reviewed the revisions to the text. There are some editorial and word changes I would have made, but I don't think they are really necessary at this point.
Let me know how you want to address those couple of things or if you have any questions.
Denice

From:	Alam, Mahbub (ECY)
To:	Cellucci, Carlotta CIV USN NAVFAC NW SVD WA (USA); Harry Craig (Craig.Harry@epamail.epa.gov) (Craig.Harry@epamail.epa.gov); "Denice Taylor (dtaylor@suquamish.nsn.us)"
Cc:	Rohrbaugh, Amanda L CIV USN NAVFAC NW SVD WA (USA); Meyer, Michael
Subject:	RE: Keyport FYR - Final back-check
Date:	Tuesday, November 10, 2020 10:05:43 AM

Carlotta:
I have taken a quick look at the revised RTC. It looks fine to me.
Thanks for including the info in the executive summary.

Mahbub Alam, PhD, PE
Environmental Engineer
(360) 407-6913; mala461@ecy.wa.gov

From: Cellucci, Carlotta CIV USN NAVFAC NW SVD WA (USA) <carlotta.cellucci@navy.mil>
Sent: Monday, November 09, 2020 9:00 PM
To: Harry Craig (Craig.Harry@epamail.epa.gov) (Craig.Harry@epamail.epa.gov) <Craig.Harry@epamail.epa.gov>; Alam, Mahbub (ECY) <MALA461@ECY.WA.GOV>; 'Denice Taylor (dtaylor@suquamish.nsn.us)' <dtaylor@suquamish.nsn.us>
Cc: Rohrbaugh, Amanda L CIV USN NAVFAC NW SVD WA (USA) <amanda.rohrbaugh@navy.mil>; Meyer, Michael <meyerm@battelle.org>
Subject: Keyport FYR - Final back-check

Hi Team,

Please review the attached revised responses to comments (RTCs) and provide concurrence or comments ASAP. These revised RTCs reinstates the revised responses to Ecology's specific comments 1-7, which were inadvertently deleted during table formatting. The response to Suquamish Tribe comment 11 has been further revised based on the follow-on comment received, and text revisions shown in the revised comment responses will be incorporated into the five-year review report.

In response to the comment from Ecology and the Suquamish Tribe, the following statement will be added to the Executive Summary and Section 7 of the five-year review: "Ecology, EPA, and the Suquamish Tribe do not concur with the Navy's protectiveness determination for OU 1, and feel that a determination of 'protectiveness deferred' would be more appropriate."

To document final comments and responses, this email and the emailed comments received will be

included with the RTCs in an appendix of the document.
Thanks,

C.

Carlotta Cellucci, LG
Remedial Project Manager
Naval Facilities Engineering Systems Command (NFESC) Northwest
206-595-6711
Carlotta.cellucci@navy.mil

From:	Denice Taylor
To:	Cellucci, Carlotta CIV USN NAVFAC NW SVD WA (USA); Harry Craig (Craig.Harry@epamail.epa.gov) (Craig.Harry@epamail.epa.gov); "MALA461@ECY.WA.GOV"
Cc:	Rohrbaugh, Amanda L CIV USN NAVFAC NW SVD WA (USA); Meyer, Michael
Subject:	RE: Keyport FYR - Final back-check
Date:	Tuesday, November 10, 2020 10:07:48 AM
Attachments:	Fifth 5YR Keyport RTCs revised DT final edits.doc

Carlotta,
A couple edits on the revisions proposed in response to comment 11. No other changes.
Denice

From: Cellucci, Carlotta CIV USN NAVFAC NW SVD WA (USA) <carlotta.cellucci@navy.mil>
Sent: Monday, November 9, 2020 9:00 PM
To: Harry Craig (Craig.Harry@epamail.epa.gov) (Craig.Harry@epamail.epa.gov) <Craig.Harry@epamail.epa.gov>; 'MALA461@ECY.WA.GOV' <MALA461@ECY.WA.GOV>; Denice Taylor <dtaylor@suquamish.nsn.us>
Cc: Rohrbaugh, Amanda L CIV USN NAVFAC NW SVD WA (USA) <amanda.rohrbaugh@navy.mil>; Meyer, Michael <meyerm@battelle.org>
Subject: Keyport FYR - Final back-check

Hi Team,

Please review the attached revised responses to comments (RTCs) and provide concurrence or comments ASAP. These revised RTCs reinstates the revised responses to Ecology's specific comments 1-7, which were inadvertently deleted during table formatting. The response to Suquamish Tribe comment 11 has been further revised based on the follow-on comment received, and text revisions shown in the revised comment responses will be incorporated into the five-year review report.

In response to the comment from Ecology and the Suquamish Tribe, the following statement will be added to the Executive Summary and Section 7 of the five-year review: "Ecology, EPA, and the Suquamish Tribe do not concur with the Navy's protectiveness determination for OU 1, and feel that a determination of 'protectiveness deferred' would be more appropriate."

To document final comments and responses, this email and the emailed comments received will be included with the RTCs in an appendix of the document.
Thanks,

C.

Carlotta Cellucci, LG
Remedial Project Manager
Naval Facilities Engineering Systems Command (NFESC) Northwest
206-595-6711

Carlotta.cellucci@navy.mil