FINAL
5 JUNE 2018

Spring 2017 Long-Term Monitoring Report

Former Plating Shop/Waste Oil Spill Area, Area 8, Operable Unit 2

CONTRACT NO. N44255-14-D-9011
LTM/OM / TASK ORDER 46

Naval Base Kitsap

Keyport, Washington

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Naval Facilities Engineering Command Northwest
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SPRING 2017 LONG-TERM MONITORING REPORT
FORMER PLATING SHOP/WASTE OIL SPILL AREA, AREA 8, OPERABLE UNIT 2

NAVAL BASE KITSAP
KEYPORT, WASHINGTON

JUNE 5, 2018

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CONTENTS

1. INTRODUCTION 1-1
1.1 SITE DESCRIPTION AND BACKGROUND 1-4
1.2 CURRENT CONCEPTUAL SITE MODEL 1-5
1.3 OBJECTIVE AND SCOPE OF WORK 1-9
1.3.1 Selected Remedy 1-12
1.3.2 Chemicals of Concern 1-12
1.4 REMEDIATION GOALS 1-12
2. FIELD ACTIVITIES 2-1
3. LABORATORY ANALYSIS AND DATA VALIDATION 3-1
4. GROUNDWATER FLOW AND ANALYTICAL RESULTS 4-1
4.1 GROUNDWATER FLOW 4-1
4.2 GROUNDWATER ANALYTICAL RESULTS 4-2
4.2.1 Volatile Organic Compounds in Groundwater 4-19
4.2.2 1,4-Dioxane in Groundwater 4-22
4.2.3 Dissolved Metals in Groundwater 4-22
4.3 SEEP WATER ANALYTICAL RESULTS 4-25
4.3.1 Volatile Organic Compounds in Seep Water 4-25
4.3.2 Dissolved Metals in Seep Water 4-27
5. DATA TRENDS 5-1
5.1 VOLATILE ORGANIC COMPOUND TRENDS 5-1
5.2 DISSOLVED METAL TRENDS 5-3
5.3 1,4-DIOXANE TRENDS 5-4
6. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS 6-1
6.1 MONITORING WELL SAMPLING SUMMARY 6-1
6.1.1 Target VOCs 6-1
6.1.2 1,4-Dioxane 6-2
6.1.3 Dissolved Metals 6-2
6.2 SEEP SAMPLING SUMMARY 6-3
6.2.1 Target VOCs 6-3
6.2.2 Dissolved Metals 6-3
6.3 LONG-TERM MONITORING RECOMMENDATIONS 6-4
7. REFERENCES 7-1

CONTENTS (continued)

APPENDICES

APPENDIX A FIELD CHANGE REQUEST
APPENDIX B FIELD FORMS, FIELD LOGBOOK PAGES, AND TABLE B-1: HISTORICAL FIELD-MEASURED PARAMETER DATA
APPENDIX C DATA VALIDATION REPORTS
APPENDIX D GRAPHS OF CONCENTRATION TRENDS
APPENDIX E RESPONSE TO AGENCY COMMENTS ON DRAFT REPORT

FIGURES

Figure 1-1. NBK Keyport Vicinity Map 1-2
Figure 1-2. Area 8 Site Location Map 1-3
Figure 1-3. Area 8 Layout 1-6
Figure 1-4. Area 8 Groundwater Surface Elevation Contour Map 1-7
Figure 4-1. Distribution of Selected VOCs in Groundwater and Seep Water 4-9
Figure 4-2. Distribution of Selected Metals in Groundwater and Seep Water 4-17

TABLES

Table 1-1. OU 2, Area 8 Remediation Goals for Groundwater and Surface Water 1-13
Table 2-1. Field Parameter Measurements for Groundwater and Seep Sampling 2-2
Table 4-1. June 2017 Groundwater Table Measurements at Area 8 4-1
Table 4-2. Summary of Selected VOC Results for Area 8 Groundwater Sampling Locations, Fall 1995 through Spring 2017 4-3
Table 4-3. Summary of 1,4-Dioxane Results for Area 8 Groundwater and Seep Sampling Locations, Spring 2007 through Spring 2017 4-7
Table 4-4. Summary of Selected Dissolved Metals Results for Area 8 Groundwater Sampling Locations, Fall 1995 through Spring 2017 4-11
Table 4-5. Summary of Selected VOC Results for Area 8 Groundwater Sampling Locations, Spring 2017 4-19
Table 4-6. Summary of Other VOC Results for Area 8 Groundwater Sampling Locations, Spring 2017 4-21
Table 4-7. Summary of Selected Dissolved Metals Results for Area 8 Groundwater Sampling Locations, Spring 2017 4-24
Table 4-8. Summary of Selected VOC Results for Area 8 Seep Sampling Locations, Fall 1995 through Spring 2017 4-26
Table 4-9. Summary of Selected Dissolved Metals Results for Area 8 Seep Sampling Locations, Fall 1995 through Spring 2017 4-28

ABBREVIATIONS AND ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirements
bgs	below ground surface
btoc	below top of casing
CFR	Code of Federal Regulations
COC	chemical of concern
DCA	dichloroethane
DCE	dichloroethene
Ecology	Washington State Department of Ecology
EPA	United States Environmental Protection Agency
FCR	field change request
IC	institutional control
LOQ	limit of quantitation
LTM	long-term monitoring
MLLW	mean lower low water
MMA	Management and Monitoring
msl	mean sea level
µg/L	microgram per liter
MTCA	Model Toxics Control Act
Navy	U.S. Navy
NAVFAC	Naval Facilities Engineering Command
NBK	Naval Base Kitsap
OU	Operable Unit
PCE	tetrachloroethene
pH	potential hydrogen
PQL	practical quantitation limit
QA	quality assurance
QC	quality control

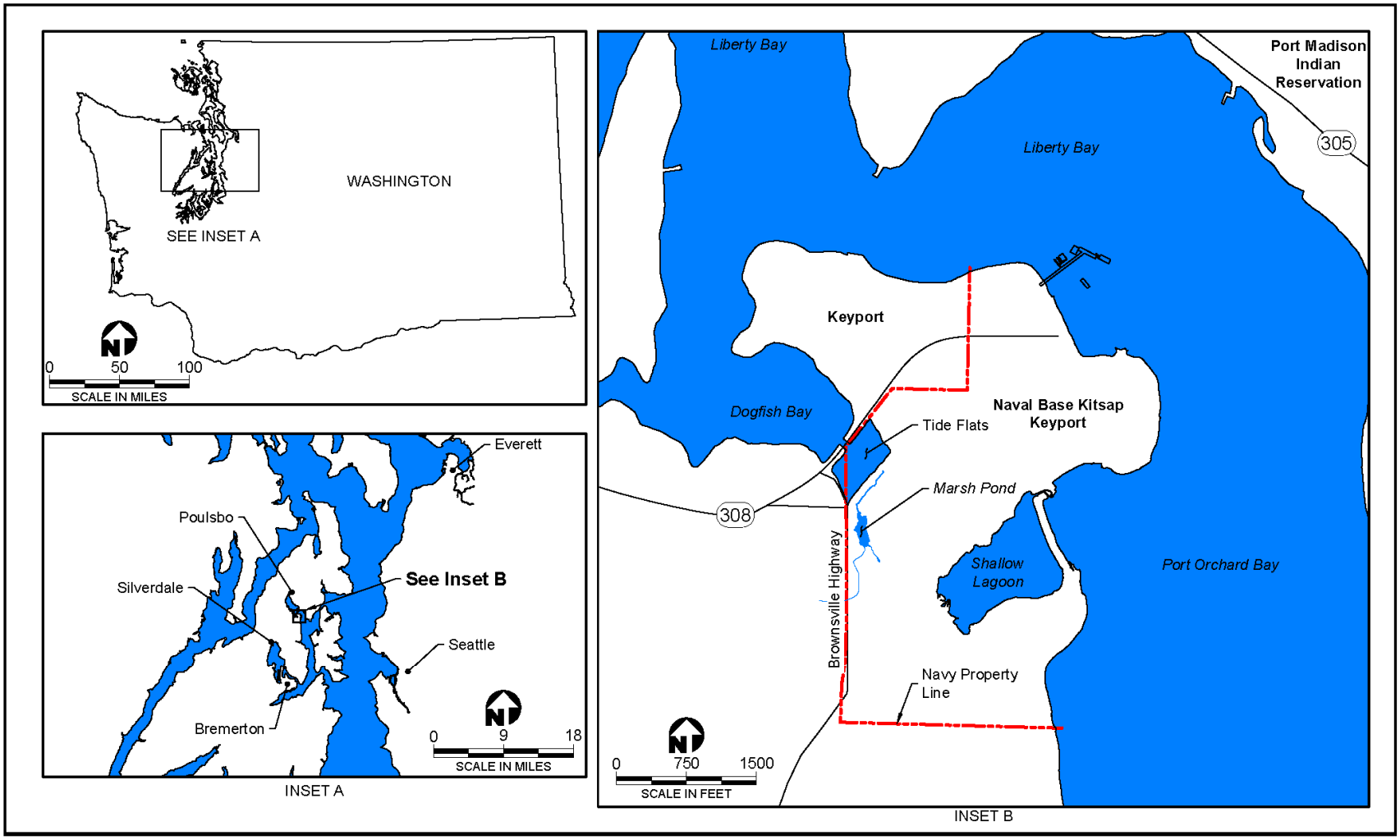
ABBREVIATIONS AND ACRONYMS (continued)

RAO	Remedial Action Objective
RG	remediation goal
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RPD	relative percent difference
SAP	Sampling and Analysis Plan
Sealaska	Sealaska Environmental Services, LLC
SIM	selected ion monitoring
SOP	standard operating procedure
SVOC	semi-volatile organic compound
TCA	trichloroethane
TCE	trichloroethene
TO	Task Order
TPH	total petroleum hydrocarbons
URS	URS Group, Inc. (aka URS Corporation)
UST	underground storage tank
VOC	volatile organic compound
WAC	Washington Administrative Code

1. INTRODUCTION

The U.S. Navy (Navy) is conducting a long-term monitoring (LTM) program for Area 8, Former Plating Shop/Waste Oil Spill Area in Operable Unit (OU) 2 of Naval Base Kitsap (NBK) Keyport in Keyport, Washington (Figures 1-1 and 1-2). Sealaska Environmental Services, LLC (Sealaska) is implementing the LTM program at Area 8 under Contract N44255-14-D-9011, Task Order (TO) 46, including groundwater, seep, sediment, and marine tissue (shellfish) sampling components. This report includes the results of groundwater and seep sampling conducted in June 2017 by Sealaska. Sediment and marine tissue were sampled in 2016 by others under contract to the Navy; the results of those investigations are presented under separate cover. Specific LTM program requirements were updated to incorporate changes recommended in the Fourth Five-Year Review (Navy 2015a), as defined in the Management and Monitoring (MMA) Sampling and Analysis Plan (SAP) for LTM at NBK Keyport (Navy 2017a) and approved by the Washington State Department of Ecology (Ecology), the United States Environmental Protection Agency (EPA), and the Suquamish Tribe. The recommended and adopted change was to revise the 1,4-dioxane analytical method to achieve a reduced practical quantitation limit (PQL) less than the Model Toxics Control Act (MTCA) Method B cleanup level for 1,4-dioxane. Based on recommendations made in the Spring 2016 LTM Report (Navy 2017b), tin, thallium, and mercury were also removed from the Area 8 list of analytes, as implemented in June 2017 through Field Change Request (FCR) TO 46 FCR-02 (Appendix A).

This monitoring report summarizes the background, scope, field activities, and results of groundwater and seep sampling conducted at Area 8 in June 2017. Sealaska conducted the field sampling and data analysis described herein, and prepared this data report. Subcontractors to Sealaska performed laboratory analytical and data validation tasks.



U.S. NAVY	SEALASKA	Figure 1-1 NBK Keyport Vicinity Map	NBK Keyport, 2017 Area 8 Long-Term Monitoring Report

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U.S. NAVY SEALASKA	Figure 1-2 Area 8 Site Location Map	NBK Keyport, 2017 Area 8 Long-Term Monitoring Report

1.1 SITE DESCRIPTION AND BACKGROUND

NBK Keyport occupies 340 acres (including tidelands) adjacent to the town of Keyport in Kitsap County, Washington, on a small peninsula in the western bays of Puget Sound. The peninsula is bordered by Liberty Bay to the north and Port Orchard Bay to the southeast (Figure 1-1). The topography of the base rises gently from the shoreline to an average elevation of 25 to 30 feet above mean sea level (msl) and then rises steeply at the southeast corner of the site to approximately 130 feet above msl.

Marine or brackish surface water bodies on and near the base include Liberty Bay, Dogfish Bay, the tide flats, a marsh pond, and a shallow lagoon. Freshwater bodies include two unnamed creeks that discharge into the marsh pond and two unnamed creeks that discharge into the lagoon.

Area 8 occupies approximately 1 acre on the eastern portion of NBK Keyport (Figure 1-2) surrounding the location of the former plating shop (Building 72; Figure 1-3). The site is located in a heavily industrialized part of the base bordered by Port Orchard Bay to the south and east (Figure 1-2). The area is predominantly flat and almost entirely paved or covered by buildings.

Past releases at Area 8 include chrome plating solution spilling onto the ground; plating wastes discharging to a utility trench; and plating solutions leaking through cracks in the Building 72 plating shop floor, waste disposal pipes, and sumps. Petroleum hydrocarbons (diesel and heavy oil) were also released to the environment from leaky underground storage tanks (USTs) and underground concrete vaults located within Area 8.

Extensive subsurface soil and groundwater sampling was conducted to determine the chemicals of concern (COCs) and their extent (Navy 1993a). The Remedial Investigation/Feasibility Study (RI/FS) process, and human health and ecological risk assessments for OU 2, Area 8 were completed in 1993 (Navy 1993a, 1993b, 1993c, and 1993d). No human health or ecological risk was identified in association with OU 2, Area 8. However, remedies were selected based on (1) unacceptable risks from exposure to soil and groundwater to future hypothetical residential, and (2) the potential for human health and ecological exposures from contaminants discharging to Port Orchard Bay and impacting marine sediment and tissue. The Record of Decision (ROD), prepared and approved in 1994 (Navy, EPA, and Ecology 1994), outlined the selected remedies for the site including continued groundwater monitoring, sediment and tissue monitoring, and institutional

controls (ICs) to restrict residential use of the site, and remove hot spots of vadose zone soil for offsite disposal.

Additional remedial actions at Area 8 since 1995 include the demolition of Building 72, the removal and disposal of hot spot (metals-contaminated) soil, and the removal of USTs and associated petroleum-contaminated soils. Two slurry (cutoff) walls were constructed at the location of former USTs (immediately northeast and immediately south of the former plating shop; Figure 1-3) as shoring during petroleum-contaminated soils removal.

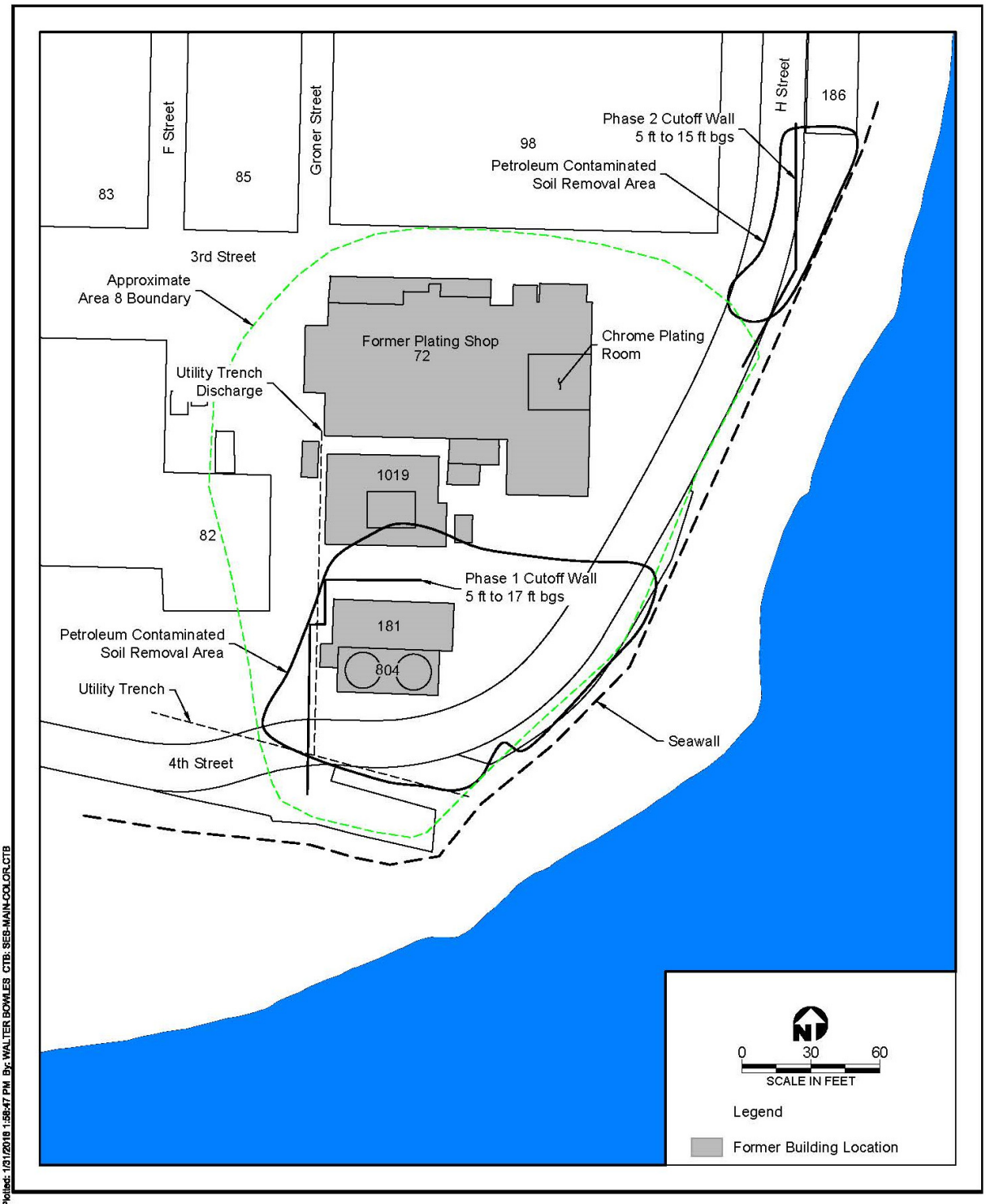
Current LTM activities at this site include sampling of groundwater and a groundwater seep for comparison to established criteria.

1.2 CURRENT CONCEPTUAL SITE MODEL

The depth to water in the upper aquifer (water table) is generally less than 10 feet below ground surface (bgs). Based on pre-ROD investigations of Area 8, the upper aquifer is believed to be 50 to 165-feet thick, with the thickest portion being where paleochannel erosion and deposition have removed portions of the Clover Park Unit and left behind alluvial sediments. However, pre-ROD investigations also indicated that water-level elevations in wells tapping the bottom of the upper aquifer are about 3 to 4 feet higher than those of wells tapping the top of the upper aquifer, which could indicate the presence of a confining layer, or an upward flow potential within the lower portion of the upper aquifer.

Although intermittent reversals from tidal influence have been inferred in wells near the shoreline during high tide, horizontal groundwater flow is generally eastward toward the shoreline (Figure 1-4). These gradient conditions characterize groundwater discharge in the region.

Groundwater also discharges from Area 8 via conspicuous groundwater seeps in the Port Orchard Bay intertidal zone adjacent and east of Area 8. Seep A is approximately 180 feet north of the former Pier 1 (removed in 2001), 40 feet east of the seawall, and 6 feet above mean lower low water (MLLW). Seep B is approximately 100 feet north of the former Pier 1, 30 feet east of the seawall, and 9 feet above MLLW (Figure 1-4). Five other seeps have been identified at the beach; Seep C is south of Seep A, and remaining seeps D through G are north of Seep A. In addition, three stormwater outfalls empty into the intertidal zone adjacent to Area 8. Seeps C through G are not sampled as a part of the scope of work performed and reported herein. Details regarding the sampling and results of stormwater outfalls and Seeps C through G are reported under separate cover (Navy 2016a).



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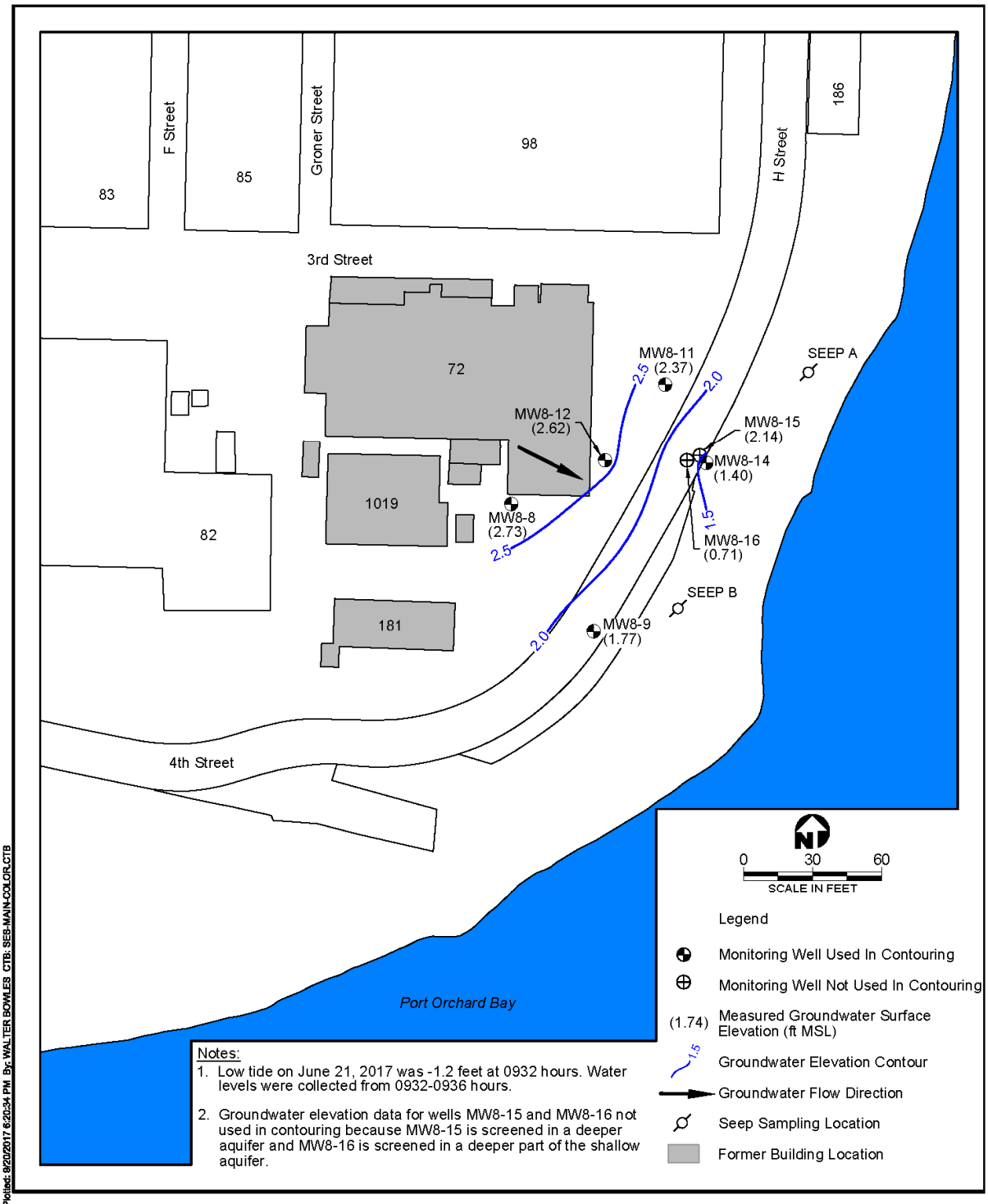
U.S. NAVY	SEALASKA	Figure 1-3 Area 8 Layout	NBK Keyport, 2017 Area 8 Long-Term Monitoring Report



C:\USERS\WALTER.BOWLES\DOCUMENTS\KEYPORT\TO 46\LTM\AREA 8\NATIVE\FIG 1-4.DWG
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U.S. NAVY	SEALASKA	Figure 1-4 Area 8 Groundwater Surface Elevation Contour Map	NBK Keyport, 2017 Area 8 Long-Term Monitoring Report

The slope of the beach adjacent to Area 8 ranges from gentle to moderate (approximately 1.5 to 10 percent). The beach is self-armored, with intertidal sediments consisting primarily of sand, gravel, and cobbles overlying fine sand, silt, and clay.

The site, located adjacent to Port Orchard Bay, is predominantly flat and almost entirely paved or covered by buildings. A paved road, 4th Street (east/west) which turns into H Street (north/south), is located along the shoreline next to the site. The shoreline has a medium embankment, which drops steeply from the road approximately 12 feet to the intertidal area, and is reinforced by an armor rock wall and seawall. Data generated to date indicate that solvents used in former Building 72 or other former adjacent buildings, and metals from plating activities conducted in former Building 72, have impacted shallow groundwater and subsurface soils. These solvents could impact downgradient groundwater seeps, surface water, and sediments in Port Orchard Bay.

Two classes of contaminants have been identified as COCs for Area 8: volatile organic compounds (VOCs) and metals. Based on a recommendation in the Second Five-Year Review (Navy 2005), the semi-volatile organic compound (SVOC) 1,4-dioxane was sampled in 2007 to determine if the contaminant was present at the site. As a result of this sampling and a recommendation in the Third Five-Year Review (Navy 2010a), 1,4-dioxane was added to the LTM program to be monitored as an emergent COC for the site. Petroleum hydrocarbons and aromatic compounds identified as heavy fuel oils were detected in groundwater samples from locations around former Buildings 181 and 804 (Figure 1-3). VOCs, SVOCs, and total petroleum hydrocarbons (TPH) as diesel in soil, were also characterized in 1998 and 1999. The source of these compounds was believed to be the former fuel storage vaults at former Buildings 181 and 804. The remediation of TPH-contaminated soil and associated risk assessment were conducted under the UST program as an independent action under MTCA regulations (Washington Administrative Code [WAC] 173-340-450), as reported in the Independent Remedial Action Report (Navy 2000). After this removal action, and follow-on sampling and risk assessment, it was determined that petroleum hydrocarbons posed no current human health or ecological risk and were dropped from the COC list.

The current conceptual site model indicates that VOCs and metals were identified as COCs due to risks associated with exposure to soil, groundwater, and produce by future hypothetical residents and the potential for human health and ecological exposure from contaminants discharging to Port Orchard Bay impacting marine sediment and tissue (Navy 2015a). VOC and metal concentrations above remediation goals (RGs) remain in the upper

aquifer, generally exhibiting stable or decreasing concentration trends except for trichloroethene (TCE) at two locations which exhibit an increasing concentration trend (Navy 2015a). Continued monitoring of groundwater and an intertidal seep is intended to confirm the effectiveness of the remedy (source removal, monitored natural attenuation, and ICs), and document progression toward achieving RGs.

1.3 OBJECTIVE AND SCOPE OF WORK

Remedial Action Objectives (RAOs) specified in the OU 2 ROD (Navy, EPA, and Ecology 1994) for Area 8 are:

- Prevent human exposures to carcinogenic chemicals resulting in cumulative risks above the 10^{-4} to 10^{-6} risk range.
- Prevent human exposures to noncarcinogenic chemicals resulting in a noncancer hazard index greater than 1.
- Prevent exposures to chemicals resulting in significant ecological risks.
- Prevent exposures to chemicals above Applicable or Relevant and Appropriate Requirements (ARARs). Principal chemical-specific ARARs for OU 2 are:
    - MTCA, 173-340 WAC, which establishes cleanup levels for groundwater, soil, and surface water based on human health risk. The cumulative sum of the individual chemical risks may not exceed 10^{-5} incremental cancer risk and a hazard index of 1 for noncancer risk.
    - The national drinking water regulations, Code of Federal Regulations (40 CFR 141, 142, and 143) and the State Board of Health drinking water regulations (246-290-310 WAC) which establish federal and state drinking water standards applicable to public water supplies.
    - The Water Quality Standards for Surface Waters of the State of Washington (173-201A WAC) which establish state standards for surface water and incorporates federal ambient water quality criteria.
    - The Sediment Management Standards (173-204 WAC) which establish state standards for marine sediments.

RAOs for Area 8 groundwater focus on preventing ingestion of metals (specifically cadmium and chromium) and VOCs (TCE and 1,1-dichloroethene [DCE]) above drinking water standards, or acceptable human health risk levels. Because it was recognized that

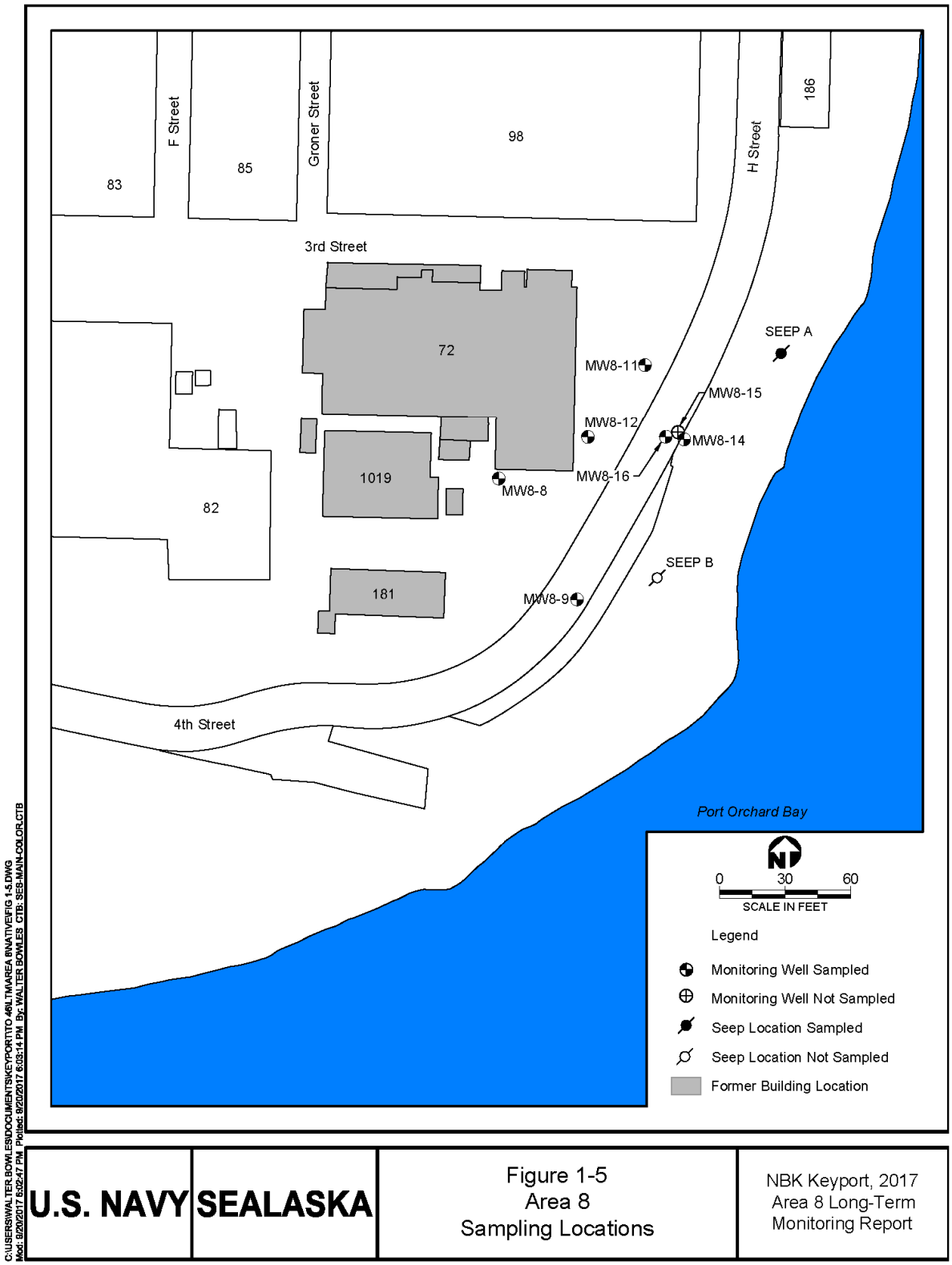
contaminants in Area 8 groundwater could cause future impacts or human health risks in Liberty Bay, RAOs developed for groundwater also include protection of sediments and surface water quality offshore of Area 8.

The overall objective of the LTM program is to assess the effectiveness of contaminated soil removal, establish contaminant trends in groundwater over time, and determine whether additional groundwater controls are necessary, or if ICs prohibiting the use of groundwater as a drinking water source can be discontinued. Data generated in the LTM program are compared to the RGs established in the OU 2 ROD to evaluate whether the selected remedy is making progress toward the RGs (Navy, EPA, and Ecology 1994). Seep monitoring is performed to evaluate the type, magnitude, and trends of contaminants being discharged to Port Orchard Bay from the shallow aquifer. Sediment and marine tissue monitoring are performed to determine if contaminated groundwater discharging from Area 8 has impacted sediment and marine tissue immediately downgradient of the site, and to support risk assessment efforts.

The LTM program at OU 2 Area 8 includes measuring depths to groundwater in site monitoring wells, and collecting and analyzing groundwater, seep, sediment, and marine tissue samples. The June 2017 monitoring event included the following scope of work:

- Measuring depths to groundwater in seven groundwater monitoring wells;
- Collecting groundwater samples from six groundwater monitoring wells;
- Collecting a seep sample at one location on the beach bordering Port Orchard Bay;
- Collecting quality assurance/quality control (QA/QC) samples;
- Laboratory analysis of groundwater, seep, and QA/QC samples using EPA Method 8260C for VOCs, Methods 200.7 and 200.8 for dissolved metals, and modified Method 1640 for reductive precipitation preparation of dissolved metals samples prior to analysis;
- Laboratory analysis of groundwater and QA/QC samples using EPA Method 8270D with selected ion monitoring (SIM) for 1,4-dioxane; and
- Third-party data validation of the laboratory data packages.

Sampling locations are shown on Figure 1-5.



U.S. NAVY	SEALASKA	Figure 1-5 Area 8 Sampling Locations	NBK Keyport, 2017 Area 8 Long-Term Monitoring Report

1.3.1 Selected Remedy

The selected remedy for Area 8 described in the ROD (Navy, EPA, and Ecology 1994) is implemented, construction is complete for all elements, monitoring activities are ongoing, and ICs are in place. The remedy includes the following components:

- Conduct LTM of groundwater and groundwater seeps in the intertidal zone of Area 8.
- Implement ICs for soil and groundwater.
- Implement contingent groundwater control actions if a risk assessment of sediments and marine tissue from Area 8 demonstrates that groundwater is a significant source of the identified risk.

The point of compliance for the groundwater RGs is defined as the entire site. This approach was taken because metals and VOCs in groundwater are widespread at the site. The effectiveness of the remedy at the site will be assessed by (1) conducting groundwater monitoring at upland monitoring wells to ensure that contaminant concentrations continue to reduce and (2) conducting groundwater monitoring at shoreline monitoring wells and one seep that discharges to marine surface water to ensure that the adjacent marine environment is not adversely impacted.

1.3.2 Chemicals of Concern

Nine inorganic analytes and eighteen VOCs are analyzed in groundwater and groundwater seep samples as COCs at Area 8. The COCs are shown in Section 1.4, Table 1-1. Although not listed as a COC in the ROD, 1,4-dioxane was added to the LTM analyte list as an emergent contaminant during the Third Five-Year Review (Navy 2010a).

1.4 REMEDIATION GOALS

The groundwater RGs for Area 8 are based on the most stringent regulatory criteria for the protection of drinking water to protect future potential residential users of groundwater (as a drinking water source) and for the protection of surface water to protect the ecosystem and potential future recreational and subsistence users of the Area 8 beach. The RG for each chemical was selected in the ROD as the lowest value included in the applicable or relevant and appropriate regulatory criteria. Selected Area 8 RGs are bolded in Table 1-1, and are listed under “MTCA Method B Cleanup Levels” for surface water and groundwater.

Table 1-1. OU 2, Area 8 Remediation Goals for Groundwater and Surface Water

	Drinking Water (µg/L)				Surface Water (µg/L)		
					State Water Quality Standards		MTCA Method B Cleanup Level[2/]
Chemical	**RI Background Value for Groundwater (µg/L)[1/]**	**Federal MCL**	**State MCL**	**MTCA Method B Cleanup Level[2/]**	**Ambient Marine[3/,4/]**	**Fish Ingestion[5/]**	
Inorganics							
Arsenic	12	50	50	**0.05**	36	0.14	**0.14**
Barium	130	2,000	1,000	**1,000**	NE	NE	NE
Cadmium	2.5	5	10	**5**	8	107	**8**
Chromium (III)	NE	NE	NE	**16,000**	NE	NE	**160,000**
Chromium (VI)	10 U	NE	NE	**80**	50	NE	**50**
Chromium (total)	4 U	100	50	**50**	NE	NE	NE
Copper	3 U	1,300[4/]	NE	**590**	2.5	NE	**2.5**
Lead	1 U	15[4/]	50	**15**	5.8	NE	**5.8**
Mercury	0.2 U	2	2	**2**	0.025	0.15	**0.025**
Nickel	3 U	100	NE	**100**	7.9	4,600	**7.9**
Silver	29	NE	NE	**48**	1.2	NE	**1.2**
Thallium	2 U	2	NE	**1.1**	NE	6.3	**1.6**
Tin	NE	NE	NE	**9,600**	NE	NE	NE
Zinc	19	NE	NE	**4,800**	77	NE	**77**
Volatile Organic Compounds							
Acetone	NE	NE	NE	**800**	NE	NE	NE
Benzene	NE	5	5	**5**	NE	71	**71**
Carbon tetrachloride	NE	5	5	**0.34**	NE	4.4	**4.4**
Chloroform	NE	100[6/]	100[6/]	**7.2**	NE	470	**470**
1,1-Dichloroethane	NE	NE	NE	**800**	NE	NE	**NE**
1,1-Dichloroethene	NE	7	7	**7**	NE	3.2	**3.2**
1,2-Dichloroethane	NE	5	5	**5**	NE	99	**5.9**
1,2-Dichloroethene (cis)	NE	70	NE	**70**	NE	NE	NE
1,2-DCE (trans)	NE	100	NE	**100**	NE	140,000	**33,000**
Ethylbenzene	NE	700	NE	**700**	NE	29,000	**69,000**
Styrene	NE	100	NE	**1.5**	NE	NE	NE
Tetrachloroethene	NE	5	NE	**5**	NE	8.9	**8.9**
Toluene	NE	1,000	NE	**1,000**	NE	200,000	**49,000**
1,1,1-Trichloroethane	NE	200	200	**200**	NE	170,000	**42,000**
1,1,2-Trichloroethane	NE	5	NE	**5**	NE	42	**42**
Trichloroethene	NE	5	5	**5**	NE	81	**81**
Xylenes	NE	10,000	NE	**10,000**	NE	NE	NE

Notes:

[1/] Background levels from Final Remedial Investigation Report (Navy 1993b).

[2/] Value listed accounts for adjustment when an MCL or water quality standard is "sufficiently protective" to serve as the MTCA cleanup level (Implementation Memo No. 1; Kraege 1993). Value does not account for adjustments due to background or practical quantitation limits.

[3/] Value listed is the lower of the chronic or acute standard for marine water.

[4/] The standard for copper and lead are "treatment techniques." Copper and lead have action levels, rather than MCLs. When applied to a purveyor of a public water supply, if the concentration measured at the tap exceeds the action level, this requires implementation of specified treatment techniques (40 CFR 261 Subpart I).

[5/] Value listed was derived from: 40 CFR 131.36, WAC 173-201A-040(3), and federal water quality criterion documents (as amended). If values conflicted, the value was selected in the following order of preference: 40 CFR 131.36 supersedes WAC 173-201A-040(3), which supersedes the federal criterion documents.

[6/] Based on trihalomethanes

Bolded values indicate the selected RG for each analyte (based on the most stringent value).

µg/L – microgram per liter
CFR – Code of Federal Regulations
N – Value is based on the non-cancerous rather than cancerous effects.
NE – Not established
U – Not detected at the specified concentration
MCL – maximum contaminant level
MTCA – Model Toxics Control Act
RI – remedial investigation
WAC – Washington Administrative Code

Because 1,4-dioxane was not specified in the ROD as a COC, no RG was established. However, to allow for data evaluation, the results of 1,4-dioxane analyses are compared to the MTCA Method B risk-based cleanup level (carcinogenic) for 1,4-dioxane. This cleanup level was reduced by Ecology in August 2010 from 4.4 to 0.44 microgram per liter (µg/L).

As previously discussed, the dissolved metals tin, thallium, and mercury were removed from the Area 8 analyte list by TO 46 FCR-02 (Appendix A) based upon recommendations made in the Spring 2016 LTM Report for Area 8 (Navy 2017b). Tin, thallium, and mercury had either not been detected at PQLs well below the RGs for these metals, or were detected at trace concentrations well below the RGs for many years.

2. FIELD ACTIVITIES

Groundwater and seep water samples were collected from the groundwater monitoring wells and the seep identified for sampling during the 2017 LTM event in the MMA SAP (Navy 2017a). Sampling was conducted in accordance with the procedures established in the MMA SAP sections for Area 8, as amended by TO 46 FCR-02 (Appendix A), and the Navy Standard Operating Procedures (SOPs) for environmental sampling (NAVFAC Northwest 2015). On June 21, 2017, groundwater samples were collected from groundwater monitoring wells MW8-8, MW8-9, MW8-11, MW8-12, MW8-14, and MW8-16 (Figure 1-5) during an extreme low-tide event and within 6 hours after the low tide. On June 22, 2017, a water sample was collected from Seep A during low tide (Figure 1-5).

Time-coincident depth to groundwater measurements were taken during low tide on June 21, 2017, between 0932 and 0936 hours in the wells listed above, along with an additional well, MW8-15, which was not scheduled for sampling. The low tide in Liberty Bay on June 21, 2017, was predicted to be -1.2 feet at 0932 hours (www.saltwatertides.com). Depth to groundwater was measured using an electronic water level indicator with a tape graduated in hundredths of a foot. Measurements were made from the surveyed top of casing elevation mark on each well.

Immediately prior to sampling, five of the six groundwater monitoring wells were purged with low-flow technique using a peristaltic pump with dedicated polyethylene tubing. The deeper well MW8-16 was purged with a submersible pump with dedicated tubing to allow placement of the pump intake at mid-screen depth (i.e., at approximately 45 feet below the top of the well casing) in accordance with the MMA SAP (Navy 2017a). The purging rate was maintained at 0.4 liters per minute. During purging, the water-quality parameters potential hydrogen (pH), specific conductance, turbidity, temperature, salinity, dissolved oxygen, and oxygen-reduction potential (redox) were measured and recorded every 5 minutes using a Horiba U22 water quality instrument. When pH, specific conductance, turbidity, and temperature stabilized to within 10 percent in consecutive measurements, groundwater samples were collected directly into clean, pre-preserved, laboratory-supplied containers.

The seep sample was collected during low tide on June 22, 2017. Sampling was conducted by digging a shallow excavation at the seep location. After allowing the water flowing into the excavation to become clear and recording water-quality parameters (pH, specific conductance, turbidity, and temperature), seep water was transferred from the excavation to clean, pre-preserved, laboratory-supplied containers by low-flow sampling techniques using a peristaltic pump.

The sample containers were packaged and shipped to ALS Environmental, Kelso, Washington, in accordance with the MMA SAP for Area 8 (Navy 2017a). Purge water, disposable polyethylene tubing, and general sampling waste (nitrile gloves, paper towels, plastic bags, etc.) from the sampling event were the only investigation-derived wastes generated. The purge water was disposed of by NBK Keyport personnel at Building 1051, as specified in the SAP. The disposable tubing and general non-hazardous sampling waste were placed in a designated on-site commercial waste dumpster.

Field forms and chain of custody documentation from the sampling event are included in Appendix B.

Final parameter measurements recorded immediately before sampling are shown in Table 2-1 below. Historical parameters recorded during sampling events from spring 2007 through spring 2017 are shown in Table B-1 in Appendix B.

Table 2-1. Field Parameter Measurements for Groundwater and Seep Sampling

Location	Sample Date	Sample Time	Temperature (Celsius)	pH	Specific Conductivity (mS/cm)	Salinity (%)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Redox (millivolts)
MW8-8	6/21/2017	1245	18.70	6.92	0.343	0.02	2.1	4.89	131
MW8-9	6/21/2017	1200	16.65	7.08	29.0	1.77	6.1	6.43	137
MW8-11	6/21/2017	1040	17.29	6.80	21.8	1.30	2.0	6.81	223
MW8-12	6/21/2017	0955	15.50	7.29	4.99	0.27	1.3	7.07	138
MW8-14	6/21/2017	1130	16.08	7.97	36.6	2.27	2.6	7.44	123
MW8-16	6/21/2017	1420	18.02	6.96	15.0	0.87	1.7	3.85	-78
SEEP A	6/22/2017	0945	16.50	7.02	28.8	1.77	15.2	6.21	136

Notes:
MW denotes groundwater monitoring well
mg/L – milligrams per liter
mS/cm – milliSiemens per centimeter
NTU – nephelometric turbidity unit

All of the field-measured water-quality parameters stabilized per requirements of the sampling protocol described in the MMA SAP. All of the parameters were similar to historical data collected from the same locations (see Appendix B, Table B-1).

Wells MW8-9; -11; -14; and -16 have historically exhibited conductivity and salinity greater than fresh water but less than the average salinity for Liberty Bay of around 2.9%. This is indicative that some degree of mixing of seawater and freshwater is occurring in the aquifer, as is expected in shallow groundwater at locations immediately adjacent to the Puget Sound.

3. LABORATORY ANALYSIS AND DATA VALIDATION

Analysis of groundwater and seep samples was performed by ALS Environmental, Kelso, Washington. The samples were analyzed according to EPA Method 8260C for VOCs (18 analytes), EPA Method 8270D SIM for the SVOC 1,4-dioxane (well samples only), and EPA Methods 200.7 and 200.8 for dissolved metals (nine analytes). Prior to analysis for dissolved metals by Method 200.8, the laboratory performed a reductive precipitation preparation using modified Method 1640 to reduce interferences.

The laboratory analytical report and an electronic data deliverable in a format compatible with Ecology's Environmental Information Management (EIM) system have been included on the compact disc attached to this report.

Laboratory Data Consultants, Inc. (Carlsbad, California) performed a Level 3 data validation using National Functional Guidelines for Inorganic Superfund Methods Data Review (EPA 2017a); National Functional Guidelines for Organic Superfund Methods Data Review (EPA 2017b); and Navy SOPs (NAVFAC Northwest 2015). The data validation reports are presented in Appendix C. Laboratory analytical results summary forms are included in the data validation reports. Data validation included a review of holding times, instrument performance checks, calibrations, laboratory and trip blanks, surrogate recovery, internal standards, interference check samples, serial dilutions, laboratory control samples, matrix spike/matrix spike duplicate sets, and field duplicate sets.

The data validation reports (Appendix C) indicate that the reviewed items, with a few exceptions, met the objectives identified in the MMA SAP (Navy 2017a), as amended by TO 46 FCR-02 (Appendix A). As discussed in Appendix C, data qualifiers were applied to sample results on the basis of trace contamination in a laboratory method blank and trip blank, and a percent difference (%D) value outside of control limits in one calibration standard. Ten sample results, which consist of nine VOC results and one dissolved metal result, out of a total of 268 sample results were qualified during validation. Thus, 3.7 percent of the sample results were qualified during validation, which is a relatively low percentage for a project of this size and nature. In addition to qualifiers applied during data validation, the laboratory applied J flags to several sample results that were detected at concentrations at or greater than the method detection limit but less than the PQL (referred to as a "limit of quantitation" or LOQ in the laboratory reports).

As discussed in the applicable data validation reports (Appendix C), no VOCs were detected in the trip blanks submitted with the field samples, with the following exception: one trip blank contained toluene (a VOC analyte) at an estimated concentration of 0.35 J µg/L. Therefore, six groundwater sample results for toluene at concentrations below the PQL were elevated to the PQL and qualified as not detected (U) during data validation. The trace detections of toluene in the samples and trip blank were significantly less than the applicable RGs of 1,000 µg/L (for drinking water) and 49,000 µg/L (for surface water); thus, the trace contamination and data qualification do not affect data usability.

Field duplicate sets were collected from well MW8-11 (for VOCs, 1,4-dioxane, and dissolved metals) and Seep A (for VOCs and dissolved metals) during the 2017 sampling event. The 55 paired results for the two field duplicate sets indicate data precision was acceptable, as demonstrated by all relative percent difference (RPD) values for analytes detected in both members of the field-duplicate set meeting the project goal of less than or equal to 50 percent, as specified in the MMA SAP (Navy 2017a). Thus, overall precision was considered acceptable.

In accordance with project specifications, matrix spike and matrix spike duplicate sets were collected at well MW8-14 (for VOCs, 1,4-dioxane, and dissolved metals) and at Seep A (for VOCs and dissolved metals). The percent recoveries for 108 out of 110 spiked analytes were within QC limits, and all RPDs were within QC limits, as specified in the MMA SAP. For the sample from Seep A, the percent recoveries for cadmium were outside the control limit; however, the original sample concentration was greater than four times the amount spiked. In accordance with data validation guidelines, the associated sample results were not qualified based on a matrix spike recovery since the recoveries were not indicative of a problem with data quality.

In conclusion, the majority of the items reviewed during data validation were within project control limits. In a few cases, data qualifiers were applied due to minor QC issues. The validated analytical data for the 2017 event, as qualified, are useable for the intended purposes of the project.

4. GROUNDWATER FLOW AND ANALYTICAL RESULTS

This section interprets the depth to groundwater data, summarizes the distribution of contaminants detected in the samples collected in June 2017, and compares the reported concentrations to the RGs (if established).

4.1 GROUNDWATER FLOW

Table 4-1 summarizes the water table and total well depth measurements, measurement point elevations, and associated groundwater elevations (hydraulic heads). Groundwater elevation contours, flow direction, and hydraulic gradient were estimated based on groundwater elevations (see Figure 1-4). On the basis of the depth to groundwater measurements performed on June 21, 2017, the shallow groundwater flow direction is inferred to be from the west-northwest toward the east-southeast. The horizontal hydraulic gradient varies from approximately 0.025 (2.5 percent) on the northern portion of Area 8 to approximately 0.015 (1.5 percent) on the southern portion of Area 8, which is consistent with historical gradients calculated for Area 8 (Navy 2014, 2015b, 2016b, and 2017b).

Table 4-1. June 2017 Groundwater Table Measurements at Area 8

Location ID	Top of Casing Elevation (feet above msl)	Depth to Water (feet btoc)	Water Level Elevation (feet above msl)	Screened Interval (feet btoc)
MW8-8	12.50	9.77	2.73	4.5-19.5
MW8-9	11.93	10.16	1.77	5-20
MW8-11	12.40	10.03	2.37	7-17
MW8-12	11.95	9.33	2.62	7-17
MW8-14	12.14	10.74	1.40	5-15
MW8-15[1/]	12.47	10.33	2.14	160.5-165.5
MW8-16[1/]	12.62	11.91	0.71	42.5-47.5

Notes:
[1/]Screened below the water table.
Measurements were conducted on June 21, 2017 between 0932 and 0936 hours. Low tide was -1.2 feet at 0932 hours.
msl – mean sea level
btoc – below top of casing

The direction of shallow groundwater flow at Area 8, which is approximately perpendicular to the shoreline, is expected for an aquifer discharging to surface water (Figure 1-4). The flow orientation is similar to the inferred direction of flow in the springs of 2006 through 2016 (Navy 2006, 2007, 2008, 2009, 2010b, 2012a, 2012b, 2014, 2015b, 2016b, and 2017b), but varies slightly from the direction inferred in 2005, which was toward the east-northeast (Navy 2005). The noted variation was likely the result of tidal influences on the upper aquifer near

the shoreline that caused apparent short-term hydraulic head variations. Wells MW8-14 and MW8-16 are both interpreted to be screened within the shallow aquifer. Hydraulic head variations in the collocated wells MW8-14, MW8-15, and MW8-16 appear to indicate that there is a downward gradient in the shallow aquifer between monitoring wells MW8-14 (water level elevation 1.40 feet above msl) and MW8-16 (water level elevation 0.71 feet above msl), but that a confining layer exists between the screened interval of well MW8-16 (42.5-47.5 feet below top of casing [btoc]; water elevation of 0.71 feet above msl) and the screened interval of well MW8-15 (160.5-165.5 feet btoc; water elevation of 2.14 feet above msl). This confining layer, which creates an upward gradient between the shallow and deeper aquifer, reduces the potential for downward migration of contaminants from the shallow to the deeper aquifer in this area. The groundwater in the shallow aquifer is known to discharge at Seep A and other seeps along the beach adjacent to Area 8.

4.2 GROUNDWATER ANALYTICAL RESULTS

Groundwater was sampled from wells MW8-8, MW8-9, MW8-11, MW8-12, MW8-14, and MW8-16 during spring 2017. Data for selected VOCs from fall 1995 through spring 2017 are summarized in Table 4-2, and are shown on Figure 4-1. Data for 1,4-dioxane for 2007 and 2011 through 2017 are summarized in Table 4-3. Data for selected metals from 1995 through 2017 are summarized in Table 4-4, and are shown on Figure 4-2. Results of selected VOCs, 1,4-dioxane, and dissolved metals analyses are discussed in the report subsections following Tables 4-2 through 4-4 and Figures 4-1 and 4-2. VOCs and metals listed in Table 1-1 but not discussed in this section have either not been detected at or above the laboratory PQLs, or have been detected only at relatively low levels below RGs since 1995.

Table 4-2. Summary of Selected VOC Results for Area 8 Groundwater Sampling Locations, Fall 1995 through Spring 2017

Location 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)	
Drinking Water Remediation Goals		5		5		7		70		200	
Surface Water Remediation Goals		81		8.9		3.2		--		42,000	
MW8-8	11-95	**190**	**J**	**49**	**J**	1		2		23	
MW8-8	05-96	**110**	**J**	**34**		0.9	J	1		11	
MW8-8	09-96	**190**	**J**	**58**	**J**	1		2		19	
MW8-8	05-97	**68**	**J**	**15**		1	U	1		3	
MW8-8	10-97	**78**	**J**	**19**		0.6	U	2		9	
MW8-8	05-98	**63**	**J**	**12**		1	U	0.9	J	3	
MW8-8	10-98	**76**	**J**	**30**		1	U	1	U	9	
MW8-8	05-99	**58**	**J**	5	U	5	U	5	U	5	U
MW8-8	11-99	**150**		2		1		3.2		10	
MW8-8	06-00	**120**		**23**		1	J	4.5		6.6	
MW8-8	06-01	**84**	**J**	**20**		1.3		7.3		3.9	
MW8-8	06-02	**81**	**J**	**17**		1.1		7.3		3.9	
MW8-8	06-03	**81**	**J**	**12**		0.94		6.8		2.7	
MW8-8	06-04	**80**		**13**		1.1		8.5		2.9	
MW8-8	06-05	**64**		**11**		0.7		7.4		2	
MW8-8	06-06	**68**	**D**	**9.2**		0.68		7.6		2.2	
MW8-8	06-07	**53**	**D**	**7.7**		0.55		7.5		1.7	
MW8-8	05-08	**59**		**8.4**		0.41	J	6.6		1.6	
MW8-8	06-09	**66**		**5.6**		0.69		9.1		1.6	
MW8-8	06-10	**58**		**5.1**		0.55		8.4		1.5	
MW8-8	07-11	**59**		**6.0**		0.37	J	5.9		1.5	
MW8-8	06-12	**38**		**9.7**		0.14	J	2.1		1.1	
MW8-8	06-13	**24**	**J**	**9.0**		0.5	U	0.46	J	0.6	
MW8-8	06-14	**32**		**9.8**		0.5	U	0.83		0.83	
MW8-8	06-15	**26**		**8.4**		0.5	U	0.45	J	0.87	
MW8-8	06-16	**37**		**6.9**		0.11	J	1.2		0.90	
MW8-8	06-17	**40**		**7.1**		0.11	J	1.6		0.93	
MW8-9	11-95	**1,600**	**J**	50	U[1]	50	U[1]	27	J	50	U
MW8-9	05-96	**800**	**J**	1	U	1	U	28		2	
MW8-9	09-96	**1,000**	**J**	0.4	J	1	U	28		2	
MW8-9	05-97	**1,400**	**J**	0.3	J	1	U	34	J	2	
MW8-9	10-97	**720**	**J**	1	U	1	U	50	U	1	
MW8-9	05-98	**370**	**J**	1	U	1	U	12		0.7	J
MW8-9	10-98	**610**	**J**	1	U	1	U	34	J	3	
MW8-9	05-99	**84**	**J**	1	U	1	U	6		1	U
MW8-9	11-99	**500**		0.6		0.5	U	30		1.4	
MW8-9	06-00	**170**		2.5	U	2.5	U	15		1	J
MW8-9	06-01	**330**	**J**	0.26	J	0.24	U	18	J	0.44	J
MW8-9	06-02	**60**	**J**	0.23	J	0.12	U	7.5		0.69	
MW8-9	06-03	**21**		0.11	U	0.12	U	1.3		0.23	J
MW8-9	06-04	**25**		0.18	J	0.12	U	1.7		0.44	J
MW8-9	06-05	4.1		0.2	U	0.2	U	0.2		0.2	U
MW8-9	06-06	3.9		0.20	J	0.5	U	0.42	J	0.28	J

Table 4-2. Summary of Selected VOC Results for Area 8 Groundwater Sampling Locations, Fall 1995 through Spring 2017 (continued)

Location 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)	
Drinking Water Remediation Goals		5		5		7		70		200	
Surface Water Remediation Goals		81		8.9		3.2		--		42,000	
MW8-9	06-07	1.9		0.5	U	0.5	U	0.27	J	0.15	J
MW8-9	05-08	1.7		0.16	J	0.5	U	0.23	J	0.14	J
MW8-9	06-09	**20**		0.18	J	0.2	U	1.3		0.14	J
MW8-9	06-10	**9.4**		0.11	J	0.5	U	0.69		0.12	J
MW8-9	07-11	**12**		0.12	J	0.5	U	0.80		0.11	J
MW8-9	06-12	**14**		0.49	J	0.5	UJ	1.2		0.16	
MW8-9	06-13	**43**	**J**	0.18	J	0.5	U	2.7		0.13	J
MW8-9	06-14	**24**		0.29	J	0.5	U	1.5		0.12	J
MW8-9	06-15	**5.6**		0.16	J	0.5	U	0.35	J	0.13	J
MW8-9	06-16	0.27	J	0.10	J	0.50	U	0.070	J	0.15	J
MW8-9	06-17	0.12	J	0.13	J	0.50	U	0.50	U	0.50	U
MW8-11	11-95	**84**	**J**	1	U	**44**	**J**	1	U	**520**	**J**
MW8-11	05-96	**84**	**J**	1	U	**47**	**J**	1	U	**460**	**J**
MW8-11	09-96	**83**		1	U	**31**		0.3	J	**470**	
MW8-11	05-97	**80**	**J**	1	U	**42**	**J**	1	U	**500**	**J**
MW8-11	10-97	**62**	**J**	1	U	**30**	**J**	1	U	**300**	**J**
MW8-11	05-98	**61**	**J**	1	U	**33**		1	U	**200**	**J**
MW8-11	10-98	**62**	**J**	1	U	**35**	**J**	1	U	**220**	**J**
MW8-11	05-99	**27**	**J**	2	U	**8**	**J**	2	U	45	J
MW8-11	11-99	**54**		0.5	U	**12**		0.5	U	64	
MW8-11	06-00	**41**	**J**	0.5	U	**12**		0.4	J	82	J
MW8-11	06-01	**62**		0.27	J	**15**		0.38	J	91	J
MW8-11	06-02	**92**	**J**	0.79		**17**		0.46	J	84	J
MW8-11	06-03	**99**	**J**	0.64		**22**		0.49	J	80	J
MW8-11	06-04	**110**		0.66		**25**		0.37	J	80	
MW8-11	06-05	**61**		0.5		**10**		0.2		33	
MW8-11	06-06	**99**	**D**	0.68		**10**		0.27	J	39	
MW8-11	06-07	**46**	**D**	0.81		3.3		0.29	J	21	
MW8-11	05-08	**53**		1.1		2.4		0.37	J	31	
MW8-11	06-09	**67**		1.2		1.6		0.38	J	22	
MW8-11	06-10	**80**	**D**	1.4		1.5		0.80		14	
MW8-11	07-11	**75**		0.79		0.35	J	0.82		10	
MW8-11	06-12	**56**	**D**	1.1		0.77	J	0.81		9.7	
MW8-11	06-13	**67**		1.0		0.56		0.61		6.7	
MW8-11	06-14	**55**		0.90		0.21	J	0.45	J	5.0	
MW8-11	06-15	**63**		0.77		0.20	J	0.55		6.3	
MW8-11	06-16	**45**		0.50		0.10	J	0.38	J	4.2	
MW8-11	06-17	**24**		0.44	J	0.50	U	0.26	J	3.0	
MW8-12	11-95	**85**	**J**	**13**		**10**		1		140	J
MW8-12	05-96	**63**	**J**	**5**		**14**		1	U	180	J
MW8-12	09-96	**120**	**J**	**23**		**20**		2		**250**	**J**
MW8-12	05-97	**63**	**J**	**12**		6		1		67	J

Table 4-2. Summary of Selected VOC Results for Area 8 Groundwater Sampling Locations, Fall 1995 through Spring 2017 (continued)

Location 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)
Drinking Water Remediation Goals		5	5	7	70	200
Surface Water Remediation Goals		81	8.9	3.2	--	42,000
MW8-12	10-97	**44 J**	**8**	4	1	41 J
MW8-12	05-98	**46 J**	**10**	2	2	20
MW8-12	10-98	**46 J**	**15**	1 U	1 U	22
MW8-12	05-99	**25 U**	4	1 U	1 U	8
MW8-12	11-99	**50**	**9.7**	0.9	2.1	14
MW8-12	06-00	**54**	**16**	0.5 J	3	6.8
MW8-12	06-01	**76**	**14**	0.67	4.8	6.5
MW8-12	06-02	**47**	**14**	0.49 J	4.5	5
MW8-12	06-03	**36**	**9.8**	0.31 J	3.2	3.2
MW8-12	06-04	**40**	**8.5**	0.34 J	3.1	4.1
MW8-12	06-05	**34**	**8.8**	0.3	3.3	2.8
MW8-12	06-06	**31**	**7.9**	0.28 J	2.5	2.5
MW8-12	06-07	**37**	**6.8**	0.22 J	3.5	2.0
MW8-12	05-08	**28**	**7.7**	0.15 J	2.4	1.8
MW8-12	06-09	**52**	**11**	0.18 J	3.4	2.5
MW8-12	06-10	**31**	**6.2**	0.20 J	3.9	1.5
MW8-12	07-11	**31**	**6.0**	0.11 J	3.0	2.1
MW8-12	06-12	**31**	**6.3**	0.5 UJ	1.8	1.6
MW8-12	06-13	**23**	**5.6**	0.5 U	0.5	1.2
MW8-12	06-14	**22**	**5.7**	0.5 U	0.39 J	1.1
MW8-12	06-15	**17**	4.6	0.5 U	0.26 J	1.7
MW8-12	06-16	**11**	2.9	0.50 U	0.19 J	1.2
MW8-12	06-17	**10**	2.8	0.50 U	0.28 J	0.87
MW8-14	11-95	1 U	1 U	1 U	1 U	1 U
MW8-14	05-96	1 U	1 U	1 U	1 U	1 U
MW8-14	09-96	1 U	1 U	1 U	1 U	1 U
MW8-14	05-97	1 U	1 U	1 U	1 U	1 U
MW8-14	10-97	1 U	1 U	1 U	1 U	1 U
MW8-14	05-98	1 U	1 U	1 U	1 U	1 U
MW8-14	10-98	1 U	1 U	1 U	1	1 U
MW8-14	05-99	1 U	1 U	1 U	1 U	1 U
MW8-14	11-99	0.5 U	0.5 U	0.5 U	3.2	0.5 U
MW8-14	06-00	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW8-14	06-01	0.12 U	0.11 U	0.12 U	0.12 U	0.93
MW8-14	06-02	0.12 U	0.11 U	0.12 U	0.12 U	0.18 J
MW8-14	06-03	0.12 U	0.11 U	0.12 U	0.12 U	0.12 U
MW8-14	06-04	0.12 U	0.11 U	0.12 U	0.12 U	0.12 J
MW8-14	06-05	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
MW8-14	06-06	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW8-14	06-07	0.23 J	0.5 U	0.5 U	0.5 U	0.5 U
MW8-14	05-08	0.5 U	0.5 U	0.5 U	0.5 U	0.11 J
MW8-14	06-09	0.5 U	0.5 U	0.2 U	0.5 U	0.10 J

Table 4-2. Summary of Selected VOC Results for Area 8 Groundwater Sampling Locations, Fall 1995 through Spring 2017 (continued)

Location 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)	
Drinking Water Remediation Goals		5		5		7		70		200	
Surface Water Remediation Goals		81		8.9		3.2		--		42,000	
MW8-14	06-10	0.5	U	0.5	U	0.5	U	0.5	U	0.18	J
MW8-14	07-11	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
MW8-14	06-12	0.5	U	0.5	U	0.5	UJ	0.5	U	0.5	U
MW8-14	06-13	0.5	UJ	0.5	U	0.5	U	0.5	U	0.5	U
MW8-14	06-14	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
MW8-14	06-15	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
MW8-14	06-16	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
MW8-14	06-17	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
MW8-16	11-95	**58**	**J**	0.6	J	1	U	2		2	
MW8-16	05-96	**72**	**J**	0.8	J	1	U	2		2	
MW8-16	09-96	**69**	**J**	0.8	J	1	U	3		2	
MW8-16	05-97	**57**	**J**	0.8	J	1	U	2		2	
MW8-16	10-97	**47**	**J**	0.6	J	1	U	2		2	
MW8-16	05-98	**63**	**J**	0.8	J	1	U	2		1	
MW8-16	10-98	**47**	**J**	1	U	1	U	3		1	U
MW8-16	05-99	**40**		1	U	1	U	6		2	
MW8-16	11-99	**63**		0.8		0.5	U	5.3		1.7	
MW8-16	06-00	**51**		0.7		0.59		16		1.1	
MW8-16	06-01	**74**	**J**	0.84		0.77		21		1.2	
MW8-16	06-02	**130**	**J**	0.99		0.67		30		0.83	
MW8-16	06-03	**190**	**J**	1.5		0.57		28		0.94	
MW8-16	06-04	**120**		0.75		0.61		130		0.49	J
MW8-16	06-05	**350**		2.2		0.9		34		0.7	
MW8-16	06-06	**200**	**D**	1.1		0.64		93	D	0.33	J
MW8-16	06-07	**430**	**D**	1.5		0.68		38		0.42	J
MW8-16	05-08	**380**	**D**	1		0.65		67	D	0.18	J
MW8-16	06-09	**140**	**D**	0.64		0.21		14		0.13	J
MW8-16	06-10	**79**	**D**	0.64		0.13	J	9.2		0.16	J
MW8-16	07-11	**88**		0.76		0.10	J	3.6		0.22	J
MW8-16	06-12	**56**	**D**	0.80		0.08	J	2.7		0.18	J
MW8-16	06-13	**50**		0.79		0.5	U	0.93		0.21	J
MW8-16	06-14	**50**		0.97		0.5	U	1		0.19	J
MW8-16	06-15	**48**		0.51		0.09	J	1.8		0.19	J
MW8-16	06-16	**8.1**		0.50	U	0.11	J	28		0.50	U
MW8-16	06-17	**7.2**		0.15	J	0.090	J	26		0.50	U

Notes:
Bold indicates detected value is equal to or exceeds the drinking water RG.
Shading indicates detected value is equal to or exceeds the surface water RG.
µg/L – microgram per liter
DCE – dichloroethene
D – result reported from a diluted analysis
ID – identification
J – estimated result
PCE – tetrachloroethene
TCA – trichloroethane
TCE – trichloroethene
U – not detected at value shown
U[1] – not detected at value shown and value exceeds remediation goal
VOC – volatile organic compounds

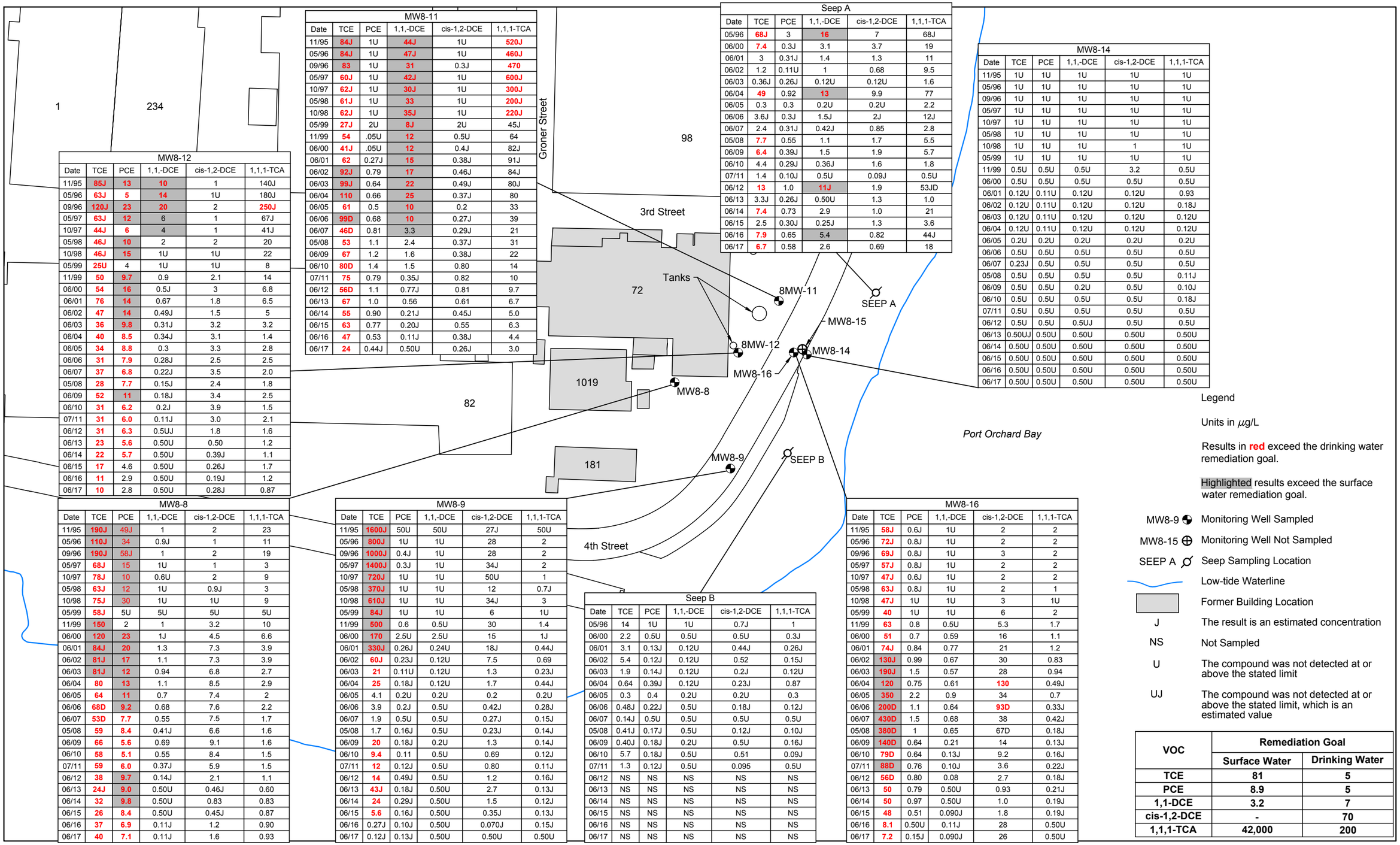
Table 4-3. Summary of 1,4-Dioxane Results for Area 8 Groundwater and Seep Sampling Locations, Spring 2007 through Spring 2017

Location ID	Date	1,4-Dioxane (µg/L)
MW8-8	06-07	**0.70 J**
MW8-8	07-11	1.0 U[1]
MW8-8	06-12	**0.76 J**
MW8-8	06-13	1.0 U[1]
MW8-8	06-14	1.0 U[1]
MW8-8	06-15	0.22 J
MW8-8	06-16	0.41
MW8-8	06-17	**1.1**
MW8-9	06-07	1.0 U[1]
MW8-9	07-11	1.0 U[1]
MW8-9	06-12	1.0 U[1]
MW8-9	06-13	1.0 U[1]
MW8-9	06-14	1.0 U[1]
MW8-9	06-15	0.40 U
MW8-9	06-16	0.25 J
MW8-9	06-17	0.40 U
MW8-11	06-07	**39**
MW8-11	07-11	**29**
MW8-11	06-12	**19**
MW8-11	06-13	**11**
MW8-11	06-14	**11**
MW8-11	06-15	**12**
MW8-11	06-16	**14**
MW8-11	06-17	**16**
MW8-12	06-07	**1.1**
MW8-12	07-11	0.18 J
MW8-12	06-12	**0.53 J**
MW8-12	06-13	1.0 U[1]
MW8-12	06-14	0.31 J
MW8-12	06-15	**0.53**
MW8-12	06-16	**1.1**
MW8-12	06-17	**1.1**
MW8-14	06-07	1.0 U[1]
MW8-14	07-11	1.0 U[1]
MW8-14	06-12	1.0 J
MW8-14	06-13	1.0 U[1]
MW8-14	06-14	1.0 U[1]
MW8-14	06-15	0.40 U
MW8-14	06-16	0.16 J
MW8-14	06-17	0.40 U
MW8-16	06-07	1.0 U[1]
MW8-16	07-11	1.0 U[1]
MW8-16	06-12	1.0 U[1]
MW8-16	06-13	1.0 U[1]
MW8-16	06-14	1.0 U[1]
MW8-16	06-15	0.40 U
MW8-16	06-16	0.22 J

Table 4-3. Summary of 1,4-Dioxane Results for Area 8 Groundwater and Seep Sampling Locations, Spring 2007 through Spring 2017 (continued)

Location ID	Date	1,4-Dioxane (µg/L)
MW8-16	06-17	0.40 U
Seep A	07-11	1.0 U[1]
Seep B	07-11	1.0 U[1]

Notes:
There is no remediation goal established for 1,4-dioxane.
Bold indicates detected value is equal to or exceeds the MTCA Method B cleanup level (0.44 µg/L).
µg/L – microgram per liter
U – Not detected at value shown
U[1] – not detected at value shown and value exceeds MTCA Method B cleanup level
J – Estimated value below reporting limit but above detection



MW8-12

Date	TCE	PCE	1,1,-DCE	cis-1,2-DCE	1,1,1-TCA
11/95	85J	13	10	1	140J
05/96	63J	5	14	1U	180J
09/96	120J	23	20	2	250J
05/97	63J	12	6	1	67J
10/97	44J	6	4	1	41J
05/98	46J	10	2	2	20
10/98	46J	15	1U	1U	22
05/99	25U	4	1U	1U	8
11/99	50	9.7	0.9	2.1	14
06/00	54	16	0.5J	3	6.8
06/01	76	14	0.67	1.8	6.5
06/02	47	14	0.49J	1.5	5
06/03	36	9.8	0.31J	3.2	3.2
06/04	40	8.5	0.34J	3.1	1.4
06/05	34	8.8	0.3	3.3	2.8
06/06	31	7.9	0.28J	2.5	2.5
06/07	37	6.8	0.22J	3.5	2.0
05/08	28	7.7	0.15J	2.4	1.8
06/09	52	11	0.18J	3.4	2.5
06/10	31	6.2	0.2J	3.9	1.5
07/11	31	6.0	0.11J	3.0	2.1
06/12	31	6.3	0.5UJ	1.8	1.6
06/13	23	5.6	0.50U	0.50	1.2
06/14	22	5.7	0.50U	0.39J	1.1
06/15	17	4.6	0.50U	0.26J	1.7
06/16	11	2.9	0.50U	0.19J	1.2
06/17	10	2.8	0.50U	0.28J	0.87

MW8-11

Date	TCE	PCE	1,1,-DCE	cis-1,2-DCE	1,1,1-TCA
11/95	84J	1U	44J	1U	520J
05/96	84J	1U	47J	1U	460J
09/96	83	1U	31	0.3J	470
05/97	60J	1U	42J	1U	600J
10/97	62J	1U	30J	1U	300J
05/98	61J	1U	33	1U	200J
10/98	62J	1U	35J	1U	220J
05/99	27J	2U	8J	2U	45J
11/99	54	.05U	12	0.5U	64
06/00	41J	.05U	12	0.4J	82J
06/01	62	0.27J	15	0.38J	91J
06/02	92J	0.79	17	0.46J	84J
06/03	99J	0.64	22	0.49J	80J
06/04	110	0.66	25	0.37J	80
06/05	61	0.5	10	0.2	33
06/06	99D	0.68	10	0.27J	39
06/07	46D	0.81	3.3	0.29J	21
05/08	53	1.1	2.4	0.37J	31
06/09	67	1.2	1.6	0.38J	22
06/10	80D	1.4	1.5	0.80	14
07/11	75	0.79	0.35J	0.82	10
06/12	56D	1.1	0.77J	0.81	9.7
06/13	67	1.0	0.56	0.61	6.7
06/14	55	0.90	0.21J	0.45J	5.0
06/15	63	0.77	0.20J	0.55	6.3
06/16	47	0.53	0.11J	0.38J	4.4
06/17	24	0.44J	0.50U	0.26J	3.0

Seep A

Date	TCE	PCE	1,1,-DCE	cis-1,2-DCE	1,1,1-TCA
05/96	68J	3	16	7	68J
06/00	7.4	0.3J	3.1	3.7	19
06/01	3	0.31J	1.4	1.3	11
06/02	1.2	0.11U	1	0.68	9.5
06/03	0.36J	0.26J	0.12U	0.12U	1.6
06/04	49	0.92	13	9.9	77
06/05	0.3	0.3	0.2U	0.2U	2.2
06/06	3.6J	0.3J	1.5J	2J	12J
06/07	2.4	0.31J	0.42J	0.85	2.8
05/08	7.7	0.55	1.1	1.7	5.5
06/09	6.4	0.39J	1.5	1.9	5.7
06/10	4.4	0.29J	0.36J	1.6	1.8
07/11	1.4	0.10J	0.5U	0.09J	0.5U
06/12	13	1.0	11J	1.9	53JD
06/13	3.3J	0.26J	0.50U	1.3	1.0
06/14	7.4	0.73	2.9	1.0	21
06/15	2.5	0.30J	0.25J	1.3	3.6
06/16	7.9	0.65	5.4	0.82	44J
06/17	6.7	0.58	2.6	0.69	18

MW8-14

Date	TCE	PCE	1,1,-DCE	cis-1,2-DCE	1,1,1-TCA
11/95	1U	1U	1U	1U	1U
05/96	1U	1U	1U	1U	1U
09/96	1U	1U	1U	1U	1U
05/97	1U	1U	1U	1U	1U
10/97	1U	1U	1U	1U	1U
05/98	1U	1U	1U	1U	1U
10/98	1U	1U	1U	1	1U
05/99	1U	1U	1U	1U	1U
11/99	0.5U	0.5U	0.5U	3.2	0.5U
06/00	0.5U	0.5U	0.5U	0.5U	0.5U
06/01	0.12U	0.11U	0.12U	0.12U	0.93
06/02	0.12U	0.11U	0.12U	0.12U	0.18J
06/03	0.12U	0.11U	0.12U	0.12U	0.12U
06/04	0.12U	0.11U	0.12U	0.12U	0.12U
06/05	0.2U	0.2U	0.2U	0.2U	0.2U
06/06	0.5U	0.5U	0.5U	0.5U	0.5U
06/07	0.23J	0.5U	0.5U	0.5U	0.5U
05/08	0.5U	0.5U	0.5U	0.5U	0.11J
06/09	0.5U	0.5U	0.2U	0.5U	0.10J
06/10	0.5U	0.5U	0.5U	0.5U	0.18J
07/11	0.5U	0.5U	0.5U	0.5U	0.5U
06/12	0.5U	0.5U	0.5UJ	0.5U	0.5U
06/13	0.50UJ	0.50U	0.50U	0.50U	0.50U
06/14	0.50U	0.50U	0.50U	0.50U	0.50U
06/15	0.50U	0.50U	0.50U	0.50U	0.50U
06/16	0.50U	0.50U	0.50U	0.50U	0.50U
06/17	0.50U	0.50U	0.50U	0.50U	0.50U

MW8-8

Date	TCE	PCE	1,1,-DCE	cis-1,2-DCE	1,1,1-TCA
11/95	190J	49J	1	2	23
05/96	110J	34	0.9J	1	11
09/96	190J	58J	1	2	19
05/97	68J	15	1U	1	3
10/97	78J	10	0.6U	2	9
05/98	63J	12	1U	0.9J	3
10/98	75J	30	1U	1U	9
05/99	58J	5U	5U	5U	5U
11/99	150	2	1	3.2	10
06/00	120	23	1J	4.5	6.6
06/01	84J	20	1.3	7.3	3.9
06/02	81J	17	1.1	7.3	3.9
06/03	81J	12	0.94	6.8	2.7
06/04	80	13	1.1	8.5	2.9
06/05	64	11	0.7	7.4	2
06/06	68D	9.2	0.68	7.6	2.2
06/07	53D	7.7	0.55	7.5	1.7
05/08	59	8.4	0.41J	6.6	1.6
06/09	66	5.6	0.69	9.1	1.6
06/10	58	5.1	0.55	8.4	1.5
07/11	59	6.0	0.37J	5.9	1.5
06/12	38	9.7	0.14J	2.1	1.1
06/13	24J	9.0	0.50U	0.46J	0.60
06/14	32	9.8	0.50U	0.83	0.83
06/15	26	8.4	0.50U	0.45J	0.87
06/16	37	6.9	0.11J	1.2	0.90
06/17	40	7.1	0.11J	1.6	0.93

MW8-9

Date	TCE	PCE	1,1,-DCE	cis-1,2-DCE	1,1,1-TCA
11/95	1600J	50U	50U	27J	50U
05/96	800J	1U	1U	28	2
09/96	1000J	0.4J	1U	28	2
05/97	1400J	0.3J	1U	34J	2
10/97	720J	1U	1U	50U	1
05/98	370J	1U	1U	12	0.7J
10/98	610J	1U	1U	34J	3
05/99	84J	1U	1U	6	1U
11/99	500	0.6	0.5U	30	1.4
06/00	170	2.5U	2.5U	15	1J
06/01	330J	0.26J	0.24U	18J	0.44J
06/02	60J	0.23J	0.12U	7.5	0.69
06/03	21	0.11U	0.12U	1.3	0.23J
06/04	25	0.18J	0.12U	1.7	0.44J
06/05	4.1	0.2U	0.2U	0.2	0.2U
06/06	3.9	0.2J	0.5U	0.42J	0.28J
06/07	1.9	0.5U	0.5U	0.27J	0.15J
05/08	1.7	0.16J	0.5U	0.23J	0.14J
06/09	20	0.18J	0.2U	1.3	0.14J
06/10	9.4	0.11	0.5U	0.69	0.12J
07/11	12	0.12J	0.5U	0.80	0.11J
06/12	14	0.49J	0.5U	1.2	0.16J
06/13	43J	0.18J	0.50U	2.7	0.13J
06/14	24	0.29J	0.50U	1.5	0.12J
06/15	5.6	0.16J	0.50U	0.35J	0.13J
06/16	0.27J	0.10J	0.50U	0.070J	0.15J
06/17	0.12J	0.13J	0.50U	0.50U	0.50U

Seep B

Date	TCE	PCE	1,1,-DCE	cis-1,2-DCE	1,1,1-TCA
05/96	14	1U	1U	0.7J	1
06/00	2.2	0.5U	0.5U	0.5U	0.3J
06/01	3.1	0.13J	0.12U	0.44J	0.26J
06/02	5.4	0.12J	0.12U	0.52	0.15J
06/03	1.9	0.14J	0.12U	0.2J	0.12U
06/04	0.64	0.39J	0.12U	0.23J	0.87
06/05	0.3	0.4	0.2U	0.2U	0.3
06/06	0.48J	0.22J	0.5U	0.18J	0.12J
06/07	0.14J	0.5U	0.5U	0.5U	0.5U
05/08	0.41J	0.17J	0.5U	0.12J	0.10J
06/09	0.40J	0.18J	0.2U	0.5U	0.16J
06/10	5.7	0.18J	0.5U	0.51	0.09J
07/11	1.3	0.12J	0.5U	0.095	0.5U
06/12	NS	NS	NS	NS	NS
06/13	NS	NS	NS	NS	NS
06/14	NS	NS	NS	NS	NS
06/15	NS	NS	NS	NS	NS
06/16	NS	NS	NS	NS	NS
06/17	NS	NS	NS	NS	NS

MW8-16

Date	TCE	PCE	1,1,-DCE	cis-1,2-DCE	1,1,1-TCA
11/95	58J	0.6J	1U	2	2
05/96	72J	0.8J	1U	2	2
09/96	69J	0.8J	1U	3	2
05/97	57J	0.8J	1U	2	2
10/97	47J	0.6J	1U	2	2
05/98	63J	0.8J	1U	2	1
10/98	47J	1U	1U	3	1U
05/99	40	1U	1U	6	2
11/99	63	0.8	0.5U	5.3	1.7
06/00	51	0.7	0.59	16	1.1
06/01	74J	0.84	0.77	21	1.2
06/02	130J	0.99	0.67	30	0.83
06/03	190J	1.5	0.57	28	0.94
06/04	120	0.75	0.61	130	0.49J
06/05	350	2.2	0.9	34	0.7
06/06	200D	1.1	0.64	93D	0.33J
06/07	430D	1.5	0.68	38	0.42J
05/08	380D	1	0.65	67D	0.18J
06/09	140D	0.64	0.21	14	0.13J
06/10	79D	0.64	0.13J	9.2	0.16J
07/11	88D	0.76	0.10J	3.6	0.22J
06/12	56D	0.80	0.08	2.7	0.18J
06/13	50	0.79	0.50U	0.93	0.21J
06/14	50	0.97	0.50U	1.0	0.19J
06/15	48	0.51	0.090J	1.8	0.19J
06/16	8.1	0.50U	0.11J	28	0.50U
06/17	7.2	0.15J	0.090J	26	0.50U

Legend

Units in μg/L

Results in **red** exceed the drinking water remediation goal.

Highlighted results exceed the surface water remediation goal.

MW8-9 — Monitoring Well Sampled

MW8-15 — Monitoring Well Not Sampled

SEEP A — Seep Sampling Location

Low-tide Waterline

Former Building Location

J — The result is an estimated concentration

NS — Not Sampled

U — The compound was not detected at or above the stated limit

UJ — The compound was not detected at or above the stated limit, which is an estimated value

VOC	Remediation Goal	
	Surface Water	Drinking Water
TCE	81	5
PCE	8.9	5
1,1-DCE	3.2	7
cis-1,2-DCE	-	70
1,1,1-TCA	42,000	200

0 30 60
SCALE IN FEET

U.S. NAVY

NBK Keyport, 2017
Area 8 Long-Term
Monitoring Report

SEALASKA

Figure 4-1
Distribution of Selected VOCs in Groundwater and Seep Water

C:\USERS\WALTER.BOWLES\DOCUMENTS\KEYPORT\TO 46\LTM\AREA 8\NATIVE\FIG 4-1.DWG
Mod: 9/16/2017 12:41:39 PM Plotted: 9/16/2017 12:41:45 PM By: WALTER BOWLES CTB: SES-MAIN-COLOR.CTB

Table 4-4. Summary of Selected Dissolved Metals Results for Area 8 Groundwater Sampling Locations, Fall 1995 through Spring 2017

Location ID	Sampling Date	Arsenic (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Cr(VI)[1/] (µg/L)	Copper (µg/L)	Lead (µg/L)	Mercury (µg/L)[2/]	Nickel (µg/L)	Silver (µg/L)	Thallium (µg/L)	Zinc (µg/L)
Drinking Water Remediation Goals		0.05[3/]	5	50[4/]	80	590	15	2	100	48	1.1	4,800
Surface Water Remediation Goals		0.14[3/]	8	50[5/]	50	2.5	5.8	0.025	7.9	1.2	1.6	77
MW8-8	11-95[6/]	1 U[1]	1 U	**436**	**390**	4.8	1.5	0.1 U[1]	12.8	3 U[1]	2 U[1]	18
MW8-8	05-96	**1.4 J**	1 U	**384**	**380**	4 U[1]	1 U	0.2 U[1]	15 U[1]	4 U[1]	**1.2 J**	12 U
MW8-8	09-96	1 U[1]	1 U	**330**	**320**	9 U[1]	1 U	0.2 U[1]	11 U[1]	8 U[1]	1 U	17.6 J
MW8-8	05-97	2 U[1]	1 U	**319**	**350**	2 U	1 U	0.2 U[1]	5 U	4 U[1]	1 U	8 U
MW8-8	10-97	0.5 U[1]	1 U	**372**	NT	2.3 J	1 J	0.1 U[1]	11 U[1]	1.8 J	1.8 U[1]	6.8 J
MW8-8	10-98	1.8 U[1]	0.2 U	**322**	NT	0.6 U	2 J	0.1 U[1]	1.3 U	1 U	1.2 U[1]	7.7 U
MW8-8	05-99	1.7 U[1]	1.2 J	**184**	NT	0.73 J	2.2 J	0.1 U[1]	3.5 J	2.2 U[1]	1 U	8.6 U
MW8-8	11-99	5 U[1]	4 U	**154**	NT	10 U[1]	2	0.2 U[1]	20 U[1]	10 U[1]	5 U[1]	10 U
MW8-8	06-00	**0.2 J**	1.33	**95.7**	**102 J**	0.46 J	0.03	0.1 U[1]	3.21 J	0.907	0.01 U	3.1
MW8-8	06-01	0.3 UJ[1]	0.58	**71.4**	NT	0.29 J	0.04 U	0.0022	1.5	0.62	0.005 U	2 U
MW8-8	06-02	**0.13 J**	0.827 J	**191**	NT	0.4	0.147 UJ	0.1 U[1]	1.45	0.468 J	0.006 J	0.8
MW8-8	06-03	**0.43 J**	0.15	**84.1 J**	NT	0.49	0.04	0.1 U[1]	0.76 J	0.17	0.005 J	0.7
MW8-8	06-04	**0.32**	0.201	**111**	NT	0.45	0.009	0.04 U[1]	0.79	0.489	0.003 U	1.45
MW8-8	06-05	**0.44**	1.2	**88.3**	NT	0.42	0.1 U	0.1 U[1]	2.8	0.265	0.01 U	0.99
MW8-8	06-06	**0.27 B**	0.334	**88.6**	NT	0.369	0.021 U	0.2 U[1]	0.61 J	0.284	0.02 U	1.02
MW8-8	06-07	**0.26 J**	0.12	**81.9**	NT	5.1	0.24	0.2 U[1]	0.69	0.19	0.02 U	1.0
MW8-8	05-08	**0.21 B**	0.124	**96**	NT	0.496	0.054 U	0.2 U[1]	1.08	0.182	0.005 B	0.77
MW8-8	06-09	**0.21 J**	0.432	43.8	NT	0.437	0.020 U	0.2 U[1]	1.05	0.746 J	0.009 J	1.43
MW8-8	06-10	**0.85**	0.114	**55.6**	NT	0.77	0.008 UJ	0.02 J	0.72	0.292	0.02 U	0.87
MW8-8	07-11	**0.91**	0.036 UJ	**118**	NT	0.55	0.020 UJ	0.20 U[1]	0.40	0.198	0.02 U	0.48 J
MW8-8	06-12	**0.7**	0.022	**59.6**	NT	0.51	0.107	0.20 U[1]	0.68	0.200	0.013 J	0.5
MW8-8	06-13	**0.648**	0.008 J	**52.3**	NT	0.33	0.020 U	0.20 U[1]	0.34	0.211	0.020 U	0.37 J
MW8-8	06-14	**0.56**	0.015 J	**66.7**	NT	0.39 J	0.050	0.00230	0.33	0.336	0.020 U	0.38 J
MW8-8	06-15	**0.61**	0.040 UJ	**83.2**	NT	1.05	0.122	0.00361	0.28	0.327 J	0.020 UJ	1.69
MW8-8	06-16	**0.8**	0.082	**53.6**	NT	0.30	0.147	0.00264	0.30	0.496	0.020 UJ	2.1
MW8-8	07-17	**0.33 J**	0.057	**70.2**	NT	0.32	0.008 J	NT	0.41	0.466	NT	0.54
MW8-9	11-95[6/]	**3**	1 U	17.1	10	3.6	10 U[1]	0.1 U[1]	9 U[1]	3 U[1]	10 U[1]	20.4
MW8-9	05-96	**2.6 J**	1	6 U	**380**	4 U[1]	1 U	0.2 U[1]	15 U[1]	4 U[1]	10 U[1]	12 U
MW8-9	09-96	**3.4 J**	3.5 J	13.4	10	9 U[1]	2 U	0.2 U[1]	11 U[1]	8 U[1]	10 U[1]	12 U
MW8-9	05-97	**3.2**	1 U	8.5 J	10 U	2 U	1 U	0.2 U[1]	5 U	4 U[1]	**134**	8 U
MW8-9	10-97	**1.4 J**	1.1 J	15.7	NT	1 U	0.5 U	0.35	11 U[1]	1 U	1.8 U[1]	10.9 J

Table 4-4. Summary of Selected Dissolved Metals Results for Area 8 Groundwater Sampling Locations, Fall 1995 through Spring 2017 (continued)

Location ID	Sampling Date	Arsenic (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Cr(VI)[1/] (µg/L)	Copper (µg/L)	Lead (µg/L)	Mercury[2/] (µg/L)	Nickel (µg/L)	Silver (µg/L)	Thallium (µg/L)	Zinc (µg/L)
Drinking Water Remediation Goals		0.05[3/]	5	50[4/]	80	590	15	2	100	48	1.1	4,800
Surface Water Remediation Goals		0.14[3/]	8	50[5/]	50	2.5	5.8	0.025	7.9	1.2	1.6	77
MW8-9	04-98	NT	5 U	10 U	NT	NT	NT	NT	NT	NT	NT	NT
MW8-9	10-98	**5.4 J**	1.2 J	7.9 J	NT	0.6 U	0.51 J	0.13 J	38.2 J	2 J	**6**	7.7 U
MW8-9	05-99	**2 J**	1 J	10.1	NT	0.7 U	2 J	0.1 J	16.3 J	2.7 J	10 U[1]	8.6 U
MW8-9	11-99	5 U[1]	**14**	8	NT	10 U[1]	2 U	0.2 U[1]	20 U[1]	10 U[1]	5 U[1]	10 U
MW8-9	06-00	**0.8 J**	1.05	9.8	16 J	0.95 J	0.97	0.1 U[1]	8.57 J	3.7	0.01 U	8.6
MW8-9	06-01	**0.5 J**	1.13	9.7	NT	0.78 J	0.04 U	0.0036	4.2	1.61	0.005 J	3 U
MW8-9	06-02	**0.43 J**	0.651 J	6.43	NT	0.9	0.049 UJ	0.1 U[1]	4.97	1.44 J	0.003 J	3.2
MW8-9	06-03	**0.58 J**	0.98	6.9 J	NT	1.38	0.23	0.1 J	4.85 J	1.66	0.015 J	4.9
MW8-9	06-04	**0.42**	0.509	7.09	NT	0.73	0.515	0.05 U[1]	3.91	1.3	0.003 U	1.57
MW8-9	06-05	**0.43**	0.904	6.8	NT	0.75	0.1 U	0.1 U[1]	3.5	0.68	0.01 U	2.17
MW8-9	06-06	**0.49 B**	0.454	6.87	NT	0.652	0.02 U	0.2 U[1]	2.57 J	0.863	0.02 U	1.01
MW8-9	06-07	**0.52 J**	0.30	6.10	NT	8.1	0.35	0.2 U[1]	2.30	0.48	0.02 U	1.30
MW8-9	05-08	**0.69**	0.363	6.38	NT	0.654	0.026 U	0.2 U[1]	2.25	0.421	0.004 B	0.82
MW8-9	06-09	**0.63 J**	0.590	4.85	NT	0.659	0.020 U	0.2 U[1]	1.55	0.263 J	0.020 U	0.59
MW8-9	06-10	**0.73**	0.174	4.28	NT	0.739	0.018 UJ	0.20 U[1]	1.20	0.312	0.006 UJ	4.57
MW8-9	07-11	**0.63**	0.343	7.46	NT	0.739	0.014 J	0.20 U[1]	1.74	0.497	0.020 UJ	0.65
MW8-9	06-12	**0.61**	0.286	6.09	NT	0.581	0.015 J	0.20 U[1]	1.48	0.430	0.020 UJ	0.60
MW8-9	06-13	**0.67**	0.238	5.41	NT	0.561	0.009 J	0.20 U[1]	1.28	0.245	0.020 UJ	0.48 J
MW8-9	06-14	**0.66**	0.231	6.3	NT	0.564	0.18	0.00439	1.38	0.36	0.020 UJ	0.7
MW8-9	06-15	**0.67 J**	0.438	6.32	NT	1.980	0.090	0.00300	1.87	0.488	0.020 U	2.5
MW8-9	06-16	**0.56**	0.523	7.81	NT	0.990	12.0	0.00374	1.54	0.668	0.020 U	6.58
MW8-9	07-17	**0.49 J**	0.284	5.00	NT	0.57	0.016 J	NT	1.51	0.439	NT	0.67
MW8-11	11-95[6/]	**2**	**299**	**887**	**950**	15.7	10 U[1]	0.22	52.5	5.6	2 U[1]	212
MW8-11	05-96	**5.6 J**	**444**	**614**	**800**	18.9 J	1 U	0.2 U[1]	39.5 J	4 U[1]	1 U	248
MW8-11	09-96	**2.4 J**	**264**	**626**	**730**	14.3 J	2 U	0.2 U[1]	42.3	8 U[1]	10 U[1]	168
MW8-11	05-97	**2.1**	**210**	**441**	**610**	12.4	1 U	0.2 U[1]	30.5	7	10 U[1]	161
MW8-11	10-97	**0.66 J**	**278**	**377**	NT	11.7 J	0.5 U	0.32	40	4.4 J	9 U[1]	178
MW8-11	10-98	**2.1 J**	**126**	**459**	NT	9 J	0.5 U	0.17 J	16.2 J	2.2 J	1.2 U[1]	50.9
MW8-11	05-99	**2.6 J**	**33.5**	**198**	NT	5.3 J	1 U	0.1 U[1]	4.6 J	2.2 J	1 U	23.7
MW8-11	11-99	5 U[1]	**205**	**201**	NT	10 U[1]	2 U	0.2 U[1]	20 U	10 U[1]	5 U[1]	89 U[1]
MW8-11	06-00	**0.8 J**	**106**	**221**	**227 J**	4.44 J	0.16	0.1 U[1]	10.2 J	2.09	0.04	109

Table 4-4. Summary of Selected Dissolved Metals Results for Area 8 Groundwater Sampling Locations, Fall 1995 through Spring 2017 (continued)

Location ID	Sampling Date	Arsenic (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Cr(VI)[1/] (µg/L)	Copper (µg/L)	Lead (µg/L)	Mercury[2/] (µg/L)	Nickel (µg/L)	Silver (µg/L)	Thallium (µg/L)	Zinc (µg/L)
Drinking Water Remediation Goals		0.05[3/]	5	50[4/]	80	590	15	2	100	48	1.1	4,800
Surface Water Remediation Goals		0.14[3/]	8	50[5/]	50	2.5	5.8	0.025	7.9	1.2	1.6	77
MW8-11	06-01	**0.7 J**	**129**	**429**	NT	4.95 J	0.062	0.0071	13	2.29	0.038	110
MW8-11	06-02	**0.52 J**	**420 J**	**608**	NT	4.9	0.047 UJ	0.1 U[1]	9.46	3.87 J	0.04 J	221
MW8-11	06-03	**0.61 J**	**353**	**308 J**	NT	5.15	0.02 U	0.1 U[1]	9.53 J	5.87	0.041	134
MW8-11	06-04	**0.57**	**357**	**290**	NT	5.29	0.036	0.08 U[1]	31.9	6.45	0.053	157
MW8-11	06-05	**1.9**	**266**	**230**	NT	4.63	0.1 U	0.1 U[1]	24.4	6	0.05	91
MW8-11	06-06	**0.61**	**338**	**157**	NT	3.48	0.066 U	0.2 U[1]	25.8 J	6.17	0.0405	135
MW8-11	06-07	**0.53 J**	**231**	**150**	NT	3.60	0.094	0.2 U[1]	19.3	4.70	0.038	81.0
MW8-11	05-08	**0.82**	**154**	**191**	NT	3.44	0.055 U	0.2 U[1]	15.1	3.5	0.025	58.1
MW8-11	06-09	**0.94 J**	**115**	**163**	NT	3.10	0.020 U	0.2 U[1]	11.1	2.45 J	0.024	49.1
MW8-11	06-10	**0.87**	**213**	**157**	NT	3.09	0.011 J	0.02 J	19.4	5.860	0.034 UJ	85.7
MW8-11	07-11	**0.68**	**166**	**165**	NT	3.00	0.023	0.20 U[1]	16.0	3.550	0.025	68.0
MW8-11	06-12	**0.70**	**152**	**153**	NT	2.810	0.020 U	0.20 U[1]	11.4	3.220	0.026 UJ	68.4
MW8-11	06-13	**0.86**	**85.1**	**187**	NT	2.610	0.014 J	0.20 U[1]	9.77	2.770	0.022 UJ	44.0
MW8-11	06-14	**0.93**	**106**	**166**	NT	2.76	0.05	0.00973	12.1	2.60	0.033 UJ	43.0
MW8-11	06-15	**0.87 J**	**127**	**182**	NT	3.520	0.047	0.0102	13.8	3.11	0.026	52.4
MW8-11	06-16	**0.74**	**131**	**145**	NT	5.75	8.020	0.0114	19.1	4.21	0.029	85.0
MW8-11	06-17	**0.91**	**135**	**140**	NT	2.62	0.017 J	NT	14.6	2.70	NT	48
MW8-12	11-95[6/]	**5.1**	**28.6**	**1790**	**1500**	32.9	11.7	0.19	34.6	3 U[1]	2 U[1]	31.3
MW8-12	05-96	**3.6 J**	**46.1**	**852**	**380**	4 U[1]	1 U	0.2 U[1]	17.9 J	4 U[1]	1 U	29.7
MW8-12	09-96	**1.9 J**	**53.8**	**1740**	**1800**	9 U[1]	1 U	0.2 U[1]	49.3	8 U[1]	1 U	30.3
MW8-12	05-97	2 U[1]	**565**	**1280**	**1400**	64.4	20 U[1]	0.2 U[1]	**673**	4 U[1]	1 U	727
MW8-12	10-97	**1.8 J**	**158**	**1030**	NT	155	0.5 U	0.12 J	**423**	2 J	1.8 U[1]	344
MW8-12	10-98	1.8 U[1]	**8.5**	**1090**	NT	4 J	0.5 U	0.15 J	8.9 J	1.2 J	1.2 U[1]	7.7 U
MW8-12	05-99	1.7 U[1]	**45.7**	**815**	NT	19.9	3.2	0.1 U[1]	70	2.2 U[1]	1	48.9
MW8-12	06-00	**0.2 J**	**20**	**163**	**216 J**	5.65 J	0.75	0.1 U[1]	26.8 J	0.88	0.01 U	24.9
MW8-12	06-01	**0.3 J**	**20.7**	**193**	NT	6.14 J	1.2	0.0022	22	**1.24**	0.013 J	25.3
MW8-12	06-02	**0.38 J**	4.42 J	**238**	NT	4.1	0.121 UJ	0.1 U[1]	3.19	0.267 J	0.006 J	1.9
MW8-12	06-03	**0.32 J**	**7.84**	**107 J**	NT	2.78	0.15	0.1 U[1]	4.36 J	0.47	0.013 J	2.3
MW8-12	06-04	**0.48**	3.48	**147**	NT	5.21	0.111	0.05 U[1]	2.67	0.202	0.007	1.76
MW8-12	06-05	**1.3**	2.04	**114**	NT	3.7	0.219	0.1 U[1]	3	0.22	0.01 U	5.97
MW8-12	06-06	**0.28 B**	2.71	**113**	NT	2.67	0.048 U	0.2 U[1]	1.99 J	0.279	0.02 U	4.17

Table 4-4. Summary of Selected Dissolved Metals Results for Area 8 Groundwater Sampling Locations, Fall 1995 through Spring 2017 (continued)

Location ID	Sampling Date	Arsenic (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Cr(VI)[1/] (µg/L)	Copper (µg/L)	Lead (µg/L)	Mercury[2/] (µg/L)	Nickel (µg/L)	Silver (µg/L)	Thallium (µg/L)	Zinc (µg/L)
Drinking Water Remediation Goals		0.05[3/]	5	50[4/]	80	590	15	2	100	48	1.1	4,800
Surface Water Remediation Goals		0.14[3/]	8	50[5/]	50	2.5	5.8	0.025	7.9	1.2	1.6	77
MW8-12	06-07	**0.47 J**	0.31	**101**	NT	2.60	0.054	0.2 U[1]	0.92	0.037	0.02 U	0.67
MW8-12	05-08	**0.53**	0.431	**100**	NT	2.18	0.036 U	0.2 U[1]	1.07	0.057	0.004 B	0.25 B
MW8-12	06-09	**0.68 J**	0.109	**80.8**	NT	1.65	0.018 J	0.2 U[1]	0.57	0.016 J	0.006 J	0.15 J
MW8-12	06-10	**0.35 J**	0.433	**74.8**	NT	2.48	0.264 J	0.02 J	0.93	0.050	0.006 UJ	0.39 J
MW8-12	07-11	**0.46 J**	0.194	**137**	NT	2.22	0.048	0.20 U[1]	0.66	0.027 UJ	0.020 UJ	0.20 J
MW8-12	06-12	**0.50**	0.128	**105**	NT	1.760	0.026	0.20 U[1]	0.55	0.019 J	0.034 J	0.50 UJ
MW8-12	06-13	**4.63**	0.063	**89.4**	NT	1.53	0.032	0.20 U[1]	0.42	0.008 J	0.020 U	0.43 J
MW8-12	06-14	**2.2**	0.096	**97.2**	NT	2.70 J	0.064	0.00142	0.33	0.020 UJ	0.020 U	0.35 J
MW8-12	06-15	**2.3**	0.082	**118**	NT	2.11	0.425	0.00328	0.58	0.020 UJ	0.020 UJ	0.58
MW8-12	06-16	**0.30 J**	0.797	**87.69**	NT	2.29	0.057 UJ	0.00367	1.11	0.141	0.020 U	1.63
MW8-12	06-17	**0.45 J**	0.352	**72.9**	NT	1.45	0.039	NT	0.79	0.045	NT	0.33 J
MW8-14	11-95[6/]	**5.1**	22.4 U[1]	**208**	**90**	152	**203**	0.52	**100**	3 U[1]	20 U[1]	**241**
MW8-14	05-96	**3.3 J**	**10.9**	6 U	11 U	6.7 J	1 U	0.2 U[1]	15 U[1]	4 U[1]	10 U[1]	29.9
MW8-14	09-96	**3.1 J**	**19.9**	19.2	20	9 U[1]	2 U	0.2 U[1]	11 U[1]	8.6 J	10 U[1]	12 U
MW8-14	05-97	**3.1**	**9.8**	9 J	10	2 U	1.2	0.2 U[1]	5 U	7.3	10 U[1]	9.2 J
MW8-14	10-97	**1 J**	**13.2**	17.7	NT	1 U	1 U	0.48	11 U[1]	2 J	1.8 U[1]	9.8 J
MW8-14	10-98	**10.8**	**16.9**	19.9	NT	0.6 U	0.5 U	0.17 J	4.9 J	1.6 J	**6**	7.7 U
MW8-14	05-99	**2.2 J**	**10.5**	10.1	NT	0.7 U	1.4 J	0.1 U[1]	3.7 J	2.2 U[1]	10 U[1]	8.6 U
MW8-14	11-99	5 U[1]	**13**	7	NT	10 U[1]	2 U	0.2 U[1]	20 U[1]	10 U[1]	5 U[1]	10 U
MW8-14	06-00	**2 J**	**13.8**	14.4	58.8 J	1.22 J	0.61	0.1 U[1]	3.71 J	0.564	0.01 U	3.2
MW8-14	06-01	**1.4 J**	**13.2**	31.5	NT	1.16 J	1.01	0.001	2.5	0.32	0.008 J	3 U
MW8-14	06-02	**1.53 J**	**14.9 J**	15.8	NT	1.7	0.741 UJ	0.1 U[1]	4.63	0.44 J	0.007 J	4
MW8-14	06-03	**2.08 J**	**14.6**	16.2 J	NT	1.53	0.74	0.1 U[1]	4.71 J	0.38	0.006 J	2.6
MW8-14	06-04	**1.63**	**13.5**	22.2	NT	1.37	0.885	0.06 U[1]	5.61	0.351	0.007	2.6
MW8-14	06-05	**2**	**12.5**	17.8	NT	1.65	1.1	0.1 U[1]	6.9	0.46	0.01 U	2.92
MW8-14	06-06	**1.66**	**11.1**	14.9	NT	1.13	0.682	0.2 U[1]	5.17 J	0.358	0.02 U	2.25
MW8-14	06-07	**1.5 J**	**9.8**	15.4	NT	2.90	0.99	0.2 U[1]	5.50	0.33	0.02 U	2.60
MW8-14	05-08	**1.91**	**8.33**	21	NT	1.38	0.817	0.2 U[1]	5.21	0.24	0.012 B	2.2
MW8-14	06-09	**1.78 J**	**8.91**	18.2	NT	1.76	1.18	0.2 U[1]	5.08	0.259 J	0.005 J	2.58
MW8-14	06-10	**1.91**	**10.4**	28.3	NT	1.42	1.57 J	0.02 U[1]	4.89	0.383	0.011 UJ	2.23
MW8-14	07-11	**1.75**	**8.65**	15.1	NT	1.87	1.06	0.20 U[1]	5.42	0.285	0.020 UJ	2.38

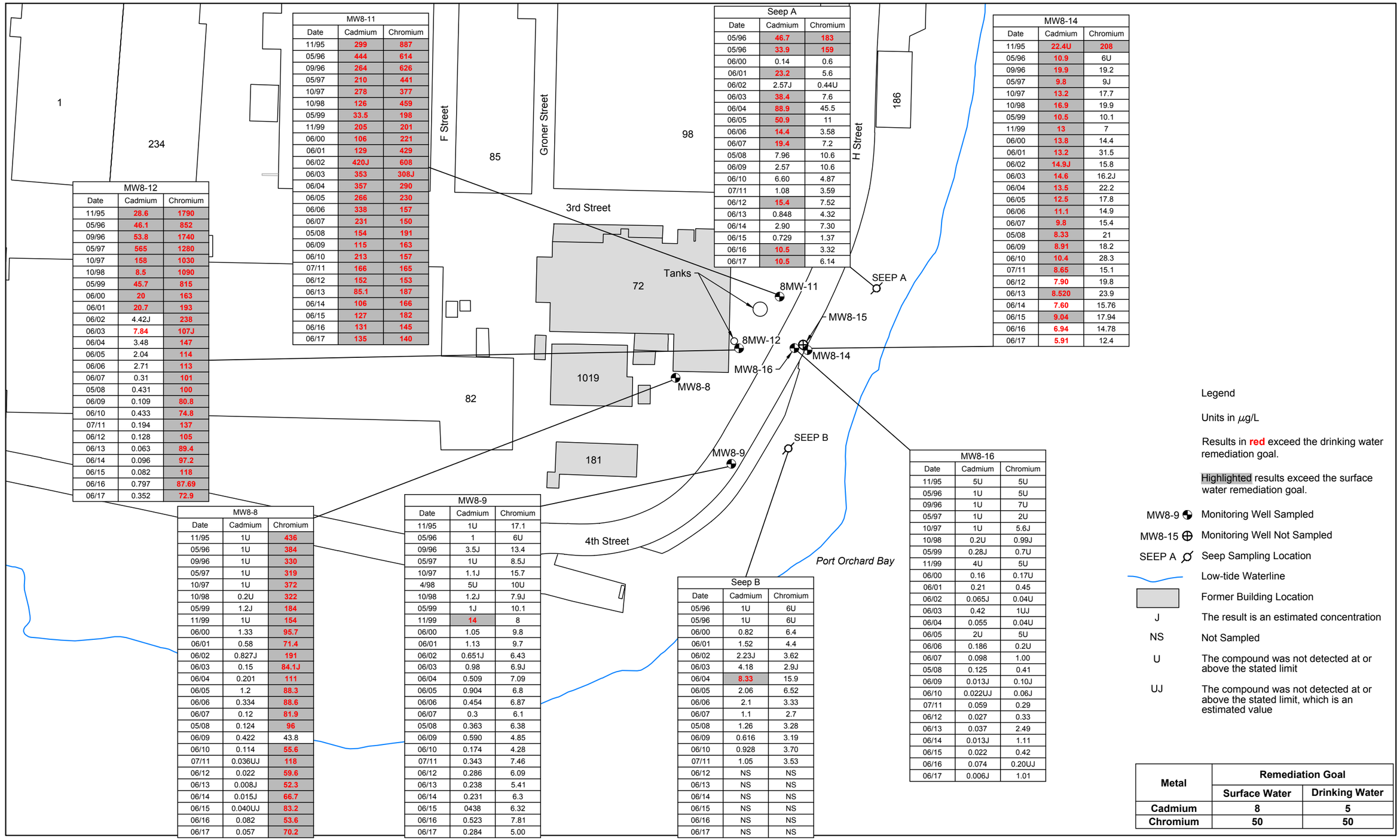
Table 4-4. Summary of Selected Dissolved Metals Results for Area 8 Groundwater Sampling Locations, Fall 1995 through Spring 2017 (continued)

Location ID	Sampling Date	Arsenic (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Cr(VI)[1/] (µg/L)	Copper (µg/L)	Lead (µg/L)	Mercury[2/] (µg/L)	Nickel (µg/L)	Silver (µg/L)	Thallium (µg/L)	Zinc (µg/L)
Drinking Water Remediation Goals		0.05[3/]	5	50[4/]	80	590	15	2	100	48	1.1	4,800
Surface Water Remediation Goals		0.14[3/]	8	50[5/]	50	2.5	5.8	0.025	7.9	1.2	1.6	77
MW8-14	06-12	**1.67**	**7.90**	19.8	NT	1.290	0.880	0.20 U[1]	4.42	0.223	0.039 J	2.10
MW8-14	06-13	**1.56**	**8.520**	23.9	NT	1.290	1.070	0.20 U[1]	4.25	0.237	0.020 UJ	2.01
MW8-14	06-14	**1.60**	**7.60**	15.76	NT	1.91	1.17	0.00202	4.35	0.25	0.020 UJ	2.6
MW8-14	06-15	**1.61 J**	**9.04**	17.94	NT	1.760	1.710	0.00197	5.19	0.286	0.011 J	3.1
MW8-14	06-16	**1.35**	**6.94**	14.78	NT	1.83	1.960	0.00125	4.64	0.232	0.008 J	4.42
MW8-14	06-17	**1.47**	**5.91**	12.4	NT	1.39	0.984	NT	4.37	0.210	NT	2.41
MW8-15	11-95[6/]	1 U[1]	1 U	5 U	10 U	1 U	1 U	0.1 U[1]		3 U[1]	2 U[1]	39.9
MW8-15	11-95	1 U[1]	1 U	5 U		1 U	1 U		9.3	3 U[1]	2 U[1]	35.6
MW8-16	11-95[6/]	**2.3**	5 U	5 U	10 U	1.2	1 U	0.16		3 U[1]	2 U[1]	7 J
MW8-16	05-96	**3.6 J**	1 U	6 U	11 U	4 U[1]	1.3 J	0.2 U[1]	15 U[1]	4 U[1]	**1.1 J**	14.9 J
MW8-16	09-96	**2.9 J**	1 U	7 U	10 U	9 U[1]	1 U	0.2 U[1]	11 U[1]	8 U[1]	1 U	12 U
MW8-16	05-97	**2.3**	1 U	2 U	10 U	2 U	1 U	0.2 U[1]	5 U	4 U[1]	1 U	8 U
MW8-16	10-97	**1.4 J**	1 U	5.6 J	NT	1 U	1 U	0.1 U[1]	11 U[1]	1 U	1.8 U[1]	7.2 J
MW8-16	10-98	1.8 U[1]	0.2 U	0.99 J	NT	0.6 U	0.5 U	0.1 U[1]	1.3 U	1 U	1.2 U[1]	7.7 U
MW8-16	05-99	1.7 U[1]	0.26 J	0.7 U	NT	0.7 U	3.4	0.11 J	4.1 J	2.2 U[1]	1 U	8.6 U
MW8-16	11-99	5 U[1]	4 U	5 U	NT	10 U[1]	2 U	0.2 U[1]	20 U[1]	10 U[1]	5 U[1]	10 U
MW8-16	06-00	**1.14 J**	0.16	0.17 U	4 U	0.2 J	0.05	0.1 U[1]	1.02 J	0.02 U	0.03 U	4
MW8-16	06-01	**1.5 J**	0.21	0.45	NT		0.04 U	0.0003 J	1.4	0.07 U	0.005 U	36.5
MW8-16	06-02	**1.82 J**	0.065 J	0.04 U	NT	0.2	0.011 UJ	0.1 U[1]	2.59	0.001 J	0.002 UJ	1.7
MW8-16	06-03	**2.37 J**	0.42	1 UJ	NT	0.1 U	0.1 U	0.1 U[1]	9.34 J	0.04 U	0.02 U	2.3 J
MW8-16	06-04	**2.75**	0.055	0.04 U	NT	0.38	0.011	0.04 U[1]	3.76	0.005 U	0.001 U	1.07
MW8-16	06-05	**3**	2 U	5 U	NT	2	2 U	0.1 U[1]	10 U[1]	3 U[1]	1 U	6 U
MW8-16	06-06	**2.44**	0.186	0.2 U	NT	0.043 B	0.02 U	0.2 U[1]	3.61 J	0.028	0.02 U	1.15
MW8-16	06-07	**2.3 J**	0.098	1.00	NT	0.77	0.075	0.2 U[1]	2.70	0.02 U	0.02 U	1.00
MW8-16	05-08	**3.61**	0.125	0.41	NT	0.043 B	0.044 U	0.2 U[1]	0.64	0.01 B	0.002 U	0.36 B
MW8-16	06-09	**3.50 J**	0.013 J	0.10 J	NT	0.156	0.020 U	0.2 U[1]	0.42	0.004 J	0.02 U	0.10 J
MW8-16	06-10	**1.52**	0.022 UJ	0.06 J	NT	0.071 UJ	0.009 UJ	0.02 U[1]	1.00	0.005 J	0.007 UJ	0.21 J
MW8-16	07-11	**3.9**	0.059	0.29	NT	0.72	0.020 UJ	0.20 U[1]	0.60	0.020 UJ	0.02 U	0.41 J
MW8-16	06-12	**2.04**	0.027	0.33	NT	0.295	0.009 J	0.20 U[1]	0.35	0.015 J	0.020 UJ	0.50 UJ
MW8-16	06-13	**4.19**	0.037	2.49	NT	0.50	0.042	0.20 U[1]	0.68	0.053	0.020 U	1.25
MW8-16	06-14	**3.9**	0.013 J	1.11	NT	1.06 J	0.054	0.00289	0.31	0.022 UJ	0.020 U	0.84

Table 4-4. Summary of Selected Dissolved Metals Results for Area 8 Groundwater Sampling Locations, Fall 1995 through Spring 2017 (continued)

Location ID	Sampling Date	Arsenic (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Cr(VI)[1/] (µg/L)	Copper (µg/L)	Lead (µg/L)	Mercury[2/] (µg/L)	Nickel (µg/L)	Silver (µg/L)	Thallium (µg/L)	Zinc (µg/L)
Drinking Water Remediation Goals		0.05[3/]	5	50[4/]	80	590	15	2	100	48	1.1	4,800
Surface Water Remediation Goals		0.14[3/]	8	50[5/]	50	2.5	5.8	0.025	7.9	1.2	1.6	77
MW8-16	06-15	**2.6**	0.022	0.42	NT	0.66	0.046	0.00218	0.26	0.020 UJ	0.020 UJ	0.99
MW8-16	06-16	**2.14**	0.074	0.20 UJ	NT	0.100 UJ	0.020 UJ	0.00034 B	1.93	0.020 UJ	0.007 J	0.76
MW8-16	06-17	**2.17**	0.006 J	1.01	NT	0.10 UJ	0.016 J	NT	4.45	0.008 J	NT	0.50 J

Notes:
[1/] Cr(VI) concentrations are for the total fraction only.
[2/] Analytical method for dissolved mercury changed to EPA Method 1631E (low-level dissolved mercury) in June 2014.
[3/] The background concentration of arsenic in groundwater at the site is 12 µg/L.
[4/] Value is for total chromium. Cr(VI) value is 80 µg/L.
[5/] The RG of 50 µg/L is for Cr(VI). There is no RG established for total dissolved chromium.
[6/] Total fraction was collected for this date and analyzed. Concentrations shown are total concentrations.
All concentrations are dissolved (except where noted above) and in µg/L.
Bold indicates detected value is equal to or exceeds the drinking water RG.
Shading indicates detected value is equal to or exceeds the surface water RG.
µg/L – microgram per liter or parts per billion (ppb)
Cr(VI) – hexavalent chromium
B – detected at a concentration greater than the method detection limit but less than the reporting limit
J – estimated result below reporting limit but above detection
U – not detected at value shown
U[1] – not detected at value shown and value exceeds remediation goal
NT – not tested



MW8-11		
Date	Cadmium	Chromium
11/95	299	887
05/96	444	614
09/96	264	626
05/97	210	441
10/97	278	377
10/98	126	459
05/99	33.5	198
11/99	205	201
06/00	106	221
06/01	129	429
06/02	420J	608
06/03	353	308J
06/04	357	290
06/05	266	230
06/06	338	157
06/07	231	150
05/08	154	191
06/09	115	163
06/10	213	157
07/11	166	165
06/12	152	153
06/13	85.1	187
06/14	106	166
06/15	127	182
06/16	131	145
06/17	135	140

Seep A		
Date	Cadmium	Chromium
05/96	46.7	183
05/96	33.9	159
06/00	0.14	0.6
06/01	23.2	5.6
06/02	2.57J	0.44U
06/03	38.4	7.6
06/04	88.9	45.5
06/05	50.9	11
06/06	14.4	3.58
06/07	19.4	7.2
05/08	7.96	10.6
06/09	2.57	10.6
06/10	6.60	4.87
07/11	1.08	3.59
06/12	15.4	7.52
06/13	0.848	4.32
06/14	2.90	7.30
06/15	0.729	1.37
06/16	10.5	3.32
06/17	10.5	6.14

MW8-14		
Date	Cadmium	Chromium
11/95	22.4U	208
05/96	10.9	6U
09/96	19.9	19.2
05/97	9.8	9J
10/97	13.2	17.7
10/98	16.9	19.9
05/99	10.5	10.1
11/99	13	7
06/00	13.8	14.4
06/01	13.2	31.5
06/02	14.9J	15.8
06/03	14.6	16.2J
06/04	13.5	22.2
06/05	12.5	17.8
06/06	11.1	14.9
06/07	9.8	15.4
05/08	8.33	21
06/09	8.91	18.2
06/10	10.4	28.3
07/11	8.65	15.1
06/12	7.90	19.8
06/13	8.520	23.9
06/14	7.60	15.76
06/15	9.04	17.94
06/16	6.94	14.78
06/17	5.91	12.4

MW8-12		
Date	Cadmium	Chromium
11/95	28.6	1790
05/96	46.1	852
09/96	53.8	1740
05/97	565	1280
10/97	158	1030
10/98	8.5	1090
05/99	45.7	815
06/00	20	163
06/01	20.7	193
06/02	4.42J	238
06/03	7.84	107J
06/04	3.48	147
06/05	2.04	114
06/06	2.71	113
06/07	0.31	101
05/08	0.431	100
06/09	0.109	80.8
06/10	0.433	74.8
07/11	0.194	137
06/12	0.128	105
06/13	0.063	89.4
06/14	0.096	97.2
06/15	0.082	118
06/16	0.797	87.69
06/17	0.352	72.9

MW8-8		
Date	Cadmium	Chromium
11/95	1U	436
05/96	1U	384
09/96	1U	330
05/97	1U	319
10/97	1U	372
10/98	0.2U	322
05/99	1.2J	184
11/99	1U	154
06/00	1.33	95.7
06/01	0.58	71.4
06/02	0.827J	191
06/03	0.15	84.1J
06/04	0.201	111
06/05	1.2	88.3
06/06	0.334	88.6
06/07	0.12	81.9
05/08	0.124	96
06/09	0.422	43.8
06/10	0.114	55.6
07/11	0.036UJ	118
06/12	0.022	59.6
06/13	0.008J	52.3
06/14	0.015J	66.7
06/15	0.040UJ	83.2
06/16	0.082	53.6
06/17	0.057	70.2

MW8-9		
Date	Cadmium	Chromium
11/95	1U	17.1
05/96	1	6U
09/96	3.5J	13.4
05/97	1U	8.5J
10/97	1.1J	15.7
4/98	5U	10U
10/98	1.2J	7.9J
05/99	1J	10.1
11/99	14	8
06/00	1.05	9.8
06/01	1.13	9.7
06/02	0.651J	6.43
06/03	0.98	6.9J
06/04	0.509	7.09
06/05	0.904	6.8
06/06	0.454	6.87
06/07	0.3	6.1
05/08	0.363	6.38
06/09	0.590	4.85
06/10	0.174	4.28
07/11	0.343	7.46
06/12	0.286	6.09
06/13	0.238	5.41
06/14	0.231	6.3
06/15	0438	6.32
06/16	0.523	7.81
06/17	0.284	5.00

Seep B		
Date	Cadmium	Chromium
05/96	1U	6U
05/96	1U	6U
06/00	0.82	6.4
06/01	1.52	4.4
06/02	2.23J	3.62
06/03	4.18	2.9J
06/04	8.33	15.9
06/05	2.06	6.52
06/06	2.1	3.33
06/07	1.1	2.7
05/08	1.26	3.28
06/09	0.616	3.19
06/10	0.928	3.70
07/11	1.05	3.53
06/12	NS	NS
06/13	NS	NS
06/14	NS	NS
06/15	NS	NS
06/16	NS	NS
06/17	NS	NS

MW8-16		
Date	Cadmium	Chromium
11/95	5U	5U
05/96	1U	5U
09/96	1U	7U
05/97	1U	2U
10/97	1U	5.6J
10/98	0.2U	0.99J
05/99	0.28J	0.7U
11/99	4U	5U
06/00	0.16	0.17U
06/01	0.21	0.45
06/02	0.065J	0.04U
06/03	0.42	1UJ
06/04	0.055	0.04U
06/05	2U	5U
06/06	0.186	0.2U
06/07	0.098	1.00
05/08	0.125	0.41
06/09	0.013J	0.10J
06/10	0.022UJ	0.06J
07/11	0.059	0.29
06/12	0.027	0.33
06/13	0.037	2.49
06/14	0.013J	1.11
06/15	0.022	0.42
06/16	0.074	0.20UJ
06/17	0.006J	1.01

Legend

Units in μg/L

Results in **red** exceed the drinking water remediation goal.

Highlighted results exceed the surface water remediation goal.

MW8-9 Monitoring Well Sampled

MW8-15 Monitoring Well Not Sampled

SEEP A Seep Sampling Location

Low-tide Waterline

Former Building Location

J The result is an estimated concentration

NS Not Sampled

U The compound was not detected at or above the stated limit

UJ The compound was not detected at or above the stated limit, which is an estimated value

Metal	Remediation Goal	
	Surface Water	Drinking Water
Cadmium	8	5
Chromium	50	50

0 30 60
SCALE IN FEET

U.S. NAVY

NBK Keyport, 2017
Area 8 Long-Term
Monitoring Report

SEALASKA

Figure 4-2
Distribution of Selected Metals in Groundwater and Seep Water

C:\USERS\WALTER.BOWLES\DOCUMENTS\KEYPORT\TO 46\LTMAREA 8\NATIVE\FIG 4-2.DWG
Mod: 9/16/2017 12:42:16 PM Plotted: 9/16/2017 12:42:24 PM By: WALTER BOWLES CTB: SES-MAIN-COLOR.CTB

4.2.1 Volatile Organic Compounds in Groundwater

The VOCs detected in groundwater samples collected in June 2017 are summarized and discussed in the following subsections. The ROD indicates that contaminant concentrations in groundwater will be compared to: (1) drinking water RGs to determine if the IC prohibiting groundwater use for drinking water can be discontinued; and (2) surface water RGs to determine if contaminants in Area 8 groundwater have the potential to adversely impact the marine environment adjacent to Area 8 (Navy, EPA, and Ecology 1994). Therefore, contaminant concentrations detected in Area 8 groundwater samples were evaluated by comparing to both the drinking water and surface water RGs. Table 4-5 presents the VOC results from the June 2017 sampling event.

Table 4-5. Summary of Selected VOC Results for Area 8 Groundwater Sampling Locations, Spring 2017

Location 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)
Drinking Water Remediation Goals		5	5	7	70	200
Surface Water Remediation Goals		81	8.9	3.2	--	42,000
MW8-8	06-17	**40**	**7.1**	0.11 J	1.6	0.93
MW8-9	06-17	0.12 J	0.13 J	0.50 U	0.50 U	0.50 U
MW8-11	06-17	**24**	0.41 J	0.50 U	0. 26 J	3.0
MW8-11 (field duplicate)	06-17	**24**	0.44 J	0.50 UJ	0.26 J	3.0
MW8-12	06-17	**10**	2.8	0.50 U	0. 28 J	0.87
MW8-14	06-17	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
MW8-16	06-17	**7.2**	0.15 J	0.090 J	26	0.50 U

Notes:
Bold indicates detected value is equal to or exceeds the drinking water RG.
Shading indicates detected value is equal to or exceeds the surface water RG.
µg/L – microgram per liter
DCE – dichloroethene
D – result reported from a diluted analysis
ID – identification
J – estimated result below reporting limit but above detection
PCE – tetrachloroethene
TCA – trichloroethane
TCE – trichloroethene
U – not detected at value shown
VOC – volatile organic compounds

4.2.1.1 Trichloroethene

The drinking water RG for trichloroethene (TCE) is 5 µg/L and the surface water RG is 81 µg/L. No TCE concentrations exceeded the surface water RG. The highest concentration of TCE in groundwater at the site was 40 µg/L detected in well MW8-8, which exceeds the drinking water RG. TCE was also detected above the drinking water RG in wells MW8-11, MW8-12, and MW8-16 (refer to Table 4-5).

TCE was not detected at or above the PQL of 0.50 µg/L in well MW8-14, which is located closest to the shoreline.

4.2.1.2 Tetrachloroethene

The drinking water RG for tetrachloroethene (PCE) is 5 µg/L and the surface water RG is 8.9 µg/L. PCE was detected above the drinking water RG only in well MW8-8, but below both RGs in wells MW8-9, MW8-11, MW8-12, and MW8-16 (refer to Table 4-5). PCE was not detected at or above the PQL of 0.50 µg/L in well MW8-14.

4.2.1.3 1,1-Dichloroethene

The drinking water RG for 1,1-DCE is 7 µg/L and the surface water RG is 3.2 µg/L. The only detections of 1,1-DCE were below both RGs in wells MW8-8 and MW8-16 (refer to Table 4-5). The VOC 1,1-DCE was not detected at or exceeding the PQL of 0.50 µg/L in well MW8-14.

4.2.1.4 cis-1,2-Dichloroethene

The drinking water RG for cis-1,2-DCE is 70 µg/L and there is no surface water RG. This VOC was detected below the drinking water RG in wells MW8-8, MW8-11, MW8-12, and MW8-16 (refer to Table 4-5). It was not detected at or exceeding the PQL of 0.50 µg/L in wells MW8-9 or MW8-14.

4.2.1.5 1,1,1-Trichloroethane

The drinking water RG for 1,1,1-trichloroethane (TCA) is 200 µg/L and the surface water RG is 42,000 µg/L. VOC 1,1,1-TCA was detected at concentrations less than both the RGs in wells MW8-8, MW8-11, and MW8-12 (refer to Table 4-5). VOC 1,1,1-TCA was not detected at or above the PQL of 0.50 µg/L in wells MW8-9, MW8-14, and MW8-16.

4.2.1.6 Other Detected VOCs: Chloroform, 1,1-Dichloroethane, Toluene, Trans-1,2-Dichloroethene, Total Xylenes, and 1,1,2-Trichloroethane

The drinking water RGs for chloroform, 1,1-dichloroethane (DCA), toluene, trans-1,2-DCE, and total xylenes are 7.2 µg/L, 800 µg/L, 1,000 µg/L, 100 µg/L, and 10,000 µg/L, respectively. The surface water RGs for chloroform, 1,1-DCA, toluene, trans-1,2-DCE, and total xylenes are 470 µg/L, none established, 49,000 µg/L, 33,000 µg/L, and none established, respectively. Three of these five VOCs were detected in one or more wells during the June 2017 sampling event, all at trace levels and less than their respective RGs, where established. Specific results are presented in Table 4-6. One other VOC, 1,1,2-trichloroethane, was detected at an estimated concentration of 0.19 µg/L in MW8-8, far less than the drinking water and surface water RGs of 5 µg/L and 42 µg/L, respectively, and was not detected in any of the other wells.

Table 4-6. Summary of Other VOC Results for Area 8 Groundwater Sampling Locations, Spring 2017

Location ID	Sampling Date	Chloroform (µg/L)		1,1-DCA (µg/L)		Toluene (µg/L)		trans-1,2-DCE (µg/L)		Total Xylenes (µg/L)	
Drinking Water Remediation Goals		7.2		800		1,000		100		10,000	
Surface Water Remediation Goals		470		NE		49,000		33,000		NE	
MW8-8	06-17	0.62		0.50	U	0.50	U	3.0		0.50	U
MW8-9	06-17	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
MW8-11	06-17	0.23	J	0.10	J	0.50	U	0.11	J	0.50	U
MW8-11 (field duplicate)	06-17	0.23	J	0.10	J	0.50	U	0.14	J	0.50	U
MW8-12	06-17	0.74		0.50	U	0.50	U	0.78		0.50	U
MW8-14	06-17	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
MW8-16	06-17	0.14	J	0. 080	J	0.50	U	0.19	J	0.50	U

Notes:
Bold indicates detected value is equal to or exceeds the drinking water RG.
Shading indicates detected value is equal to or exceeds the surface water RG.
µg/L – microgram per liter
DCA – dichloroethane
DCE – dichloroethene
D – result reported from a diluted analysis
ID – identification
J – estimated result
PCE – tetrachloroethene
TCA – trichloroethane
TCE – trichloroethene
U – not detected at value shown
U[1] – not detected at value shown and value exceeds remediation goal
VOC – volatile organic compounds

4.2.2 1,4-Dioxane in Groundwater

Sampling in Area 8 for 1,4-dioxane was first conducted at the request of Ecology in June 2007, and based on the results of this initial sampling was conducted again in summer 2011, and spring 2012 through 2017. As specified in the MMA SAP (Navy 2017a), sampling of the Area 8 groundwater monitoring wells for 1,4-dioxane is conducted annually. There is no RG established for 1,4-dioxane. For data evaluation, concentrations are compared to the MTCA Method B cleanup level (carcinogenic) of 0.44 µg/L. During the June 2017 sampling event, 1,4-dioxane was detected above the MTCA Method B cleanup level in wells MW8-8, MW8-11, and MW8-12 (refer to Table 4-3). It was not detected at a PQL of 0.40 in wells MW8-9, MW8-14, and MW8-16.

4.2.3 Dissolved Metals in Groundwater

The dissolved metals detected in groundwater samples collected during the June 2017 sampling event are discussed in the following subsections. Again, concentrations of metals detected in Area 8 groundwater samples were evaluated by comparison to both the drinking water and surface water RGs. Table 4-7 presents the dissolved metals results from the June 2017 sampling event.

4.2.3.1 Dissolved Arsenic

The drinking water RG for arsenic 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 RGs in all six groundwater wells (refer to Table 4-7). However, the concentrations detected were well below the background value of 12 µg/L for arsenic in groundwater at Area 8, as determined during the remedial investigation (Navy 1993e).

4.2.3.2 Dissolved Cadmium

The drinking water RG for cadmium is 5 µg/L and the surface water RG is 8 µg/L. Dissolved cadmium was detected at concentrations exceeding both RGs in well MW8-11 at 135 µg/L, but only the drinking water RG in MW8-14 at 5.91 µg/L. Dissolved cadmium was detected below both RGs in wells MW8-8, MW8-9, MW8-12, and MW8-16 (refer to Table 4-7).

4.2.3.3 Dissolved Chromium

The drinking water RG for total chromium is 50 µg/L and the surface water RG for chromium VI is also 50 µg/L (most stringent). Dissolved chromium was detected above both RGs in wells MW8-8, MW8-11, and MW8-12, but below both RGs in wells MW8-9 and MW8-14, and MW8-16 (refer to Table 4-7).

4.2.3.4 Dissolved Copper

The drinking water RG for copper is 590 µg/L and the surface water RG is 2.5 µg/L. Dissolved copper was detected above the surface water RG, but less than the drinking water RG, in well MW8-11. It was also detected below both RGs in wells MW8-8, MW8-9, MW8-12 and MW8-14. Dissolved copper was not detected at an estimated PQL of 0.10 µg/L in MW8-16 (refer to Table 4-7).

4.2.3.5 Dissolved Lead

The drinking water RG for lead is 15 µg/L and the surface water RG is 5.8 µg/L. Dissolved lead was detected at concentrations below both RGs in all six of the wells (refer to Table 4-7).

4.2.3.6 Dissolved Nickel

The drinking water RG for nickel is 100 µg/L and the surface water RG is 7.9 µg/L. Dissolved nickel was detected above the surface water RG, but below the drinking water RG in well MW8-11, and below both RGs in the five remaining wells sampled (refer to Table 4-7).

4.2.3.7 Dissolved Silver

The drinking water RG for silver is 48 µg/L and the surface water RG is 1.2 µg/L. Dissolved silver was detected above the surface water RG, but below the drinking water RG, in well MW8-11. Dissolved silver was detected below both RGs in wells MW8-8, MW8-9, MW8-12, MW8-14, and MW8-16 (refer to Table 4-7).

4.2.3.8 Dissolved Zinc

The drinking water RG for zinc is 4,800 µg/L and the surface water RG is 77 µg/L. Dissolved zinc was detected well below both RGs in all six of the sampled wells (refer to Table 4-7).

4.2.3.9 Dissolved Barium

The drinking water RG for barium is 1,000 µg/L. No surface water RG has been developed for barium. Dissolved barium was not detected at concentrations exceeding its RGs in any of the six wells sampled during June 2017. The maximum dissolved barium concentration detected was 144 µg/L in MW8-16 (Appendix C). Barium levels have ranged from a maximum of 62.5 µg/L to 197 µg/L over the past decade. Thus, barium has not been detected at Area 8 at concentrations significantly above its background concentration (130 µg/L) or approaching the drinking water remediation goal for barium of 1,000 µg/L (there is no surface water remediation goal for barium).

Table 4-7. Summary of Selected Dissolved Metals Results for Area 8 Groundwater Sampling Locations, Spring 2017

Location ID	Sampling Date	Arsenic (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Cr(VI)[1/] (µg/L)	Copper (µg/L)	Lead (µg/L)	Mercury (µg/L)[2/]	Nickel (µg/L)	Silver (µg/L)	Thallium (µg/L)	Zinc (µg/L)
Drinking Water Remediation Goals		0.05[3/]	5	50[4/]	80	590	15	2	100	48	1.1	4,800
Surface Water Remediation Goals		0.14[3/]	8	50[5/]	50	2.5	5.8	0.025	7.9	1.2	1.6	77
MW8-8	06-17	**0.33 J**	0.057	**70.2**	NT	0.32	0.008 J	NT	0.41	0.466	NT	0.54
MW8-9	06-17	**0.49 J**	0.284	5.00	NT	0.57	0.016 J	NT	1.51	0.439	NT	0.67
MW8-11	06-17	**0.90**	**134**	**136**	NT	2.62	0.017 J	NT	14.6	2.70	NT	47
MW8-11 (field duplicate)	06-17	**0.91**	**135**	**140**	NT	2.61	0.015 J	NT	14.3	2.69	NT	48
MW8-12	06-17	**0.45 J**	0.352	**72.9**	NT	1.45	0.039	NT	0.79	0.045	NT	0.33 J
MW8-14	06-17	**1.47**	**5.91**	12.4	NT	1.39	0.984	NT	4.37	0.210	NT	2.41
MW8-16	06-17	**2.17**	0.006 J	1.01	NT	0.10 UJ	0.016 J	NT	4.45	0.008 J	NT	0.50 J

Notes:
[1/]Cr(VI) concentrations are for the total fraction only.
[2/]Analytical method for dissolved mercury changed to EPA Method 1631E (low-level dissolved mercury) in June 2014.
[3/]The background concentration of arsenic in groundwater at the site is 12 µg/L.
[4/]Value is for total chromium. Cr(VI) value is 80 µg/L.
[5/]The RG of 50 µg/L is for Cr(VI). There is no RG established for total dissolved chromium.
All concentrations are dissolved (except where noted above) and in µg/L.
Bold indicates detected value is equal to or exceeds the drinking water RG.
Shading indicates detected value is equal to or exceeds the surface water RG.
µg/L – microgram per liter or parts per billion (ppb)
Cr(VI) – hexavalent chromium
J – estimated result below reporting limit but above detection
U – not detected at value shown
U[1] – not detected at value shown and value exceeds remediation goal
NT – not tested

4.3 SEEP WATER ANALYTICAL RESULTS

Water from Seep A in Area 8 on the western shoreline of Port Orchard Bay was sampled in June 2017. The location of Seep A is shown on Figures 1-4, 1-5, 4-1, and 4-2. Seep sample results were compared to surface water RGs for data evaluation to determine if Area 8 groundwater is adversely impacting the adjacent marine environment.

4.3.1 Volatile Organic Compounds in Seep Water

In June 2017 at Seep A, TCE was detected at 6.7 µg/L which is below the surface water RG of 81 µg/L (Table 4-8). PCE was detected at a concentration of 0.58 µg/L, below the surface water RG of 8.9 µg/L. The VOC 1,1-DCE was detected in Seep A at a concentration of 2.6 µg/L, below the surface water RG of 3.2 µg/L. The VOC cis-1,2-DCE was detected at 0.69 µg/L in Seep A. No surface water RG has been established for cis-1,2-DCE; however, the detected concentration does not exceed the drinking water RG for cis-1,2-DCE of 70 µg/L. The VOC 1,1,1-TCA was detected below the surface water RG of 42,000 µg/L in Seep A at a concentration of 18 µg/L. Chloroform and trans-1,2-DCE were detected well below their respective surface water RGs of 470 µg/L and 33,000 µg/L in Seep A at concentrations of 0.76 µg/L and 0.11 J µg/L (estimated concentration), respectively (Appendix C). The VOC 1,1-DCA was detected in Seep A at 1.3 µg/L (Appendix C). Although no surface water RG has been established for 1,1-DCA, the concentration detected does not exceed the drinking water RG of 800 µg/L. Total xylene concentrations were not detected in Seep A at the PQL of 0.50 µg/L. No surface water RG has been established for total xylenes. No other VOCs were detected in Seep A above their respective PQLs.

Table 4-8. Summary of Selected VOC Results for Area 8 Seep Sampling Locations, Fall 1995 through Spring 2017

Location 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)	
Drinking Water Remediation Goals		5		5		7		70		200	
Surface Water Remediation Goals		81		8.9		3.2		--		42,000	
Seep A	05-96	68	J	3		16		7		88	J
Seep A	06-00	7.4		0.3	J	3.1		3.7		19	
Seep A	06-01	3		0.31	J	1.4		1.3		11	
Seep A	06-02	1.2		0.11	U	1		0.68		9.5	
Seep A	06-03	0.36	J	0.26	J	0.12	U	0.12	U	1.6	
Seep A	06-04	49		0.92		13		9.9		77	
Seep A	06-05	0.3		0.3		0.2	U	0.2	U	2.2	
Seep A	06-06	3.6	J	0.30	J	1.5	J	2.0	J	12	J
Seep A	06-07	2.4		0.31	J	0.42		0.85		2.8	
Seep A	05-08	7.7		0.55		1.1		1.7		5.5	
Seep A	06-09	6.4		0.39	J	1.5		1.9		5.7	
Seep A	06-10	4.4		0.29	J	0.36	J	1.6		1.8	
Seep A	07-11	1.4		0.10	J	0.5	U	0.09	J	0.5	U
Seep A	06-12	13		1.0		11	J	1.9		53	JD
Seep A	06-13	3.3	J	0.26	J	0.5	U	1.3		1.0	
Seep A	06-14	7.4		0.73		2.9		1.0		21	
Seep A	06-15	2.5		0.30	J	0.25	J	1.3		3.6	
Seep A	06-16	7.9		0.65		5.4		0.82		44	J
Seep A	06-17	6.7		0.58		2.6		0.69		18	
Seep B	05-96	14		1	U	1	U	0.7	J	1	
Seep B	06-00	2.2		0.5	U	0.5	U	0.5	U	0.3	J
Seep B	06-01	3.1		0.13	J	0.12	U	0.44	J	0.26	J
Seep B	06-02	5.4		0.12	J	0.12	U	0.52		0.15	J
Seep B	06-03	1.9		0.14	J	0.12	U	0.2	J	0.12	U
Seep B	06-04	0.64		0.39	J	0.12	U	0.23	J	0.87	
Seep B	06-05	0.3		0.4		0.2	U	0.2	U	0.3	
Seep B	06-06	0.48	J	0.22	J	0.5	U	0.18	J	0.12	J
Seep B	06-07	0.14	J	0.5	U	0.5	U	0.5	U	0.5	U
Seep B	05-08	0.41	J	0.17	J	0.5	U	0.12	J	0.1	J
Seep B	06-09	0.40	J	0.18	J	0.2	U	0.5	U	0.16	J
Seep B	06-10	5.7		0.18	J	0.5	U	0.51		0.09	J
Seep B	07-11	1.3		0.12	J	0.5	U	0.09	J	0.5	U

Notes:
Shading indicates detected value is equal to or exceeds surface water RG.
µg/L – microgram per liter
DCE – dichloroethene
D – result reported from a diluted analysis
ID – identification
J – estimated result
PCE – tetrachloroethene
TCA – trichloroethane
TCE – trichloroethene
U – not detected at value shown
U[1] – not detected at value shown and value exceeds remediation goal
VOC – volatile organic compounds

4.3.2 Dissolved Metals in Seep Water

Dissolved arsenic was detected at a concentration of 0.93 µg/L in Seep A, above the surface water RG of 0.14 µg/L (refer to Table 4-9). However, this concentration is less than the Area 8 background concentration for arsenic in groundwater of 12 µg/L established during the remedial investigation (Navy 1993e).

Dissolved cadmium was detected at a concentration of 10.5 µg/L in Seep A, above the surface water RG of 8 µg/L.

Dissolved chromium was detected at 6.14 µg/L in Seep A, well below the surface water RG of 50 µg/L. Dissolved chromium in samples collected from Area 8 seeps has not exceeded the surface water RG since 1996.

Dissolved copper was detected at 0.42 µg/L in Seep A, below the surface water RG of 2.5 µg/L. Dissolved copper in samples collected from Area 8 seeps has not exceeded the surface water RG since 1996.

Dissolved lead was detected at 0.034 µg/L in Seep A, below the surface water RG of 5.8 µg/L. Dissolved lead in samples collected from Area 8 seeps has not exceeded the surface water RG since 1996 (refer to Table 4-9).

Dissolved nickel was detected in Seep A at 6.78 µg/L, below the surface water RG of 7.9 µg/L. Dissolved nickel in samples collected from Area 8 seeps has not exceeded the surface water RG since 1996 (refer to Table 4-9).

Dissolved silver was detected in Seep A at a concentration of 0.039 µg/L below the surface water RG of 1.2 µg/L. Dissolved silver in samples collected from Area 8 seeps has never exceeded the surface water RG since sampling began in 1996 (refer to Table 4-9).

Dissolved zinc was detected in Seep A at 0.87 µg/L, below the surface water RG of 77 µg/L. Dissolved zinc in samples collected from Area 8 seeps has never exceeded the surface water RG since sampling began in 1996 (refer to Table 4-9).

Dissolved barium was detected in Seep A at a concentration of 43.6 µg/L (Appendix C). No surface water RG exists for barium. The concentration detected did not exceed the drinking water RG for barium of 1,000 µg/L.

Table 4-9. Summary of Selected Dissolved Metals Results for Area 8 Seep Sampling Locations, Fall 1995 through Spring 2017

Location ID	Sampling Date	Arsenic (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Cr(VI)[1/] (µg/L)	Copper (µg/L)	Lead (µg/L)	Mercury[2/] (µg/L)	Nickel (µg/L)	Silver (µg/L)	Thallium (µg/L)	Zinc (µg/L)
Drinking Water Remediation Goals		0.05[3/]	5	50[4/]	80	590	15	2	100	48	1.1	4,800
Surface Water Remediation Goals		0.14[3/]	8	50[5/]	50	2.5	5.8	0.025	7.9	1.2	1.6	77
Seep A	05-96[6/]	1.8 J	46.7	183	240	7.8 J	1 U	0.2 U[1]	15 U[1]	4 U[1]	10 U[1]	12 U
Seep A	05-96	1.3 J	33.9	159		5.1 J	1 U	0.2 U[1]	15 U[1]	4 U[1]	10 U[1]	12 U
Seep A	06-00	2.4 J	0.14	0.6	450	0.27	1.3 J		5.59 J	1.14 J	0.02	0.8
Seep A	06-01	0.9 J	23.2	5.6	NT	1 J	0.06	0.0034	1	0.1	0.022	7.6 J
Seep A	06-02	1.95 J	2.57 J	0.44 U	NT	0.8	0.054 UJ	0.1 U[1]	0.95	0.011 UJ	0.003 J	1.3
Seep A	06-03	1.33 J	38.4	7.6 J	NT	0.93	0.08	0.1 U[1]	1.26 J	0.09	0.015 J	1
Seep A	06-04	0.66	88.9	45.5	NT	1.08	0.032	0.06 U[1]	4.29	0.031	0.015	0.83
Seep A	06-05	1.7	50.3	11	NT	1.13	0.1 U	0.1 U[1]	2	0.032 U	0.014	1.83
Seep A	06-06	1.21	14.4	3.58	NT	0.814	0.08 U	0.2 U[1]	1.74 J	0.162	0.02 U	1.40
Seep A	06-07	1.00 J	19.4	7.2	NT	1.20	0.063	0.2 U[1]	1.50	0.02 U	0.02 U	1.50
Seep A	05-08	2.48	7.96	10.6	NT	0.867	0.092 U	0.2 U[1]	1.77	0.037	0.01 B	1.44
Seep A	06-09	1.50 J	2.57	5.0	NT	0.383	0.028	0.2 U[1]	1.18	0.013 J	0.003 J	1.00
Seep A	06-10	1.66	6.60	4.87	NT	0.517	0.042 UJ	0.02 U[1]	1.94	0.030	0.007 UJ	2.58
Seep A	07-11	1.19	1.08	3.59	NT	0.651	0.036	0.20 U[1]	1.58	0.020 UJ	0.020 UJ	0.60
Seep A	06-12	0.98	15.4	7.52	NT	0.468	0.047	0.20 U[1]	2.99	0.107	0.026 UJ	1.21
Seep A	06-13	1.27	0.848	4.32	NT	0.435	0.016 J	0.20 U[1]	1.03 UJ	0.009 J	0.020 UJ	0.68
Seep A	06-14	1.10	2.90	7.30	NT	0.511	0.03	0.00162	1.97	0.020 UJ	0.020 UJ	0.8
Seep A	06-15	0.99 J	0.729	1.37	NT	0.380	0.047	0.00506	1.05	0.011 J	0.006 J	2.3
Seep A	06-16	0.89	10.5	3.22	NT	0.372	0.053 UJ	0.00134	6.83	0.057	0.008 J	0.62
Seep A	06-17	0.93	10.5	6.14	NT	0.42	0.034	NT	6.78	0.039	NT	0.87
Seep B	05-96	3 J	1 U	6 U	10 U	24.5 J	1 U	0.2 U[1]	15 U[1]	4 U[1]	1 U	12 U
Seep B	05-96	4.6 J	1 U	6 U	NT	8.5 J	1 U	0.2 U[1]	15 U[1]	4 U[1]	10 U[1]	12 U
Seep B	06-00	2.5 J	0.82	6.4	17.5	0.77	0.22 J		0.88 J	0.297 J	0.02	1.4
Seep B	06-01	1.4 J	1.52	4.4	NT	0.9 J	0.06	0.0009 J	1	0.1 U	0.011 J	3.4 U
Seep B	06-02	1.3 J	2.23 J	3.62	NT	0.9	0.009 UJ	0.1 U[1]	1.95	0.049 J	0.011 J	1.9
Seep B	06-03	1.6 J	4.18	2.9 J	NT	0.76	0.02 U	0.1 U[1]	3.14 J	0.04	0.013 J	1.3
Seep B	06-04	1.02	8.33	15.9	NT	0.71	0.27	0.06 U[1]	4.31	0.097	0.017	0.97

Table 4-9. Summary of Selected Dissolved Metals Results for Area 8 Seep Sampling Locations, Fall 1995 through Spring 2017 (continued)

Location ID	Sampling Date	Arsenic (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Cr(VI)[1/] (µg/L)	Copper (µg/L)	Lead (µg/L)	Mercury[2/] (µg/L)	Nickel (µg/L)	Silver (µg/L)	Thallium (µg/L)	Zinc (µg/L)
Drinking Water Remediation Goals		0.05[3/]	5	50[4/]	80	590	15	2	100	48	1.1	4,800
Surface Water Remediation Goals		0.14[3/]	8	50[5/]	50	2.5	5.8	0.025	7.9	1.2	1.6	77
Seep B	06-05	1.43	2.06	6.52	NT	0.89	0.1 U	0.1 U[1]	2.77	0.035	0.01 U	1.12
Seep B	06-06	1.32	2.1	3.33	NT	0.602	0.022	0.2 U[1]	2.64 J	0.085	0.02 U	1.01
Seep B	06-07	1.10 J	1.1	2.7	NT	0.60	0.058	0.2 U[1]	1.80	0.02 U	0.02 U	0.96
Seep B	05-08	2.27	1.26	3.28	NT	0.668	0.18 U	0.2 U[1]	2.11	0.051	0.019 B	1.39
Seep B	06-09	1.26 J	0.616	3.19	NT	0.618	0.058	0.2 U[1]	1.10	0.009 J	0.004 J	0.73
Seep B	06-10	1.40	0.928	3.70	NT	0.646	0.015 UJ	0.02 U[1]	1.46	0.202	0.009 UJ	2.31
Seep B	07-11	1.17	1.05	3.53	NT	0.690	0.025	0.20 U[1]	1.61	0.024 UJ	0.018 J	0.68

Notes:
[1/]Cr(VI) concentrations are for the total fraction only.
[2/]Analytical method for dissolved mercury changed to EPA Method 1631E (low-level dissolved mercury) in June 2014.
[3/]The background concentration of arsenic in groundwater at the site is 12 µg/L.
[4/]Value is for total chromium. Cr(VI) value is 80 µg/L.
[5/]The RG of 50 µg/L is for Cr(VI). There is no RG established for total dissolved chromium.
[6/]Total fraction was collected for this date and analyzed. Concentrations shown are total concentrations.
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 per liter or parts per billion (ppb)
Cr(VI) – hexavalent chromium
J – estimated result below reporting limit but above detection
U – not detected at value shown
U[1] – not detected at value shown and value exceeds remediation goal
NT – not tested

5. DATA TRENDS

Monitoring trends for VOCs, 1,4-dioxane, and dissolved metals in groundwater are presented and discussed in this section.

5.1 VOLATILE ORGANIC COMPOUND TRENDS

Graphs showing trends in VOC concentrations over the last 10 years (2007 through 2017) for groundwater are included in Appendix D. Graphs are presented as Figures D-1 through D-6, and D-1a through D-6a for sampling locations where chemicals have historically been detected (MW8-8, MW8-9, MW8-11, MW8-12, MW8-16, and Seep A). For each of these locations, chemical concentrations of particular interest, specifically TCE, PCE, and cis-1,2-DCE on Figures D-1 through D-6, and 1,1-DCE and 1,1,1-TCA on Figures D-1a through D-6a are graphically presented. Drinking water RGs are shown on the groundwater monitoring well graphs and surface water RGs are shown on the seep water graphs.

No VOC trend analysis graph was developed for MW8-14 because target VOCs have not been detected consistently or have been detected at only low concentrations, below RGs.

Analysis of concentrations trends from the past 10 years (2007 to 2017, inclusive) indicates that target VOC concentrations are generally declining; exceptions and RG exceedances are summarized by sample location below:

- MW8-8 (Figures D-1 and D-1a): PCE appears stable and continues to exceed the drinking water RG, but is less than the surface water RG (surface water RG not shown on figure). TCE exhibits an overall decrease in the last 10 years, however has increased three of the last four years. TCE continues to exceed the drinking water RG, but is less than the surface water RG. Since 2009, the TCE-degradation daughter product cis-1,2-DCE, exhibits an overall decreasing trend that corresponds roughly with the reduction of the parent compound TCE. The compound cis-1,2-DCE remains an order of magnitude lower than the drinking water RG. Other COCs are trending downward overall and have consistently remained below their respective RGs.
- MW8-9 (Figures D-2 and D-2a): PCE appears stable and at trace concentrations well below the RGs. Since 2013, TCE appears to be decreasing and has been below the drinking water RG for the past two years. The TCE concentration remains well below the surface water RG. The cis-1,2-DCE trend corresponds closely with the trend of its

parent compound TCE, mirroring the recent decreasing trend since 2013, and is well below the drinking water RG. Other COCs appear stable and have consistently remained below their respective RGs, or have not been detected at or above PQLs.

- MW8-11 (Figures D-3 and D-3a): PCE concentrations are consistently below the RGs and appear to be exhibiting a decreasing trend since 2010. The TCE concentration also appears to exhibit an overall decreasing trend since 2010, at levels that exceed the drinking water RG but are less than the surface water RG. The compound cis-1,2,-DCE may be decreasing since 2012, and is at levels well below the drinking water RG. Other COCs are trending downward overall and remain below their respective RGs.
- MW8-12 (Figures D-4 and D-4a): PCE and TCE appear to be decreasing, with TCE remaining above the drinking water RG, and PCE falling below the drinking water RG for the third consecutive time since 1999 (see Figure D-4). Both PCE and TCE remain below their respective surface water RGs. Concentrations of cis-1,2-DCE exhibit a decreasing trend and remain an order of magnitude below the drinking water RG. Other COCs are generally decreasing and remain well below their respective RGs or are not detected at the PQL.
- MW8-14: Given that VOCs have remained consistently either not detected at the PQL; detected at or above the laboratory PQLs, but below RGs; or detected at very low concentrations below RGs, a trend analysis graph was not developed for this well.
- MW8-16 (Figures D-5 and D-5a): PCE exhibits a stable to slightly decreasing trend at levels below the drinking water and surface water RGs. TCE exhibits a decreasing trend, although at levels exceeding the drinking water RG, but below the surface water RG. The cis-1,2-DCE concentration exhibits an increasing trend since 2013, but remains below the RG. Other COCs are generally stable and remain well below their respective RGs.
- Seep A (Figures D-6 and D-6a): The PCE trend is stable at levels remaining well below the surface water RG. TCE also exhibits a stable trend at levels well below the surface water RG since monitoring began in 1996 (see Figure D-6 and Table 4-2). The cis-1,2-DCE concentrations exhibit a stable trend at levels well below the RG. Referring to Table 4-2 and Figures D-6 and D-6a, all VOC concentrations at Seep A have remained less than their respective surface water RGs over the past 10 years (2007 to 2017, inclusive), with the exception of 1,1-DCE which exceeded the surface water RG in only 2012 and 2016.

5.2 DISSOLVED METAL TRENDS

Graphs showing trends of concentrations of dissolved metals over the past 10 years in Area 8 groundwater are included in Appendix D. Graphs are presented as Figures D-7 through D-12 for sampling locations where dissolved metals have historically been detected (MW8-8, MW8-9, MW8-11, MW8-12, MW8-14, and Seep A). Metals of particular interest include dissolved cadmium and chromium, which have been charted for each of these locations. Drinking water RGs are shown on the groundwater monitoring well graphs and surface water RGs are shown on the seep water graphs.

A trend analysis graph was not developed for well MW8-16 because target metals have not been consistently detected in this well, or have been detected at only low concentrations, below RGs.

For groundwater wells and seeps, the overall trends over the past 10 years are generally stable or decreasing toward lower metal concentrations and below the RGs for the following wells and metals:

- Dissolved cadmium at wells MW8-8 and MW8-12;
- Dissolved chromium at MW8-14 and Seep A; and
- Both dissolved cadmium and dissolved chromium at well MW8-9.

The following are the exceptions summarized by sample location below:

- MW8-8 (Figure D-7): The dissolved chromium concentration continues to be stable but remains above the drinking water and surface water RGs.
- MW8-11 (Figure D-9): Dissolved cadmium may be decreasing, and chromium appears stable, however, this well consistently exhibits the highest levels of dissolved cadmium and chromium with concentrations exceeding their respective drinking water and surface water RGs.
- MW8-12 (Figure D-10): The dissolved chromium concentration appears stable but remains above both drinking water and surface water RGs.
- MW8-14 (Figure D-11): The dissolved cadmium concentration appears to be decreasing, but continues to exceed the drinking water RG. It has remained below the surface water RG for the past two years.
- Seep A (Figure D-12): The dissolved cadmium concentration may be decreasing however it has oscillated above and below the surface water RG, and has exceeded the RG over the past two years.

5.3 1,4-DIOXANE TRENDS

Graphs depicting trends for 1,4-dioxane in groundwater at wells where it has been historically detected (MW8-8, MW8-11, and MW8-12) are presented in Figure D-13. Based upon 1,4-dioxane analyses at Area 8 in June 2007 and over the past 7 consecutive years, MW8-11 has exhibited an overall downward trend from a high of 39 µg/L in June 2007, declining to 11 µg/L in June 2013 and June 2014, and is now at 16 µg/L in June 2017. Wells MW8-8 and MW8-12 have exhibited relatively stable trends with low concentrations of 1,4-dioxane detected both above and below the MTCA Method B cleanup level in these wells over that same time period. June 2017 concentrations of 1,4-dioxane continue to exceed the MTCA Method B cleanup level of 0.44 µg/L in wells MW8-11 (16 µg/L), MW8-8 (1.1 µg/L), and MW8-12 (1.1 µg/L).

6. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

6.1 MONITORING WELL SAMPLING SUMMARY

Groundwater was sampled in June 2017 from six groundwater monitoring wells at Area 8 (MW8-8, MW8-9, MW8-11, MW8-12, MW8-14, and MW8-16) within 6 hours after an extreme low tide event. Water levels were measured at those wells and at well MW8-15.

Groundwater flows in a generally east-southeast direction toward Port Orchard Bay at an orientation essentially perpendicular to the shoreline. The calculated horizontal hydraulic gradient is approximately 0.02 (2 percent), which is consistent with discharge occurring to the nearby bay. Hydraulic head variations in the collocated wells MW8-14, MW8-15, and MW8-16 appear to indicate that a confining layer exists between the screened interval of well MW8-16 (42.5-47.5 feet btoc; groundwater elevation of 0.71 feet above msl) and the screened interval of well MW8-15 (160.5-165.5 feet btoc; groundwater elevation of 2.14 feet above msl). This confining layer creates an upward gradient between the shallow and deeper aquifers, reducing the potential for downward migration of contaminants in this area. MW8-14 and MW8-16 are both interpreted to be screened in the shallow aquifer. The groundwater in the shallow aquifer is known to discharge at Seep A and other seeps along the shoreline.

6.1.1 Target VOCs

Concentrations of TCE and PCE detected in several Area 8 monitoring wells consistently exceed drinking water RGs (see Figure 4-1).

Similar to previous sampling rounds, the highest PCE concentrations detected during June 2017 were in the shallow-aquifer wells MW8-8 and MW8-12 immediately downgradient of, and adjacent to, the former plating shop. PCE remains above the drinking water RG but below the surface water RG in MW8-8. PCE in MW8-12 declined to less than the drinking water RG, and has remained below the surface water RG since June 2015.

The highest concentrations of TCE continue to be detected (in order of decreasing concentrations) in MW8-8, MW8-11, MW8-12, and deeper well, MW8-16. The TCE drinking water RG continues to be exceeded at all four wells.

VOCs have never been detected above PQLs in MW8-14, with the exceptions of cis-1,2-DCE and 1,1,1-TCA detected three times at concentrations well below their respective RGs.

Trend analyses were performed on selected groundwater monitoring wells for target VOCs over the past 10 years. Based on these analyses, target VOCs are generally declining or stable at VOC concentrations below their respective RGs with the following exceptions:

- MW8-8: Both PCE and TCE remain above drinking water RGs, but below their surface water RGs. PCE appears stable while TCE may be decreasing overall.
- MW8-9: TCE appears to be decreasing and is below the drinking water RG for the second consecutive year; a change since 2015.
- MW8-11: TCE appears stable and exceeds the drinking water RG, but is less than the surface water RG.
- MW8-12: PCE and TCE trends appear to be continuing to decrease, with TCE remaining above the drinking water RG, and PCE falling below the drinking water RG for the third consecutive time since 2015. Both PCE and TCE remain below their surface water RGs.
- MW8-16: TCE exhibits a decreasing trend and is above the drinking water RG but below the surface water RG.

6.1.2 1,4-Dioxane

The SVOC 1,4-dioxane was detected in MW8-11 at a concentration of 16 µg/L, in MW8-8 at 1.1 µg/L, and in MW8-12 at 1.1 µg/L. As previously discussed, there is no RG established for 1,4-dioxane, so the MTCA Method B cleanup level (carcinogenic) of 0.44 µg/L is used for data evaluation. Therefore, concentrations of 1,4-dioxane in wells MW8-11, MW8-8, and MW8-12 exceed the current MTCA Method B cleanup level (carcinogenic). The SVOC 1,4-dioxane was not detected above the PQL of 0.4 µg/L in groundwater samples from the other wells sampled. Based upon the 7 years of 1,4-dioxane analyses at Area 8, MW8-11 has exhibited an overall downward trend, although levels have been slightly increasing over the past 3 years. Wells MW8-8 and MW8-12 have exhibited some relatively low concentrations of 1,4-dioxane, with levels oscillating both below and above the MTCA Method B cleanup level over that same time period.

6.1.3 Dissolved Metals

The target metals dissolved cadmium and dissolved chromium were detected in all Area 8 shallow aquifer wells, but were not detected at significant concentrations in the deeper well MW8-16. Consistent with previous reports, the drinking water and surface water RGs for dissolved cadmium were exceeded in MW8-11, but only the drinking water RG was

exceeded in MW8-14 in 2017, as in years past. The drinking water and surface water RGs for dissolved chromium were exceeded at three wells, MW8-8, MW8-11, and MW8-12. Dissolved cadmium and chromium concentrations over the past 10 years have generally shown stable or decreasing trends in all wells.

The drinking water RG for dissolved arsenic has consistently been exceeded in all wells. However, the dissolved arsenic concentrations detected have been well below the background concentration identified for arsenic during the remedial investigation (Navy 1993e).

As was the case during past sampling rounds, dissolved copper, nickel, and silver surface water RGs were also exceeded at well MW8-11, but levels have steadily declined over the past several years. In 2016, dissolved zinc and lead were detected above the surface water RG at MW8-11; the first exceedance for dissolved lead since sampling began. Dissolved lead was also detected for the first time above the surface water RG in well MW8-9. In 2017, concentrations of dissolved zinc and lead declined to levels below their surface water RGs.

6.2 SEEP SAMPLING SUMMARY

During the June 2017 sampling round, water was sampled from Seep A at Area 8. Due to consistently low and stable VOC and dissolved metals concentrations detected in Seep B water, sampling was discontinued for Seep B in spring 2012, in accordance with the recommendations of the Final Third Five-Year Review (Navy 2010a).

6.2.1 Target VOCs

TCE concentrations have fluctuated at Seep A over the past 10 years, but levels have been well below the surface water RG since monitoring began in 1996. PCE was detected in June 2017 at a concentration well below the RG and the trend appears stable. The VOC 1,1-DCE has exceeded the surface water RG four times since sampling began, including 2016, but is below the RG again in 2017. The fluctuation in TCE concentrations over the last 6 years with spikes in 2012, 2014, and 2016 can be seen mirrored in the TCE-degradation daughter products concentrations cis-1,2-DCE, 1,1-DCE, and 1,1-TCA.

6.2.2 Dissolved Metals

The only target metals that exceeded surface water RGs at Seep A in June 2017 were dissolved arsenic and cadmium. Subsequent to removal of the plating shop, increased concentrations in seep samples were observed in 1999 through 2004 followed by decreasing or stabilized trends with small fluctuations since then. Including 2017, dissolved cadmium has exceeded the surface water RG six times in the last 11 years.

The surface water RG for arsenic has consistently been exceeded at Seep A, but arsenic concentration trends have remained stable and well below the Area 8 background level for arsenic identified during the remedial investigation (Navy 1993e).

6.3 LONG-TERM MONITORING RECOMMENDATIONS

Based on the results of the June 2017 sampling event and concentrations trends over time, no changes to the locations or frequency of well or seep sampling are recommended.

Barium levels have ranged from a maximum of 62.5 µg/L to 197 µg/L over the past decade. Thus, barium has not been detected at Area 8 at concentrations significantly above its background concentration (130 µg/L) or approaching the drinking water remediation goal for barium of 1,000 µg/L (there is no surface water remediation goal). Therefore, discontinuing barium analysis is recommended as only very low concentrations, well below the RG, have been detected since the RG was established in the OU 2 ROD (Navy, EPA, and Ecology 1994).

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APPENDICES

APPENDIX A FIELD CHANGE REQUEST
APPENDIX B FIELD FORMS, FIELD LOGBOOK PAGES, AND TABLE B-1: HISTORICAL FIELD-MEASURED PARAMETER DATA
APPENDIX C DATA VALIDATION REPORTS
APPENDIX D GRAPHS OF CONCENTRATION TRENDS
APPENDIX E RESPONSE TO AGENCY COMMENTS ON DRAFT REPORT

APPENDIX A
FIELD CHANGE REQUEST

SEALASKA ENVIRONMENTAL SERVICES

CONTRACT NUMBER: N44255-14-D-9011

FIELD CHANGE REQUEST (FCR)

TASK ORDER # 46 **FCR #** TO 46 FCR-02 **DATE** 5/24/17

LOCATION: NBK Keyport, WA **NTR / RPM** Charlie Escola/ Carlotta Cellucci

1. Document to be changed. Identify revision, date, section, drawing, etc.

Management and Monitoring Approach Sampling and Analysis Plan, Final, 19 May 2017 - Tables 5-1 and 5-5

2. Description of existing requirement and proposed change (Attach sheet if necessary)

ITEM 1
REQUIREMENT: Table 5-1 indicates sampling and analysis for VOCs at Area 1 well MW1-02 at a frequency of once every two years with the next event scheduled for spring 2018.
PROPOSED CHANGE: Area 1 well MW1-02 will be sampled for VOCs in 2017 and then revert back to sampling in even years.

ITEM 2
REQUIREMENT: Table 5-5 indicates annual sampling and analysis at Area 8 locations (Seep A and wells MW8-8, MW8-9, MW8-11, MW8-12, MW8-14, and MW8-16) will include dissolved low-level mercury, dissolved tin, and dissolved thallium along with several other target analytes.
PROPOSED CHANGE: Three dissolved metals (low-level mercury, tin, and thallium) will be excluded from the Area 8 locations beginning with the June 2017 field event.

3. Reason for Change (Attach sheet if necessary)

ITEM 1
Sampling and analysis for VOCs at Area 1 well MW1-02 in 2017 is proposed in order to determine if ABS solution (root enhancer/oxidizer) applied at the upgradient tree roots had any effect on concentrations of VOCs.

ITEM 2
Per the recommendation presented in the Spring 2016 Long-Term Monitoring Report, Former Plating Shop/Waste Oil Spill Area, Area 8, Operable Unit 2 (Final, 14 April 2017) (specifically Section 6.3, Long-Term Monitoring Conclusions and Recommendations), sampling and analysis for three dissolved metals (low-level mercury, tin, and thallium) at Area 8 locations should be discontinued since no concentrations exceed the applicable remediation goals.

4. Originator: (print name and sign) Sherri Wunderlich Sherri L Wunderlich		**Title** Project Chemist	**Date** 5/24/17
Reviewed by: (print name and sign) Cara Alferness Cara Alferness		**Title** Project Quality Control Manager	**Date** 5/24/17
Site Superintendent (Print name and sign) James Ruef James R. Ruef	**Date** 5/24/17	**Task Order Manager (Print name and sign)** James Ruef James R. Ruef	**Date** 5/24/17
Program QC Manager (Print Name and Sign) Sherri Wunderlich Sherri L Wunderlich	**Date** 5/24/17	**NTR Acknowledgement (Print name and sign)**	**Date**

APPENDIX B

FIELD FORMS, FIELD LOGBOOK PAGES, AND TABLE B-1: HISTORICAL FIELD-MEASURED PARAMETER DATA

Sealaska Environmental Services

SEA Discovery Center, P.O. Box 869

18743 Front Street, NE, Suite 201

Poulsbo, WA 98370

Contract Number: N44255-14-D-9011 Task Order: 46 Naval Installation: NAVBASE Kitsap Keyport Site Name: Area 8 Sampling Event: Annual LTM, June 2017

Location	Sample ID	Sample Type	Snapshot DTW (ft btoc)	Sampling Date	Sampling Time	pH/cond/turb/ DO/temp/ORP/ salinity	VOCs (18) 8260C 40 mL VOC HCl	1,4-Dioxane 8270D SIM 250 mL Amber	Dissolved Metals (9) Ba, As, Cd, Cr, Co, Pb, Ni, Ag, Zn 200.7/200.8 with RPP if necessary 1 L Poly HNO3 (f)	Previous DTB (ft btoc)	DTB (ft btoc)	
MW8-8	AREA-8-17-200	Environmental	9.77	06/21/17	1245	1	3	2	1	18.30	18.30	
MW8-9	AREA-8-17-201	Environmental	10.16	06/21/17	1200	1	3	2	1	20.46	20.46	
MW8-11	AREA-8-17-202	Environmental	10.03	06/21/17	1040	1	3	2	1	18.00	15.96	DTB = 15.79
MW8-11	AREA-8-17-203	Duplicate	-	06/21/17	1050	-	3	2	1	-	-	
MW8-12	AREA-8-17-204	Environmental	9.33	06/21/17	0955	1	3	2	1	18.00	14.18	DTB = 13.99
MW8-14	AREA-8-17-205	Environmental MS/MSD	10.74	06/21/17	1130	1	9	2	3	15.50	15.19	DTB = 15.13
MW8-16	AREA-8-17-206	Environmental	11.91	06/21/17	1420	1	3	2	1	48.00	47.06	DTB = 47.11
SEEP A	AREA-8-17-207	Environmental MS/MSD	-	06/22/17	0935	1	9	-	3	-	-	
SEEP A	AREA-8-17-208	Duplicate	-	06/22/17	0945	1	3	-	1	-	-	
MW8-15	NA	DTW only	10.33	06/21/17	0935	-	-	-	-	170.00	166.66	SOFT BOTTOM
Trip Blank	TB-	QC	-		-	-	2	-	-	-	-	
Trip Blank	TB-	QC	-		-	-	2	-	-	-	-	
Trip Blank	TB-	QC	-		-	-	-	-	-	-	-	
Total							43	14	13	-	-	

Notes:

Duplicate

MS/MSD Note: regular volume is sufficient for 1,4-dioxane MS/MSD.

Dissolved Metals (9) will be *field filtered*.

Snapshot DTW needed at wells listed above per MMA SAP Section 6.3.

On COC, indicate "Analyses per SOW, include EIM EDD."

Laboratory

ALS-Kelso PO-01281 BJ

B-1

CHAIN OF CUSTODY

ALS Environmental

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SR# K170 6626 PAGE 1 OF 1 COC#

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PHONE #: 360 377 0780 FAX #:
SAMPLER'S SIGNATURE:

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	Semivolatile Organics by GC/MS 625☐ 8270☐ SIM PAH☐	Volatile Organics 624☐ 8260☐ 8021☐ BTEX☐	Hydrocarbons (*see below) Gas☐ Diesel☐ Oil☐	Oil & Grease/TRPH 1664 HEM☐ 1664 SGT☐	PCBs Aroclors☐ Congeners☐	Pesticides/Herbicides 608☐ 8081☐ 8141☐ 8151☐	Chlorophenolics - 8151M Tri☐ Tetra☐ PCP☐	Metals, Total or (Dissolved) (See List below)	Cyanide☐ Hex-Chrom☐	(circle) pH, Cond., Cl, SO_4, PO_4, F, NO_2, NO_3, BOD, TSS, TDS, Turb.	(circle) NH_3-N, COD, TKN, TOC, DOC, NO_2+NO_3, T-Phos	TOX 9020☐ AOX 1650☐ 506☐	Alkalinity☐ CO_3☐ HCO_3☐	Dioxins/Furans 1613☐ 8290☐	Dissolved Gases RSK 175☐ Methane☐ Ethane☐ Ethene☐ CO_2☐	14-Day RUSH STAT			REMARKS
AREA-8-17-204	6/21/17	0955		WG	6		3					1								2				
AREA-8-17-203	6/21/17	1050		WG	6		3					1								2				
AREA-8-17-202	6/21/17	1040		WG	6		3					1								2				
AREA-8-17-205	6/21/17	1130		WG	14		9					3								2				MS/MSD
AREA-8-17-201	6/21/17	1200		WG	6		3					1								2				
~~AREA-8-17-205~~	6/21/17	~~1230~~ 6/22/17																						
AREA-8-17-200	6/21/17	1245		WG	6		3					1								2				
AREA-8-17-206	6/21/17	1420		WG	6		3					1								2				
AREA-8-17-207	6/22/17	0935		SP	12		9					3												MS/MSD
AREA-8-17-208	6/22/17	0945		SP	4		3					1												

B-2

REPORT REQUIREMENTS

___ I. Routine Report: Method Blank, Surrogate, as required
___ II. Report Dup., MS, MSD as required
___ III. CLP Like Summary (no raw data)
X IV. Data Validation Report
X V. EDD

INVOICE INFORMATION

P.O. # PO-01281BJ
Bill To:

TURNAROUND REQUIREMENTS

___ 24 hr. ___ 48 hr.
___ 5 day
X Standard (15 working days)
___ Provide FAX Results

Requested Report Date

Circle which metals are to be analyzed:

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al (As) Sb (Ba) Be B Ca (Cd) Co (Cr) (Cu) Fe (Pb) Mg Mn Mo (Ni) K (Ag) Na Se Sr Tl Sn V (Zn) Hg

*INDICATE STATE HYDROCARBON PROCEDURE: AK CA WI NORTHWEST OTHER: _____ (CIRCLE ONE)

SPECIAL INSTRUCTIONS/COMMENTS:
* AS PER CONTRACT

Container Supply Number
77101

☐ Sample Shipment contains USDA regulated soil samples (check box if applicable)

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature:	MC Delivery	MC Delivery	
Date/Time: 6/23/17 0800	Date/Time:	Date/Time:	Date/Time: 6/23/17 1112
Printed Name:	Printed Name:	Printed Name:	Printed Name:
Firm: Sealaska	Firm:	Firm:	Firm: ALS

SEALASKA ENVIRONMENTAL

Sealaska Environmental Services

Marine Science Center, P.O. Box 869
18743 Front Street, NE, Suite 201
Poulsbo, WA 98370

Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-14-D-9011 | Task Order: 46 | Naval Installation: Naval Base Kitsap at Keyport | Site Name: Area 8

Well Data

Well ID: MW8-8 | Measuring Point (MP): Top of Casing, Rim Monument, Other:

Total Well Depth (ft below MP): 18.30 (time 2017) | Pooled Water in Well Head: Y: N: ✓ | Well Casing Volume (liters/ft): 0.6

Depth to Water (ft below MP): 9.93 | Inner Casing Straight and Clear:: Y: ✓ N: | Well Volume (liters): 5.02

Length of Water Column in well (ft): 8.37 | Well Head Locked: Y: ✓ N: | 2 x Well Volume (liters): 10.04

Diameter of well casing (inches): 2" | Exterior Seal Good Y: ✓ N: | Volume Purged (liters): 8

Purge Method: Peristaltic/Submersible/Bladder/Other: | Remarks: PID- 0.0 ppm

Water Sample Data

Sample ID: AREA-8-17-200 | Type: ENV. | Date: 06/ 21 /2017 | Time: 1245 | # Containers: 6

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

Sampling Personnel: Andy Lewis | Sampling Method: Low Flow Grab

Remarks (color, odor, etc.): purge water - clear & odorless

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	pH	Spec. Cond. (ms/cm)	Turbidity (NTU)	DO (mg/L)	Temp. (°C)	ORP (mv)	Salinity (%)
Stabilization Requirements			(± 10%)	(± 10%)	(± 10%)		(± 10%)		
1211	0	9.93	Initial Depth to Water (Pre-pumping)						
1213	power on pump, set flow rate to 400ml/min								
1215	connect sample tubing to the flow cell								
1220	2	9.93	7.09	0.611	2.1	5.13	18.16	109	0.03
1225	4	9.94	6.95	0.353	2.0	4.95	18.32	127	0.02
1230	6	9.94	6.93	0.348	2.1	4.93	18.54	130	0.02
1235	8	9.94	6.92	0.343	2.1	4.89	18.70	131	0.02
1245	collect sample.								
Final (at time of sample collection)									
1235	8	9.94	6.92	0.343	2.1	4.89	18.70	131	0.02

Well Volume Calculation

Well volume (liters) = [Well casing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)

1.25" → 0.3 | 1.5" → 0.4 | 2" → 0.6 | 2.5" → 1 | 3" → 1.4 | 3.5" → 2 | 4" → 2.5 | 6" → 5.5

Recorded by: Andy Lewis Date: 6/21/17

Reviewed by: SM Arrieta Date: 6/21/17

Page 1 of 1

Meter Model: Horiba U-52

Revision: January 2016
Filename: GW Sample Collection Form-Keyport-2016.doc

SEALASKA ENVIRONMENTAL

Sealaska Environmental Services

Marine Science Center, P.O. Box 869
18743 Front Street, NE, Suite 201
Poulsbo, WA 98370

Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-14-D-9011 | Task Order: 46 | Naval Installation: Naval Base Kitsap at Keyport | Site Name: Area 8

Well Data

Well ID: MW8-9 | Measuring Point (MP): Top of Casing, Rim Monument, Other:

Total Well Depth (ft below MP): 20.46 - same 2017 | Pooled Water in Well Head: Y: ___ N: ✓ | Well Casing Volume (liters/ft): 0.6

Depth to Water (ft below MP): 10.32 | Inner Casing Straight and Clear:: Y: ✓ N: ___ | Well Volume (liters): 6.08

Length of Water Column in well (ft): 10.14 | Well Head Locked: Y: ✓ N: ___ | 2 x Well Volume (liters): 12.17

Diameter of well casing (inches): 2" | Exterior Seal Good Y: ✓ N: ___ | Volume Purged (liters): 8

Purge Method: Peristaltic/Submersible/Bladder/Other: | Remarks: PID- 0.0 ppm

Water Sample Data

Sample ID: AREA-8-17-201 | Type: ~~MS/MSD~~ ENV | Date: 06/21/2017 | Time: 1200 | # Containers: 6

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

Sampling Personnel: A. Lewis & S. Patterson | Sampling Method: Low Flow Grab

Remarks (color, odor, etc.): clear & odorless purge water

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	pH	Spec. Cond. (ms/cm)	Turbidity (NTU)	DO (mg/L)	Temp. (°C)	ORP (mv)	Salinity (%)
Stabilization Requirements			(± 10%)	(± 10%)	(± 10%)		(± 10%)		
1132	0	10.32	Initial Depth to Water (Pre-pumping)						
1134	Power on pump and set flow rate to 400 ml/min								
1136	connect sample tubing to flow cell								
1141	2	10.35	7.16	29.2	6.0	6.66	16.04	137	1.79
1146	4	10.36	7.10	29.0	5.9	6.58	16.45	142	1.78
1151	6	10.37	7.08	29.0	6.0	6.36	16.44	140	1.78
1156	8	10.37	7.08	29.0	6.1	6.43	16.65	137	1.77
1200	collect sample								
Final (at time of sample collection)									
1200	8	10.37	7.08	29.0	6.1	6.43	16.65	137	1.77

Well Volume Calculation

Well volume (liters) = [Well casing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)

1.25" → 0.3 | 1.5" → 0.4 | 2" → 0.6 | 2.5" → 1 | 3" → 1.4 | 3.5" → 2 | 4" → 2.5 | 6" → 5.5

Recorded by: Andy Lewis Date: 6/21/17

Reviewed by: S Patterson Date: 06/21/17

Meter Model: Horiba U-52

Revision: January 2016
Filename: GW Sample Collection Form-Keyport-2016.doc

SEALASKA ENVIRONMENTAL

Sealaska Environmental Services

Marine Science Center, P.O. Box 869
18743 Front Street, NE, Suite 201
Poulsbo, WA 98370

Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-14-D-9011 | Task Order: 46 | Naval Installation: Naval Base Kitsap at Keyport | Site Name: Area 8

Well Data

Well ID: MW8-11 | Measuring Point (MP): Top of Casing, Rim Monument, Other:

Total Well Depth (ft below MP): 15.96 (5/May/2017) | Pooled Water in Well Head: Y: ___ N: ✓ | Well Casing Volume (liters/ft): 0.6

Depth to Water (ft below MP): 10.02 | Inner Casing Straight and Clear:: Y: ✓ N: ___ | Well Volume (liters): 3.56

Length of Water Column in well (ft): 5.94 | Well Head Locked: Y: ✓ N: ___ | 2 x Well Volume (liters): 7.13

Diameter of well casing (inches): 2" | Exterior Seal Good Y: ✓ N: ___ | Volume Purged (liters): 8

Purge Method: Peristaltic/Submersible/Bladder/Other: | Remarks: PID- 0.0ppm

Water Sample Data

Sample ID: AREA-8-17-202 | Type: ENV. | Date: 06/ 21 /2017 | Time: 1040 | # Containers: 6

QC Sample ID: AREA-8-17-203 | Type: DUP. | Date: 06/ 21 /2017 | Time: 1050 | # Containers: 6

Sampling Personnel: Andy Lewis & Sunrise Patterson | Sampling Method: Low Flow Grab

Remarks (color, odor, etc.): Clear & odorless purge water

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	pH	Spec. Cond. (ms/cm)	Turbidity (NTU)	DO (mg/L)	Temp. (°C)	ORP (mv)	Salinity (%)
Stabilization Requirements			(± 10%)	(± 10%)	(± 10%)		(± 10%)		
1012	0	10.02	Initial Depth to Water (Pre-pumping)						
1014	Start pump and Set flow rate to 400ml/min								
1016	connect sample tubing to Flowcell								
1021	2	10.06	6.80	23.0	1.8	7.41	17.29	181	1.38
1026	4	10.07	6.80	22.7	1.6	7.20	17.26	204	1.34
1031	6	10.07	6.80	21.9	1.9	7.05	17.26	215	1.31
1036	8	10.07	6.80	21.8	2.0	6.81	17.29	223	1.30
	2x CASING VOLUME								
1040	COLLECT SAMPLE								
1050	COLLECT DUP SAMPLE								
Final (at time of sample collection)									
1036	8	10.07	6.80	21.8	2.0	6.81	17.29	223	1.30

Well Volume Calculation

Well volume (liters) = [Well casing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)

1.25" → 0.3 | 1.5" → 0.4 | 2" → 0.6 | 2.5" → 1 | 3" → 1.4 | 3.5" → 2 | 4" → 2.5 | 6" → 5.5

Recorded by: Andy Lewis Date: 6-21-17

Reviewed by: USPATTERSON Date: 6/21/17

Meter Model: Horiba U-52

Revision: January 2016
Filename: GW Sample Collection Form-Keyport-2016.doc

SEALASKA ENVIRONMENTAL

Sealaska Environmental Services

Marine Science Center, P.O. Box 869
18743 Front Street, NE, Suite 201
Poulsbo, WA 98370

Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-14-D-9011 | Task Order: 46 | Naval Installation: Naval Base Kitsap at Keyport | Site Name: Area 8

Well Data

Well ID: MW8-12 | Measuring Point (MP): Top of Casing, Rim Monument, Other: ____

Total Well Depth (ft below MP): 14.13 | Pooled Water in Well Head: Y: ___ N: ✓ | Well Casing Volume (liters/ft): 0.6

Depth to Water (ft below MP): ~~10.83~~ 9.33 | Inner Casing Straight and Clear:: Y: ✓ N: ___ | Well Volume (liters): 2.88

Length of Water Column in well (ft): 4.80 | Well Head Locked: Y: ✓ N: ___ | 2 x Well Volume (liters): 5.76

Diameter of well casing (inches): 2" | Exterior Seal Good Y: ✓ N: ___ | Volume Purged (liters): 6

Purge Method: (Peristaltic)/Submersible/Bladder/Other: ____ | Remarks: pid = 0.0 ppm

Water Sample Data

Sample ID: AREA-8-17-204 | Type: ENV. | Date: 6-21-17 | Time: 0955 | # Containers: 6

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

Sampling Personnel: Andy Lewis & Sunnie Patterson | Sampling Method: low flow

Remarks (color, odor, etc.): clear & odorless water 2017 DTB = 14.18

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	pH (± 10%)	Spec. Cond. (ms/cm) (± 10%)	Turbidity (NTU) (± 10%)	DO (mg/L)	Temp. (°C) (± 10%)	ORP (mv)	Salinity (%)
Stabilization Requirements	0								
Initial Depth to Water (Pre-pumping)									
0936	Start pump and set flow rate to 400 ml/min								
0938	Connect tubing to flowcell								~~0.0~~ 0.2
0943	2	9.36	7.32	4.99	1.3	6.88	15.59	122	0.27
0948	4	9.36	7.31	4.98	1.3	6.99	15.49	132	0.27
0953	6	9.36	7.29	4.99	1.3	7.07	15.50	138	0.27
0955	Collect sample								
Final (at time of sample collection)									
0955	6	9.36	7.29	4.99	1.3	7.07	15.50	138	0.27

Well Volume Calculation

Well volume (liters) = [Well casing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)

1.25" → 0.3 | 1.5" → 0.4 | 2" → 0.6 | 2.5" → 1 | 3" → 1.4 | 3.5" → 2 | 4" → 2.5 | 6" → 5.5

Recorded by: Andy Lewis Date: 6-21-17

Reviewed by: V Patterson Date: 06/21/17

Meter Model: Horiba U-52

Revision: January 2016
Filename: GW Sample Collection Form-Keyport-2016.doc

SEALASKA ENVIRONMENTAL

Sealaska Environmental Services

Marine Science Center, P.O. Box 869
18743 Front Street, NE, Suite 201
Poulsbo, WA 98370

Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-14-D-9011 | Task Order: 46 | Naval Installation: Naval Base Kitsap at Keyport | Site Name: Area 8

Well Data

Well ID: MW8-14 | Measuring Point (MP): Top of Casing, Rim Monument, Other:

Total Well Depth (ft below MP): 15.13 | Pooled Water in Well Head: Y: __ N: ✓ | Well Casing Volume (liters/ft): 0.6

Depth to Water (ft below MP): 10.97 | Inner Casing Straight and Clear:: Y: ✓ N: __ | Well Volume (liters): 2.50

Length of Water Column in well (ft): 4.16 | Well Head Locked: Y: ✓ N: __ | 2 x Well Volume (liters): 5.00

Diameter of well casing (inches): 2" | Exterior Seal Good Y: ✓ N: __ | Volume Purged (liters): 6

Purge Method: (Peristaltic) Submersible/Bladder/Other: | Remarks: pid = 0.0 ppm

Water Sample Data

Sample ID: AREA-8-17-205 | Type: MS/MSD | Date: 6/21/17 | Time: 1130 | # Containers: 14

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

Sampling Personnel: Andy Lewis & Sunrise Patterson | Sampling Method: low flow

Remarks (color, odor, etc.): clear and odorless purge water DTW 2017 = 15.19

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	pH	Spec. Cond. (ms/cm)	Turbidity (NTU)	DO (mg/L)	Temp. (°C)	ORP (mv)	Salinity (%)
Stabilization Requirements			(± 10%)	(± 10%)	(± 10%)		(± 10%)		
1105	0	10.97	Initial Depth to Water (Pre-pumping)						
1109	Start pump and set purge rate to 400 ml/min								
1111	Connect tubing to flow cell								
1116	2	11.21	7.94	35.3	5.2	7.74	17.71	128	2.21
1121	4	11.24	7.96	36.3	2.8	7.59	16.32	124	2.27
1126	6	11.27	7.97	36.6	2.6	7.44	16.08	123	2.27
	2x CASING VOLUME								
1130	COLLECT SAMPLE								
Final (at time of sample collection)									
1126	6	11.27	7.97	36.6	2.6	7.44	16.08	123	2.27

Well Volume Calculation

Well volume (liters) = [Well casing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)

1.25" → 0.3 | 1.5" → 0.4 | 2" → 0.6 | 2.5" → 1 | 3" → 1.4 | 3.5" → 2 | 4" → 2.5 | 6" → 5.5

Recorded by: Andy Lewis Date: 6/21/17

Reviewed by: S. Patterson Date: 06/21/17

Meter Model: Horiba U-52

Revision: January 2016
Filename: GW Sample Collection Form-Keyport-2016.doc

SEALASKA ENVIRONMENTAL

Sealaska Environmental Services

Marine Science Center, P.O. Box 869
18743 Front Street, NE, Suite 201
Poulsbo, WA 98370

Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-14-D-9011 | Task Order: ~~27~~ 46 | Naval Installation: Naval Base Kitsap at Keyport | Site Name: Area 8

Well Data

Well ID: MW8-16 | Measuring Point (MP): Top of Casing, Rim Monument, Other: TOC

Total Well Depth (ft below MP): 47.11 | Pooled Water in Well Head: Y: ___ N: ✓ | Well Casing Volume (liters/ft): 0.6

Depth to Water (ft below MP): 10.48 | Inner Casing Straight and Clear:: Y: ✓ N: ___ | Well Volume (liters): 21.98

Length of Water Column in well (ft): 36.63 | Well Head Locked: Y: ✓ N: ___ | 2 x Well Volume (liters): 43.96

Diameter of well casing (inches): 2" | Exterior Seal Good Y: ✓ N: ___ | Volume Purged (liters): 22

Purge Method: Peristaltic/(Submersible)/Bladder/Other: ___ | Remarks: PID = 0.0 ppm

Water Sample Data

Sample ID: AREA-8-~~16~~17-206 (A) | Type: ENV. | Date: 6/21/17 | Time: 1420 | # Containers: ~~8~~ (A) 6

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

Sampling Personnel: Andy Lewis & Sunrise Patterson | Sampling Method: low flow

Remarks (color, odor, etc.): clear and odorless purge water

20M DTB - 47.06 FIBTOC

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	pH	Spec. Cond. (ms/cm)	Turbidity (NTU)	DO (mg/L)	Temp. (°C)	ORP (mv)	Salinity (%)
Stabilization Requirements			(± 10%)	(± 10%)	(± 10%)		(± 10%)		
1318	0	10.48	Initial Depth to Water (Pre-pumping)						
1320	start pump and set flow rate				400ml/min				
1355	14	correct flow cell to tubing							
1400	16	~~9.96~~ 9.94	6.96	15.2	1.8	4.11	18.31	-78	0.88
1405	18	9.88	6.96	15.1	1.7	3.99	18.13	-78	0.88
1410	20	9.82	6.96	15.1	1.7	3.90	18.07	-78	0.87
1415	22	9.75	6.96	15.0	1.7	3.85	18.02	-78	0.87
Final (at time of sample collection)									

Well Volume Calculation

Well volume (liters) = [Well casing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)

1.25" → 0.3 | 1.5" → 0.4 | 2" → 0.6 | 2.5" → 1 | 3" → 1.4 | 3.5" → 2 | 4" → 2.5 | 6" → 5.5

Recorded by: Andy Lewis Date: 6/21/17

Reviewed by: S Patterson Date: 06/21/2017

Meter Model: Horiba U-52

Revision: January 2016
Filename: GW Sample Collection Form-Keyport-2016.doc

SEALASKA ENVIRONMENTAL

Sealaska Environmental Services

Marine Science Center, P.O. Box 869
18743 Front Street, NE, Suite 201
Poulsbo, WA 98370

Well Inspection, Purging, and Field Measurement Form

Contract Number: N44255-14-D-9011 | Task Order: 46 | Naval Installation: Naval Base Kitsap at Keyport | Site Name: Area 8

Well Data

Well ID: SEEP A | Measuring Point (MP): Top of Casing, Rim Monument, Other: NA

Total Well Depth (ft below MP): NA | Pooled Water in Well Head: Y: NA N: ___ | Well Casing Volume (liters/ft): NA

Depth to Water (ft below MP): NA | Inner Casing Straight and Clear:: Y: NA N: ___ | Well Volume (liters): NA

Length of Water Column in well (ft): NA | Well Head Locked: Y: NA N: ___ | 2 x Well Volume (liters): NA

Diameter of well casing (inches): NA | Exterior Seal Good Y: NA N: ___ | Volume Purged (liters): NA

Purge Method: (Peristaltic)/Submersible/Bladder/Other: ___ | Remarks: NA

Water Sample Data

Sample ID: AREA 8 17 207 | Type: MS/MSD | Date: 6/22/17 | Time: 0935 | # Containers: 12

QC Sample ID: AREA-8-17-208 | Type: DUP. | Date: 6/22/17 | Time: 0945 | # Containers: 4

Sampling Personnel: Andy Lewis & Sunnive Patterson | Sampling Method: grab

Remarks (color, odor, etc.): ___

Time	Purge Vol. (liters)	Depth to Water (ft btoc)	pH (± 10%)	Spec. Cond. (ms/cm) (± 10%)	Turbidity (NTU) (± 10%)	DO (mg/L)	Temp. (°C) (± 10%)	ORP (mv)	Salinity (%)
Stabilization Requirements									
NA	0	NA	Initial Depth to Water (Pre-pumping)						
0930	30min purge	Surface	7.02	28.8	15.2	6.21	16.50	136	1.77
0935	collect	MS/MSD	Sample						
0945	collect	duplicate	sample						
Final (at time of sample collection)									
0930	30min. purge	surface	7.02	28.8	15.2	6.21	16.50	136	1.77

Well Volume Calculation

Well volume (liters) = [Well casing volume (liters/ft)] x [Length of water column (ft)]

Well casing diameter (in) → Well casing volume (liters/ft)

1.25" → 0.3 | 1.5" → 0.4 | 2" → 0.6 | 2.5" → 1 | 3" → 1.4 | 3.5" → 2 | 4" → 2.5 | 6" → 5.5

Recorded by: Andy Lewis Date: 6/22/17

Reviewed by: V.S. Patterson Date: 6/22/17

Meter Model: Horiba U-52

Revision: January 2016
Filename: GW Sample Collection Form-Keyport-2016.doc

TO 46 NAVBASE KITSAP KEYPORT 2017JUNE21

0730 S.PATTERSON, M.HALDANE, A.LEWIS, S.PATTERSON ON SITE

CONDUCT TAILGATE SAFETY BRIEFING

SSHO-S.PATTERSON

TOPICS INCLUDE:

- PRESERVATIVE SAFETY
- CUTS, SCRAPES, ~~BURNS~~ BURNS, PUNCTURES
- USE CAUTION GETTING IN/OUT OF TRUCK
- HYDRATION
- PROPER PPE-LEVEL D
  - SAFETY: GLASSES, TOED BOOTS, VEST
  - GLOVES: WORK, NITRILE
  - WEED WHACKER: CHAPS, HARD HAT, FACE SHIELD, HEARING PROTECTION

SITE INSPECTION: STUMPS & DEBRIS IN LANDFILL

WX: CLOUDY-PARTLY CLOUDY, 55-66°F, WIND 5-10 MPH

MOB FOR SAMPLE COLLECTION/MAINTENANCE

0750 CLEAN/CALIBRATE HORIBA U52: pH-3.98, COND.-4.50ms/cm, TURB.-0.0NTUs, DO-9.94mg/L, TEMP.-17.1°C, ORP-294mV, SAL-0.24%

R.BOYD & M.HALDANE START PLANTATION MAINTENANCE

S.PATTERSON & A.LEWIS CONDUCT SAMPLING ACTIVITIES VHMP 06/21/17

TO 46 NAVBASE KITSAP KEYPORT 2017JUNE21

S.PATTERSON & A.LEWIS ON SITE PUD

MEET OPERATOR SET UP TO SAMPLE

0816 START PURGE

0825 COLLECT PARAMETERS: PURGE VOL.-30L, pH-7.77, COND.-0.287ms/cm, TURB.-11.1 NTUs, DO-9.03mg/L, TEMP.-12.94°C, ORP-32mV, SAL.-0.01%, CLEAR, ODORLESS

0830 COLLECT SAMPLE AREA-1-17-208

3-40mL VOA W/HCl VOCs (9) 8260C

ON SITE NAVY#5 SET UP TO SAMPLE VIA GRAB PUMP RUNNING PURGE

0840 COLLECT PARAMETERS: pH-8.22, COND.-0.735 mS/cm, TURB.-1.7NTUs, DO-9.5mg/L, TEMP.-13.13°C, ORP-17mV, SALINITY-0.01%, CLEAR, ODORLESS

0845 COLLECT SAMPLE AREA-1-17-209

3-40mL VOA W/HCl VOCs (9) 8260C

0854 ON SITE AREA & OPEN WELLS

LOW TIDE -1.2 @ 0932

0932 COLLECT DTWs

WELL ID	DTW
MW8-12	9.33
MW8-11	10.03
MW8-16	11.91
0935 MW8-15	10.33

VHMP 06/21/17

Rite in the Rain

TO 46 NAVBASE KITSAP KEYPORT 2017 JUNE 21

WELL ID	DTW
MW8-14	10.74
MW8-9	10.16
MW8-8	9.77

0936 ON SITE MW8-12 START PERISTALTIC PUMP
SET FLOW RATE: 400 mL/min
0938 CONNECT TO FLOW CELL
0943 COLLECT PARAMETERS - LISTED ON PURGE FORM
0953 PARAMETERS STABILIZE: PURGE VOL. - 6L,
DTW - 9.36 FT BTOC, pH - 7.29, COND. - 4.99 ms/cm,
TURB. - 1.3 NTUs, DO - 7.07 mg/L, TEMP. - 15.50°C,
ORP - 138 mV, SAL - 0.27 %, CLEAR, ODORLESS
0955 COLLECT SAMPLE AREA-8-17-204
3-40 mL VOA W/HCl VOCs (18) 8260C
2-250 mL AMBER UP 8270D SIM 1,4-DIOXANE
1-1L POLY W/HNO3 (FF) DISS. METALS 200.7/200.8/RPP
DTB - 14.18 FT BTOC
ON SITE MW8-11 SET UP TO SAMPLE
VIA PERISTALTIC PUMP PID - 0.0 ppm
1012 DTW - 10.02 FT BTOC
1014 START PUMP SET FLOW RATE: 400 mL/min
1016 CONNECT TO FLOW CELL
1021 COLLECT PARAMETERS - LISTED ON PURGE FORM
1036 PARAMETERS ~~STABILIZE~~ 2X CASING VOLUME: PURGE VOL. - 8L,
DTW - 10.07 FT BTOC, pH - 6.80, COND. - 21.8 ms/cm,
ad 6/21/17

TO 46 NAVBASE KITSAP KEY PORT 2017 JUNE 21
TURB. - 2.0 NTUs, DO - 6.8 mg/L, TEMP. - 17.29°C,
ORP - 223 mV, SAL. - 1.30 %
1020 J. RUEF ON SITE REVIEW H&S
1040 COLLECT SAMPLE AREA-8-17-202
3-40 mL VOA W/HCl VOCs (18) 8260C
2-250 mL AMBER UP 8270D SIM 1,4-DIOXANE
1-1L POLY W/HNO3 (FF) DISS METALS 200.7/200.8/RPP
1050 COLLECT DUP SAMPLE AREA-8-17-203
3-40 mL VOA W/HCl VOCs (18) 8260C
2-250 mL AMBER UP 8270D SIM 1,4-DIOXANE
1-1L POLY W/HNO3 (FF) DISS. METALS 200.7/200.8/RPP
DTB - 15.96 FT BTOC
ON SITE ~~SB~~ MW8-14 SETUP TO SAMPLE
VIA PERISTALTIC PUMP PID - 0.0 ppm
1105 DTW - 10.97 FT BTOC
1109 START PUMP SET FLOW RATE: 400 mL/min
1111 CONNECT TO FLOW CELL
1116 COLLECT PARAMETERS - LISTED ON PURGE FORM
1126 ~~PARAMETERS~~ REACH 2X CASING VOLUME
FINAL PARAMETERS: PURGE - 6L, DTW - 11.27 FT BTOC,
pH - 7.97, COND. - 3.66 ms/cm, TURB. - 2.6 NTUs, DO - 7.44 mg/L,
TEMP. - 16.05°C, ORP - 123 mV, SAL. - 2.27 %, CLEAR,
ODORLESS.
1130 COLLECT SAMPLE AREA-8-17-205 MS/MSD
6/21/17

Rite in the Rain

TO 46 NAVBASE KITSAP KEYPORT 2017JUNE21
9-40mL VOA w/HCl VOCs (18) 8260C
2-250mL AMBER UP 1,4-DIOXANE 8270D SIM
3-1L POLY w/HNO3 (FF) DISS. METALS 200.7/200.8/RPP
DTW-15.19 FT BTOC.
ON SITE MW8-9 SET UP TO SAMPLE VIA PERISTALTIC PUMP PID-0.0 ppm
1132 DTW-10.32 FT BTOC
1134 START PURGE SET FLOW RATE: 400mL/min
1136 CONNECT TO FLOW CELL
1141 COLLECT PARAMETERS-LISTED ON PURGE FORM
1156 PARAMETERS STABILIZE: PURGE VOL-8L,
DTW-10.37 FT BTOC, pH-7.08, COND.-29.0 ms/cm,
TURB.-6.1 NTUs, DO-6.43 mg/L, TEMP.-16.65°C,
ORP-137mV, SAL.-1.77%, CLEAR, ODORLESS
1200 COLLECT SAMPLE AREA-8-17-201
3-40mL VOA w/HCl VOCs (18) 8260C
2-250mL AMBER UP 1,4-DIOXANE 8270D SIM
1-1L POLY w/HNO3 (FF) DISS. METALS 200.7/200.8/RPP
DTB-20.46 FT BTOC
ON SITE MW8-8 SET UP TO SAMPLE VIA PERISTALTIC PUMP PID-0.0 ppm
1211 DTW-9.93 FT BTOC
1213 START PURGE SET FLOW RATE: 400mL/min
1215 CONNECT TO FLOW CELL
1220 COLLECT PARAMETERS-LISTED ON PURGE FORM
VH/JD 06/21/17

TO 46 NAVBASE KITSAP KEYPORT 2017JUNE21
1235 PARAMETERS STABILIZE: PURGE VOL.-8L,
DTW-9.94 FT BTOC, pH-6.92, COND.-0.343 ms/cm,
TURB.-2.1 NTUs, DO-4.89 mg/L, TEMP.-18.70°C,
ORP-131mV, SAL.-0.02%, CLEAR, ODORLESS
1245 COLLECT SAMPLE AREA-8-17-200
3-40mL VOA w/HCl VOCs (18) 8260C
2-250mL AMBER UP 1,4-DIOXANE 8270D SIM
1-1L POLY w/HNO3 (FF) DISS. METALS 200.7/200.8/RPP
DTB-18.30
ON SITE MW8-16 SET UP TO SAMPLE VIA SUBMERSIBLE PUMP PID-0.0 ppm
1318 DTW-10.48 FT BTOC
1320 START PUMP SET FLOW RATE: 400mL/min
1355 CONNECT TO FLOW CELL
1400 COLLECT PARAMETERS-LISTED ON PURGE FORM
1415 PARAMETERS STABILIZE: PURGE VOL.-22L,
DTW-9.75 FT BTOC, pH-6.96, COND.-15.0 ms/cm,
TURB.-1.7 NTUs, DO-3.55 mg/L, TEMP.-18.02°C,
ORP.-78mV, SAL.-0.87%, CLEAR, ODORLESS
1420 COLLECT SAMPLE AREA-8-17-204
3-40mL VOA w/HCl VOCs (18) 8260C
2-250mL AMBER w/HCl (06/21/17) UP 1,4-DIOXANE 8270D SIM
1-1L POLY w/HNO3 (FF) DISS. METALS 200.7/200.8/RPP
DTB-47.04 FT BTOC
CLEAN SUBMERSIBLE PUMP VH/JD 06/21/17
Rite in the Rain

TO 46 NAVBASE KITSAP KEYPORT 2017JUNE21

1. CLEAN PUMP W/ SCRUB BRUSH
2. PLACE PUMP IN LIQUINOX SOLUTION ALLOW TO CYCLE FOR MINIMUM OF 5 MINUTES
3. TRANSFER PUMP TO RINSE WATER ALLOW TO CYCLE FOR MINIMUM OF 5 MINUTES

1450 ON SITE BUILD 1057 DISPOSE OF APPROX 16 GALLONS OF PURGE AND DECON WATER.
ON SITE SHED DEMOB/QC PAPERWORK.
J. RUEF REVIEWED IC AREAS
NO FINDINGS W/EXCEPTION TO ≥20FT AREA IN THE NORTHEAST PORTION OF AREA 22 SE OF THE INTERSECTION OF TORPEDO RD & A ST.

1610 CALIBRATE HORIBA U-52: pH-3.99, COND-4.51 mS/cm, TURB-0.0 NTUs, DO-10.04 mg/L, TEMP.-17.1°C, ORP-307 mV, SAL-0.24 ‰

1635 A. LEWIS, J. RUEF, S. PATTERSON, R. BOYD, M. HALDANE OFFSITE

06/21/2017

TO 46 NAVBASE KITSAP KEYPORT 2017JUNE22

0700 A. LEWIS, S. PATTERSON, M. HALDANE ON SITE
CONDUCT TAILGATE SAFETY BRIEFING
SSHO - S. PATTERSON
TOPICS INCLUDE:
- VEHICLE OPERATIONS
- CUTS, SCRAPES, BURNS, PUNCTURES
- HAND TOOL SAFETY
- BIOLOGICAL HAZARDS
- PROPER PPE - LEVEL D
  - SAFETY: GLASSES, TOED BOOTS, VEST
  - WORK OR NITRILE GLOVES

SITE INSPECTIONS:
- DEBRIS/ROCKS/STUMPS IN LANDFILL
- SLIPPERY/UNEVEN SURFACES AT BEACH

WX: SUNNY, 52-72°F, WIND 10-15 MPH
MOB TRUCK FOR SAMPLING
CONDUCT PLANTATION INSPECTIONS
INSPECTION RESULTS: BOTH PLANTATIONS:
- TREES LEAFED OUT W/ FULL CANOPY
- A FEW DEAD LEAVES NOTED IN CANOPY (<5%)
  - ON SMALL BROKEN BRANCHES
- GROWTH ON UPPER HALF OF TREES
- SEVERAL BROKEN/DEAD/FALLEN BRANCHES INCLUDING LARGE BRANCHES
  - CUT BACK/REMOVED

06/22/17

Rite in the Rain

TABLE B-1 HISTORICAL FIELD-MEASURED PARAMETER DATA FOR OU 2 AREA 8 LTM PROGRAM

MW8-8	6/11/2007	5/5/2008	6/17/2009	6/14/2010	7/20/2011	6/14/2012	6/18/2013	6/17/2014	6/26/2015	6/20/2016	6/21/2017	
Temperature (°C)	14.6	13.5	14.3	14.4	15.9	14.5	16.10	15.35	17.35	17.90	18.7	
pH (SU)	6.49	6.76	6.50	7.09	6.58	7.18	7.17	7.12	6.85	6.78	6.92	
Specific Conductivity (mS/cm)	0.305	0.427	0.625	0.495	0.321	0.154	0.172	0.276	0.480	0.346	0.343	
Salinity (%)	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.02	
Turbidity (NTUs)	3	16	10	35	4	0	134.0	20	0	0	2.1	
Dissolved Oxygen (mg/L)	2.3	2.13	2.77	1.92	2.51	5.94	9.49	7.15	7.55	6.01	4.89	
Redox (millivolts)	137	122	145	156	229	212	165	200	192	158	131	
MW8-9	6/11/2007	5/5/2008	6/17/2009	6/14/2010	7/20/2011	6/14/2012	6/18/2013	6/18/2014	6/25/2015	6/20/2016	6/21/2017	
Temperature (°C)	12.4	11.9	13.5	13.0	14.3	13.0	15.11	14.37	16.30	18.79	16.65	
pH (SU)	6.71	6.91	6.89	6.87	6.92	6.36	7.23	7.28	6.98	6.92	7.08	
Specific Conductivity (mS/cm)	32.7	35.4	30.2	26.6	37.2	28.7	30.1	34.9	34.7	31.5	29	
Salinity (%)	2.0	2.2	1.9	1.6	2.3	1.7	1.9	2.1	2.1	2.0	1.77	
Turbidity (NTUs)	16	22	25	36	22	14	29.4	30	32	0	6.1	
Dissolved Oxygen (mg/L)	6.0	6.20	7.99	5.68	5.75	5.18	4.38	3.88	5.47	5.13	6.43	
Redox (millivolts)	152	144	165	207	248	239	155	163	197	176	137	
MW8-11	6/11/2007	5/6/2008	6/17/2009	6/14/2010	7/19/2011	6/14/2012	6/18/2013	6/17/2014	6/25/2015	6/20/2016	6/21/2017	
Temperature (°C)	15.4	13.0	14.3	14.70	15.9	14.9	16.15	16.24	18.94	19.74	17.29	
pH (SU)	6.68	6.88	6.80	6.41	6.65	6.02	6.81	7.10	6.68	6.50	6.80	
Specific Conductivity (mS/cm)	29.1	26.4	28.9	26.8	28.0	24.0	21.7	24.6	24.1	24.0	21.8	
Salinity (%)	1.8	1.6	1.8	1.6	1.7	1.5	1.3	1.6	1.6	1.6	1.30	
Turbidity (NTUs)	0	6	8.0	19	3	0	67.7	13	0	0	2.0	
Dissolved Oxygen (mg/L)	7.9	7.08	6.96	6.49	7.24	6.51	6.31	6.01	7.05	5.03	6.81	
Redox (millivolts)	200	220	269	263	256	257	237	242	241	240	223	
MW8-12	6/11/2007	5/6/2008	6/17/2009	6/14/2010	7/19/2011	6/14/2012	6/18/2013	6/17/2014	6/25/2015	6/20/2016	6/21/2017	
Temperature (°C)	14.4	11.7	13.8	13.7	16.1	14.5	15.54	16.93	19.34	19.40	15.50	
pH (SU)	7.20	7.29	7.37	7.00	7.11	7.17	7.66	7.84	7.51	6.94	7.29	
Specific Conductivity (mS/cm)	2.89	3.90	1.59	5.84	3.45	2.44	1.20	1.46	1.51	1.70	4.99	
Salinity (%)	0.1	0.2	0.1	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.27	
Turbidity (NTUs)	0	5	7	20	3	0	25.6	31	23	0	1.3	
Dissolved Oxygen (mg/L)	7.9	8.22	7.77	4.75	7.35	7.40	7.91	6.15	7.51	5.99	7.07	
Redox (millivolts)	139	147	209	224	202	250	151	227	161	180	138	
MW8-14	6/11/2007	5/5/2008	6/18/2009	6/14/2010	7/19/2011	6/14/2012	6/18/2013	6/18/2014	6/26/2015	6/21/2016	6/21/2017	
Temperature (°C)	13.9	10.6	14.1	13.4	15.5	13.2	15.47	16.21	18.91	18.02	16.08	
pH (SU)	7.85	8.04	7.87	7.18	7.91	7.71	8.24	8.36	7.92	7.84	7.97	
Specific Conductivity (mS/cm)	48.3	49.5	50.1	51.0	49.8	43.0	52.9	55.3	53.7	47.4	36.6	
Salinity (%)	3.1	3.2	3.2	3.2	3.2	2.7	3.5	3.5	3.5	3.0	2.27	
Turbidity (NTUs)	10	14	14	21	3	0	30.6	89	10	0	2.6	
Dissolved Oxygen (mg/L)	9.7	9.24	8.79	8.56	7.55	7.25	7.62	6.55	6.72	5.09	7.44	
Redox (millivolts)	107	145	130	192	219	237	149	180	181	155	123	
MW8-16	6/12/2007	5/6/2008	6/18/2009	6/14/2010	7/20/2011	6/14/2012	6/18/2013	6/18/2014	6/25/2015	6/21/2016	6/21/2017	
Temperature (°C)	14.3	13.4	14.4	14.50	15.7	14.3	18.06	16.18	16.97	17.12	18.02	
pH (SU)	6.61	6.74	7.27	6.40	6.75	6.72	7.44	7.30	6.93	7.08	6.96	
Specific Conductivity (mS/cm)	10.2	7.42	6.44	5.24	0.592	0.459	0.313	0.348	0.486	0.408	15.0	
Salinity (%)	0.6	0.4	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.87	
Turbidity (NTUs)	8	7	7	18	7	0	87.9	60	23	0	1.7	
Dissolved Oxygen (mg/L)	0.4	0.5	0.61	0.62	2.29	3.74	0.65	0.60	3.08	4.65	3.85	
Redox (millivolts)	-53	-64	-95	28	225	197	113	199	155	138	-78	
SEEP A	6/12/2007	5/5/2008	6/19/2009	6/15/2010	7/19/2011	6/18/2012	6/19/2013	6/17/2014	6/29/2015	6/20/2016	6/22/2017	
Temperature (oC)	17.1	18.6	16.1	15.8	16.3	15.5	16.19	16.51	17.29	18.01	16.50	
pH (SU)	6.48	6.36	6.18	6.33	6.50	6.21	5.48	6.61	6.81	6.65	7.02	
Specific Conductivity (mS/cm)	42.7	38.4	41.1	41.1	41.7	31.9	40.9	40.9	39.1	37.3	28.8	
Salinity (%)	2.8	2.4	2.6	2.7	2.7	2.0	2.6	2.6	2.5	2.4	1.77	
Turbidity (NTUs)	12	1.8	24	33	36	41	79.2	61	34	14	15	
Dissolved Oxygen (mg/L)	8.4	7.61	7.89	8.17	7.84	6.89	6.13	5.29	6.21	5.51	6.21	
Redox (millivolts)	169	154	105	131	141	278	30	89	91	101	136	

Notes:

ft. msl = feet mean sea level

SU = scale units 1 to 14 (1 = acidic; 7 = neutral; 14 = basic)

mS/cm = milliSiemens per centimeter

NTUs = nephelometric turbidity units

mg/L = milligrams per liter

APPENDIX C
DATA VALIDATION REPORTS

LABORATORY DATA CONSULTANTS, INC.
2701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Bus: 760-827-1100 Fax: 760-827-1099

Sealaska Environmental Services
PO BOX 869
Marine Science Center, 2nd Floor
18743 Front Street NE
Poulsbo, WA 98370
ATTN: Ms. Sherri Wunderlich

August 14, 2017

SUBJECT: Keyport LTM, Area 8, TO 046, Data Validation

Dear Ms. Wunderlich,

Enclosed is the final validation report for the fractions listed below. This SDG was received on July 31, 2017. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project #39185:

SDG #	Fraction
K1706626	Volatiles, 1,4-Dioxane, Dissolved Metals

The data validation was performed under Level III guidelines. The analyses were validated using the following documents, as applicable to each method:

- NAVFAC North West Standard Operating Procedure: Field Procedures Manual, Naval Facilities Engineering Command Northwest, 2015
- USEPA National Functional Guidelines for Organic Superfund Methods Data Review, January 2017
- USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review, January 2017

Please feel free to contact us if you have any questions.

Sincerely,

Christina Rink

Christina Rink
Project Manager/Chemist

HC

Attachment 1

Level III

LDC #39185 (Sealaska-Bothell, WA / Keyport LTM, Area 8, TO 046)

LDC	SDG#	DATE REC'D	(3) DATE DUE	VOA (8260C)		1,4-Dioxane (8270D-S)		Diss. Metals (200.7/8)																											
Matrix:	Water/Soil			W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S
A	K1706626	07/31/17	08/21/17	10	0	7	0	9	0																										
Total	T/CR			10	0	7	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26

Shaded cells indicate Level IV review (all other cells are Level III review). These sample counts do not include MS/MSD, DL, RE and DUPs

V:\LOGIN\Sealaska\Keyport\39185ST-Area 8-TO46.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Keyport, Area 8, TO 046

LDC Report Date: August 14, 2017

Parameters: Volatiles

Validation Level: Level III

Laboratory: ALS Environmental

Sample Delivery Group (SDG): K1706626

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
AREA-8-17-204	K1706626-001	Water	06/21/17
AREA-8-17-203	K1706626-002	Water	06/21/17
AREA-8-17-202	K1706626-003	Water	06/21/17
AREA-8-17-205	K1706626-004	Water	06/21/17
AREA-8-17-201	K1706626-005	Water	06/21/17
AREA-8-17-200	K1706626-006	Water	06/21/17
AREA-8-17-206	K1706626-007	Water	06/21/17
AREA-8-17-207	K1706626-008	Water	06/21/17
AREA-8-17-208	K1706626-009	Water	06/21/17
TB-061917	K1706626-010	Water	06/21/17
AREA-8-17-205MS	K1706626-004MS	Water	06/21/17
AREA-8-17-205MSD	K1706626-004MSD	Water	06/21/17
AREA-8-17-207MS	K1706626-008MS	Water	06/21/17
AREA-8-17-207MSD	K1706626-008MSD	Water	06/21/17

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the NAVFAC Northwest Standard Operating Procedure: Field Procedures Manual (Naval Facilities Engineering Command Northwest, 2015) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Volatile Organic Compounds (VOCs) by Environmental Protection Agency (EPA) SW 846 Method 8260C

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detect): The compound or analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detect at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A bromofluorobenzene (BFB) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average relative response factors (RRFs) were utilized, the percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r^2) were greater than or equal to 0.990.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag
06/29/17	Carbon tetrachloride	24	AREA-8-17-205 AREA-8-17-207 TB-061917	UJ (all non-detects)

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

Sample TB-061917 was identified as a trip blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
TB-061917	06/21/17	Toluene	0.35 ug/L	AREA-8-17-204 AREA-8-17-203 AREA-8-17-202 AREA-8-17-205 AREA-8-17-201 AREA-8-17-200 AREA-8-17-206 AREA-8-17-207 AREA-8-17-208

Sample concentrations were compared to concentrations detected in the field blanks. The sample concentrations were either not detected or were significantly greater (>10X for common contaminants, >5X for other contaminants) than the concentrations found in the associated field blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
AREA-8-17-205	Toluene	0.070 ug/L	0.50U ug/L
AREA-8-17-201	Toluene	0.060 ug/L	0.50U ug/L
AREA-8-17-200	Toluene	0.11 ug/L	0.50U ug/L
AREA-8-17-206	Toluene	0.070 ug/L	0.50U ug/L
AREA-8-17-207	Toluene	0.090 ug/L	0.50U ug/L
AREA-8-17-208	Toluene	0.060 ug/L	0.50U ug/L

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

X. Field Duplicates

Samples AREA-8-17-203 and AREA-8-17-202 and samples AREA-8-17-207 and AREA-8-17-208 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD (Limits)
	AREA-8-17-203	AREA-8-17-202	
trans-1,2-Dichloroethene	0.14	0.11	24 (≤50)
1,1-Dichloroethane	0.10	0.10	0 (≤50)
cis-1,2-Dichloroethene	0.26	0.26	0 (≤50)
Chloroform	0.23	0.23	0 (≤50)
1,1,1-Trichloroethane	3.0	3.0	0 (≤50)
Trichloroethene	24	24	0 (≤50)
Tetrachloroethene	0.44	0.41	7 (≤50)

Compound	Concentration (ug/L)		RPD (Limits)
	AREA-8-17-207	AREA-8-17-208	
1,1-Dichloroethene	2.6	2.6	0 (≤50)
trans-1,2-Dichloroethene	0.10	0.11	10 (≤50)
1,1-Dichloroethane	1.3	1.2	8 (≤50)
cis-1,2-Dichloroethene	0.69	0.69	0 (≤50)

Compound	Concentration (ug/L)		RPD (Limits)
	AREA-8-17-207	AREA-8-17-208	
Chloroform	0.76	0.73	4 (≤50)
1,1,1-Trichloroethane	18	17	6 (≤50)
Trichloroethene	6.7	6.6	2 (≤50)
Toluene	0.090	0.060	40 (≤50)
Tetrachloroethene	0.58	0.58	0 (≤50)

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Level III validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Level III validation.

XIV. System Performance

Raw data were not reviewed for Level III validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to continuing calibration %D, data were qualified as estimated in three samples.

Due to trip blank contamination, data were qualified as not detected in six samples.

Quality control criteria were met, other than those discussed above, and no significant issues impacting data quality were identified. The analytical data are acceptable for use as reported by the laboratory and qualified during data validation.

Keyport, Area 8, TO 046
Volatiles - Data Qualification Summary - SDG K1706626

Sample	Compound	Flag	Reason
AREA-8-17-205 AREA-8-17-207 TB-061917	Carbon tetrachloride	UJ (all non-detects)	Continuing calibration (%D)

Keyport, Area 8, TO 046
Volatiles - Laboratory Blank Data Qualification Summary - SDG K1706626

No Sample Data Qualified in this SDG

Keyport, Area 8, TO 046
Volatiles - Field Blank Data Qualification Summary - SDG K1706626

Sample	Compound	Modified Final Concentration
AREA-8-17-205	Toluene	0.50U ug/L
AREA-8-17-201	Toluene	0.50U ug/L
AREA-8-17-200	Toluene	0.50U ug/L
AREA-8-17-206	Toluene	0.50U ug/L
AREA-8-17-207	Toluene	0.50U ug/L
AREA-8-17-208	Toluene	0.50U ug/L

Analytical Results

Client:	Sealaska Environmental Services, LLC	**Service Request:**	K1706626
Project:	NAVBASE Kitsap Keyport Area 8/TO 46	**Date Collected:**	06/21/2017
Sample Matrix:	Water	**Date Received:**	06/23/2017

Volatile Organic Compounds

Sample Name:	AREA-8-17-204	**Units:**	ug/L
Lab Code:	K1706626-001	**Basis:**	NA
Extraction Method:	EPA 5030B	**Level:**	Low
Analysis Method:	8260C		

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
1,1-Dichloroethene	ND	U	0.50	0.20	0.080	1	06/26/17	06/26/17	KWG1705299	
Acetone	ND	U	20	10	3.3	1	06/26/17	06/26/17	KWG1705299	
trans-1,2-Dichloroethene	**0.78**		0.50	0.20	0.072	1	06/26/17	06/26/17	KWG1705299	
1,1-Dichloroethane	ND	U	0.50	0.20	0.077	1	06/26/17	06/26/17	KWG1705299	
cis-1,2-Dichloroethene	**0.28**	J	0.50	0.20	0.067	1	06/26/17	06/26/17	KWG1705299	
Chloroform	**0.74**		0.50	0.20	0.072	1	06/26/17	06/26/17	KWG1705299	
1,1,1-Trichloroethane (TCA)	**0.87**		0.50	0.20	0.075	1	06/26/17	06/26/17	KWG1705299	
Carbon Tetrachloride	ND	U	0.20	0.20	0.096	1	06/26/17	06/26/17	KWG1705299	
Benzene	ND	U	0.50	0.10	0.062	1	06/26/17	06/26/17	KWG1705299	
1,2-Dichloroethane (EDC)	ND	U	0.50	0.15	0.080	1	06/26/17	06/26/17	KWG1705299	
Trichloroethene (TCE)	**10**		0.50	0.20	0.10	1	06/26/17	06/26/17	KWG1705299	
Toluene	ND	U	0.50	0.10	0.054	1	06/26/17	06/26/17	KWG1705299	
1,1,2-Trichloroethane	ND	U	0.50	0.40	0.14	1	06/26/17	06/26/17	KWG1705299	
Tetrachloroethene (PCE)	**2.8**		0.50	0.20	0.099	1	06/26/17	06/26/17	KWG1705299	
Ethylbenzene	ND	U	0.50	0.10	0.050	1	06/26/17	06/26/17	KWG1705299	
m,p-Xylenes	ND	U	0.50	0.20	0.11	1	06/26/17	06/26/17	KWG1705299	
o-Xylene	ND	U	0.50	0.20	0.074	1	06/26/17	06/26/17	KWG1705299	
Styrene	ND	U	0.50	0.20	0.089	1	06/26/17	06/26/17	KWG1705299	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Dibromofluoromethane	87	80-119	06/26/17	Acceptable
Toluene-d8	97	89-112	06/26/17	Acceptable
4-Bromofluorobenzene	88	85-114	06/26/17	Acceptable

AUG 14 2017

Initials: CR

Comments:

Analytical Results

Client: Sealaska Environmental Services, LLC
Project: NAVBASE Kitsap Keyport Area 8/TO 46
Sample Matrix: Water

Service Request: K1706626
Date Collected: 06/21/2017
Date Received: 06/23/2017

Volatile Organic Compounds

Sample Name: AREA-8-17-203
Lab Code: K1706626-002

Units: ug/L
Basis: NA

Extraction Method: EPA 5030B
Analysis Method: 8260C

Level: Low

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
1,1-Dichloroethene	ND	U	0.50	0.20	0.080	1	06/26/17	06/26/17	KWG1705299	
Acetone	ND	U	20	10	3.3	1	06/26/17	06/26/17	KWG1705299	
trans-1,2-Dichloroethene	**0.14**	J	0.50	0.20	0.072	1	06/26/17	06/26/17	KWG1705299	
1,1-Dichloroethane	**0.10**	J	0.50	0.20	0.077	1	06/26/17	06/26/17	KWG1705299	
cis-1,2-Dichloroethene	**0.26**	J	0.50	0.20	0.067	1	06/26/17	06/26/17	KWG1705299	
Chloroform	**0.23**	J	0.50	0.20	0.072	1	06/26/17	06/26/17	KWG1705299	
1,1,1-Trichloroethane (TCA)	**3.0**		0.50	0.20	0.075	1	06/26/17	06/26/17	KWG1705299	
Carbon Tetrachloride	ND	U	0.20	0.20	0.096	1	06/26/17	06/26/17	KWG1705299	
Benzene	ND	U	0.50	0.10	0.062	1	06/26/17	06/26/17	KWG1705299	
1,2-Dichloroethane (EDC)	ND	U	0.50	0.15	0.080	1	06/26/17	06/26/17	KWG1705299	
Trichloroethene (TCE)	**24**		0.50	0.20	0.10	1	06/26/17	06/26/17	KWG1705299	
Toluene	ND	U	0.50	0.10	0.054	1	06/26/17	06/26/17	KWG1705299	
1,1,2-Trichloroethane	ND	U	0.50	0.40	0.14	1	06/26/17	06/26/17	KWG1705299	
Tetrachloroethene (PCE)	**0.44**	J	0.50	0.20	0.099	1	06/26/17	06/26/17	KWG1705299	
Ethylbenzene	ND	U	0.50	0.10	0.050	1	06/26/17	06/26/17	KWG1705299	
m,p-Xylenes	ND	U	0.50	0.20	0.11	1	06/26/17	06/26/17	KWG1705299	
o-Xylene	ND	U	0.50	0.20	0.074	1	06/26/17	06/26/17	KWG1705299	
Styrene	ND	U	0.50	0.20	0.089	1	06/26/17	06/26/17	KWG1705299	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Dibromofluoromethane	93	80-119	06/26/17	Acceptable
Toluene-d8	98	89-112	06/26/17	Acceptable
4-Bromofluorobenzene	89	85-114	06/26/17	Acceptable

AUG 14 2017

Initials: CR

Comments:

Analytical Results

Client: Sealaska Environmental Services, LLC
Project: NAVBASE Kitsap Keyport Area 8/TO 46
Sample Matrix: Water

Service Request: K1706626
Date Collected: 06/21/2017
Date Received: 06/23/2017

Volatile Organic Compounds

Sample Name: AREA-8-17-202
Lab Code: K1706626-003

Units: ug/L
Basis: NA

Extraction Method: EPA 5030B
Analysis Method: 8260C

Level: Low

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
1,1-Dichloroethene	ND	U	0.50	0.20	0.080	1	06/26/17	06/26/17	KWG1705299	
Acetone	ND	U	20	10	3.3	1	06/26/17	06/26/17	KWG1705299	
trans-1,2-Dichloroethene	**0.11**	J	0.50	0.20	0.072	1	06/26/17	06/26/17	KWG1705299	
1,1-Dichloroethane	**0.10**	J	0.50	0.20	0.077	1	06/26/17	06/26/17	KWG1705299	
cis-1,2-Dichloroethene	**0.26**	J	0.50	0.20	0.067	1	06/26/17	06/26/17	KWG1705299	
Chloroform	**0.23**	J	0.50	0.20	0.072	1	06/26/17	06/26/17	KWG1705299	
1,1,1-Trichloroethane (TCA)	**3.0**		0.50	0.20	0.075	1	06/26/17	06/26/17	KWG1705299	
Carbon Tetrachloride	ND	U	0.20	0.20	0.096	1	06/26/17	06/26/17	KWG1705299	
Benzene	ND	U	0.50	0.10	0.062	1	06/26/17	06/26/17	KWG1705299	
1,2-Dichloroethane (EDC)	ND	U	0.50	0.15	0.080	1	06/26/17	06/26/17	KWG1705299	
Trichloroethene (TCE)	**24**		0.50	0.20	0.10	1	06/26/17	06/26/17	KWG1705299	
Toluene	ND	U	0.50	0.10	0.054	1	06/26/17	06/26/17	KWG1705299	
1,1,2-Trichloroethane	ND	U	0.50	0.40	0.14	1	06/26/17	06/26/17	KWG1705299	
Tetrachloroethene (PCE)	**0.41**	J	0.50	0.20	0.099	1	06/26/17	06/26/17	KWG1705299	
Ethylbenzene	ND	U	0.50	0.10	0.050	1	06/26/17	06/26/17	KWG1705299	
m,p-Xylenes	ND	U	0.50	0.20	0.11	1	06/26/17	06/26/17	KWG1705299	
o-Xylene	ND	U	0.50	0.20	0.074	1	06/26/17	06/26/17	KWG1705299	
Styrene	ND	U	0.50	0.20	0.089	1	06/26/17	06/26/17	KWG1705299	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Dibromofluoromethane	92	80-119	06/26/17	Acceptable
Toluene-d8	98	89-112	06/26/17	Acceptable
4-Bromofluorobenzene	90	85-114	06/26/17	Acceptable

AUG 14 2017

Initials: CR

Comments:

Analytical Results

Client:	Sealaska Environmental Services, LLC	**Service Request:**	K1706626
Project:	NAVBASE Kitsap Keyport Area 8/TO 46	**Date Collected:**	06/21/2017
Sample Matrix:	Water	**Date Received:**	06/23/2017

Volatile Organic Compounds

Sample Name:	AREA-8-17-205	**Units:**	ug/L
Lab Code:	K1706626-004	**Basis:**	NA
Extraction Method:	EPA 5030B	**Level:**	Low
Analysis Method:	8260C		

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
1,1-Dichloroethene	ND	U	0.50	0.20	0.080	1	06/29/17	06/29/17	KWG1705456	
Acetone	ND	U	20	10	3.3	1	06/29/17	06/29/17	KWG1705456	
trans-1,2-Dichloroethene	ND	U	0.50	0.20	0.072	1	06/29/17	06/29/17	KWG1705456	
1,1-Dichloroethane	ND	U	0.50	0.20	0.077	1	06/29/17	06/29/17	KWG1705456	
cis-1,2-Dichloroethene	ND	U	0.50	0.20	0.067	1	06/29/17	06/29/17	KWG1705456	
Chloroform	ND	U	0.50	0.20	0.072	1	06/29/17	06/29/17	KWG1705456	
1,1,1-Trichloroethane (TCA)	ND	U	0.50	0.20	0.075	1	06/29/17	06/29/17	KWG1705456	
Carbon Tetrachloride	ND	U UJ	0.20	0.20	0.096	1	06/29/17	06/29/17	KWG1705456	*
Benzene	ND	U	0.50	0.10	0.062	1	06/29/17	06/29/17	KWG1705456	
1,2-Dichloroethane (EDC)	ND	U	0.50	0.15	0.080	1	06/29/17	06/29/17	KWG1705456	
Trichloroethene (TCE)	ND	U	0.50	0.20	0.10	1	06/29/17	06/29/17	KWG1705456	
Toluene	0.070	J 0.50U	0.50	0.10	0.054	1	06/29/17	06/29/17	KWG1705456	
1,1,2-Trichloroethane	ND	U	0.50	0.40	0.14	1	06/29/17	06/29/17	KWG1705456	
Tetrachloroethene (PCE)	ND	U	0.50	0.20	0.099	1	06/29/17	06/29/17	KWG1705456	
Ethylbenzene	ND	U	0.50	0.10	0.050	1	06/29/17	06/29/17	KWG1705456	
m,p-Xylenes	ND	U	0.50	0.20	0.11	1	06/29/17	06/29/17	KWG1705456	
o-Xylene	ND	U	0.50	0.20	0.074	1	06/29/17	06/29/17	KWG1705456	
Styrene	ND	U	0.50	0.20	0.089	1	06/29/17	06/29/17	KWG1705456	

* See Case Narrative

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Dibromofluoromethane	86	80-119	06/29/17	Acceptable
Toluene-d8	97	89-112	06/29/17	Acceptable
4-Bromofluorobenzene	87	85-114	06/29/17	Acceptable

AUG 14 2017

Initials: CR

Comments:

Analytical Results

Client:	Sealaska Environmental Services, LLC	**Service Request:**	K1706626
Project:	NAVBASE Kitsap Keyport Area 8/TO 46	**Date Collected:**	06/21/2017
Sample Matrix:	Water	**Date Received:**	06/23/2017

Volatile Organic Compounds

Sample Name:	AREA-8-17-201	**Units:**	ug/L
Lab Code:	K1706626-005	**Basis:**	NA
Extraction Method:	EPA 5030B	**Level:**	Low
Analysis Method:	8260C		

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
1,1-Dichloroethene	ND	U	0.50	0.20	0.080	1	06/26/17	06/26/17	KWG1705299	
Acetone	ND	U	20	10	3.3	1	06/26/17	06/26/17	KWG1705299	
trans-1,2-Dichloroethene	ND	U	0.50	0.20	0.072	1	06/26/17	06/26/17	KWG1705299	
1,1-Dichloroethane	ND	U	0.50	0.20	0.077	1	06/26/17	06/26/17	KWG1705299	
cis-1,2-Dichloroethene	ND	U	0.50	0.20	0.067	1	06/26/17	06/26/17	KWG1705299	
Chloroform	ND	U	0.50	0.20	0.072	1	06/26/17	06/26/17	KWG1705299	
1,1,1-Trichloroethane (TCA)	ND	U	0.50	0.20	0.075	1	06/26/17	06/26/17	KWG1705299	
Carbon Tetrachloride	ND	U	0.20	0.20	0.096	1	06/26/17	06/26/17	KWG1705299	
Benzene	ND	U	0.50	0.10	0.062	1	06/26/17	06/26/17	KWG1705299	
1,2-Dichloroethane (EDC)	ND	U	0.50	0.15	0.080	1	06/26/17	06/26/17	KWG1705299	
Trichloroethene (TCE)	**0.12**	J	0.50	0.20	0.10	1	06/26/17	06/26/17	KWG1705299	
Toluene	**0.060**	J	0.50U	0.50	0.10	0.054	1	06/26/17	06/26/17	KWG1705299
1,1,2-Trichloroethane	ND	U	0.50	0.40	0.14	1	06/26/17	06/26/17	KWG1705299	
Tetrachloroethene (PCE)	**0.13**	J	0.50	0.20	0.099	1	06/26/17	06/26/17	KWG1705299	
Ethylbenzene	ND	U	0.50	0.10	0.050	1	06/26/17	06/26/17	KWG1705299	
m,p-Xylenes	ND	U	0.50	0.20	0.11	1	06/26/17	06/26/17	KWG1705299	
o-Xylene	ND	U	0.50	0.20	0.074	1	06/26/17	06/26/17	KWG1705299	
Styrene	ND	U	0.50	0.20	0.089	1	06/26/17	06/26/17	KWG1705299	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Dibromofluoromethane	85	80-119	06/26/17	Acceptable
Toluene-d8	97	89-112	06/26/17	Acceptable
4-Bromofluorobenzene	88	85-114	06/26/17	Acceptable

AUG 14 2017

Initials: CR

Comments:

Analytical Results

Client: Sealaska Environmental Services, LLC
Project: NAVBASE Kitsap Keyport Area 8/TO 46
Sample Matrix: Water

Service Request: K1706626
Date Collected: 06/21/2017
Date Received: 06/23/2017

Volatile Organic Compounds

Sample Name: AREA-8-17-200
Lab Code: K1706626-006

Extraction Method: EPA 5030B
Analysis Method: 8260C

Units: ug/L
Basis: NA
Level: Low

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
1,1-Dichloroethene	**0.11**	J	0.50	0.20	0.080	1	06/26/17	06/26/17	KWG1705299	
Acetone	ND	U	20	10	3.3	1	06/26/17	06/26/17	KWG1705299	
trans-1,2-Dichloroethene	**3.0**		0.50	0.20	0.072	1	06/26/17	06/26/17	KWG1705299	
1,1-Dichloroethane	ND	U	0.50	0.20	0.077	1	06/26/17	06/26/17	KWG1705299	
cis-1,2-Dichloroethene	**1.6**		0.50	0.20	0.067	1	06/26/17	06/26/17	KWG1705299	
Chloroform	**0.62**		0.50	0.20	0.072	1	06/26/17	06/26/17	KWG1705299	
1,1,1-Trichloroethane (TCA)	**0.93**		0.50	0.20	0.075	1	06/26/17	06/26/17	KWG1705299	
Carbon Tetrachloride	ND	U	0.20	0.20	0.096	1	06/26/17	06/26/17	KWG1705299	
Benzene	ND	U	0.50	0.10	0.062	1	06/26/17	06/26/17	KWG1705299	
1,2-Dichloroethane (EDC)	ND	U	0.50	0.15	0.080	1	06/26/17	06/26/17	KWG1705299	
Trichloroethene (TCE)	**40**		0.50	0.20	0.10	1	06/26/17	06/26/17	KWG1705299	
Toluene	**0.11**	J 0.50U	0.50	0.10	0.054	1	06/26/17	06/26/17	KWG1705299	
1,1,2-Trichloroethane	**0.19**	J	0.50	0.40	0.14	1	06/26/17	06/26/17	KWG1705299	
Tetrachloroethene (PCE)	**7.1**		0.50	0.20	0.099	1	06/26/17	06/26/17	KWG1705299	
Ethylbenzene	ND	U	0.50	0.10	0.050	1	06/26/17	06/26/17	KWG1705299	
m,p-Xylenes	ND	U	0.50	0.20	0.11	1	06/26/17	06/26/17	KWG1705299	
o-Xylene	ND	U	0.50	0.20	0.074	1	06/26/17	06/26/17	KWG1705299	
Styrene	ND	U	0.50	0.20	0.089	1	06/26/17	06/26/17	KWG1705299	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Dibromofluoromethane	87	80-119	06/26/17	Acceptable
Toluene-d8	99	89-112	06/26/17	Acceptable
4-Bromofluorobenzene	88	85-114	06/26/17	Acceptable

AUG 14 2017

Initials: CR

Comments:

Analytical Results

Client:	Sealaska Environmental Services, LLC	**Service Request:**	K1706626
Project:	NAVBASE Kitsap Keyport Area 8/TO 46	**Date Collected:**	06/21/2017
Sample Matrix:	Water	**Date Received:**	06/23/2017

Volatile Organic Compounds

Sample Name:	AREA-8-17-206	**Units:**	ug/L
Lab Code:	K1706626-007	**Basis:**	NA
Extraction Method:	EPA 5030B	**Level:**	Low
Analysis Method:	8260C		

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
1,1-Dichloroethene	**0.090**	J	0.50	0.20	0.080	1	06/26/17	06/26/17	KWG1705299	
Acetone	ND	U	20	10	3.3	1	06/26/17	06/26/17	KWG1705299	
trans-1,2-Dichloroethene	**0.19**	J	0.50	0.20	0.072	1	06/26/17	06/26/17	KWG1705299	
1,1-Dichloroethane	**0.080**	J	0.50	0.20	0.077	1	06/26/17	06/26/17	KWG1705299	
cis-1,2-Dichloroethene	**26**		0.50	0.20	0.067	1	06/26/17	06/26/17	KWG1705299	
Chloroform	**0.14**	J	0.50	0.20	0.072	1	06/26/17	06/26/17	KWG1705299	
1,1,1-Trichloroethane (TCA)	ND	U	0.50	0.20	0.075	1	06/26/17	06/26/17	KWG1705299	
Carbon Tetrachloride	ND	U	0.20	0.20	0.096	1	06/26/17	06/26/17	KWG1705299	
Benzene	ND	U	0.50	0.10	0.062	1	06/26/17	06/26/17	KWG1705299	
1,2-Dichloroethane (EDC)	ND	U	0.50	0.15	0.080	1	06/26/17	06/26/17	KWG1705299	
Trichloroethene (TCE)	**7.2**		0.50	0.20	0.10	1	06/26/17	06/26/17	KWG1705299	
Toluene	**0.070**	J	0.50U	0.50	0.10	0.054	1	06/26/17	06/26/17	KWG1705299
1,1,2-Trichloroethane	ND	U	0.50	0.40	0.14	1	06/26/17	06/26/17	KWG1705299	
Tetrachloroethene (PCE)	**0.15**	J	0.50	0.20	0.099	1	06/26/17	06/26/17	KWG1705299	
Ethylbenzene	ND	U	0.50	0.10	0.050	1	06/26/17	06/26/17	KWG1705299	
m,p-Xylenes	ND	U	0.50	0.20	0.11	1	06/26/17	06/26/17	KWG1705299	
o-Xylene	ND	U	0.50	0.20	0.074	1	06/26/17	06/26/17	KWG1705299	
Styrene	ND	U	0.50	0.20	0.089	1	06/26/17	06/26/17	KWG1705299	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Dibromofluoromethane	87	80-119	06/26/17	Acceptable
Toluene-d8	97	89-112	06/26/17	Acceptable
4-Bromofluorobenzene	88	85-114	06/26/17	Acceptable

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Comments:

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Analytical Results

Client:	Sealaska Environmental Services, LLC	**Service Request:**	K1706626
Project:	NAVBASE Kitsap Keyport Area 8/TO 46	**Date Collected:**	06/22/2017
Sample Matrix:	Water	**Date Received:**	06/23/2017

Volatile Organic Compounds

Sample Name:	AREA-8-17-207	**Units:**	ug/L
Lab Code:	K1706626-008	**Basis:**	NA
Extraction Method:	EPA 5030B	**Level:**	Low
Analysis Method:	8260C		

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
1,1-Dichloroethene	**2.6**		0.50	0.20	0.080	1	06/29/17	06/29/17	KWG1705456	
Acetone	ND	U	20	10	3.3	1	06/29/17	06/29/17	KWG1705456	
trans-1,2-Dichloroethene	**0.10**	J	0.50	0.20	0.072	1	06/29/17	06/29/17	KWG1705456	
1,1-Dichloroethane	**1.3**		0.50	0.20	0.077	1	06/29/17	06/29/17	KWG1705456	
cis-1,2-Dichloroethene	**0.69**		0.50	0.20	0.067	1	06/29/17	06/29/17	KWG1705456	
Chloroform	**0.76**		0.50	0.20	0.072	1	06/29/17	06/29/17	KWG1705456	
1,1,1-Trichloroethane (TCA)	**18**		0.50	0.20	0.075	1	06/29/17	06/29/17	KWG1705456	
Carbon Tetrachloride	ND	U UJ	0.20	0.20	0.096	1	06/29/17	06/29/17	KWG1705456	*
Benzene	ND	U	0.50	0.10	0.062	1	06/29/17	06/29/17	KWG1705456	
1,2-Dichloroethane (EDC)	ND	U	0.50	0.15	0.080	1	06/29/17	06/29/17	KWG1705456	
Trichloroethene (TCE)	**6.7**		0.50	0.20	0.10	1	06/29/17	06/29/17	KWG1705456	
Toluene	**0.090**	J 0.50U	0.50	0.10	0.054	1	06/29/17	06/29/17	KWG1705456	
1,1,2-Trichloroethane	ND	U	0.50	0.40	0.14	1	06/29/17	06/29/17	KWG1705456	
Tetrachloroethene (PCE)	**0.58**		0.50	0.20	0.099	1	06/29/17	06/29/17	KWG1705456	
Ethylbenzene	ND	U	0.50	0.10	0.050	1	06/29/17	06/29/17	KWG1705456	
m,p-Xylenes	ND	U	0.50	0.20	0.11	1	06/29/17	06/29/17	KWG1705456	
o-Xylene	ND	U	0.50	0.20	0.074	1	06/29/17	06/29/17	KWG1705456	
Styrene	ND	U	0.50	0.20	0.089	1	06/29/17	06/29/17	KWG1705456	

* See Case Narrative

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Dibromofluoromethane	102	80-119	06/29/17	Acceptable
Toluene-d8	98	89-112	06/29/17	Acceptable
4-Bromofluorobenzene	89	85-114	06/29/17	Acceptable

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Comments:

Analytical Results

Client:	Sealaska Environmental Services, LLC	**Service Request:**	K1706626
Project:	NAVBASE Kitsap Keyport Area 8/TO 46	**Date Collected:**	06/22/2017
Sample Matrix:	Water	**Date Received:**	06/23/2017

Volatile Organic Compounds

Sample Name:	AREA-8-17-208	**Units:**	ug/L
Lab Code:	K1706626-009	**Basis:**	NA
Extraction Method:	EPA 5030B	**Level:**	Low
Analysis Method:	8260C		

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
1,1-Dichloroethene	**2.6**		0.50	0.20	0.080	1	06/26/17	06/26/17	KWG1705299	
Acetone	ND	U	20	10	3.3	1	06/26/17	06/26/17	KWG1705299	
trans-1,2-Dichloroethene	**0.11**	J	0.50	0.20	0.072	1	06/26/17	06/26/17	KWG1705299	
1,1-Dichloroethane	**1.2**		0.50	0.20	0.077	1	06/26/17	06/26/17	KWG1705299	
cis-1,2-Dichloroethene	**0.69**		0.50	0.20	0.067	1	06/26/17	06/26/17	KWG1705299	
Chloroform	**0.73**		0.50	0.20	0.072	1	06/26/17	06/26/17	KWG1705299	
1,1,1-Trichloroethane (TCA)	**17**		0.50	0.20	0.075	1	06/26/17	06/26/17	KWG1705299	
Carbon Tetrachloride	ND	U	0.20	0.20	0.096	1	06/26/17	06/26/17	KWG1705299	
Benzene	ND	U	0.50	0.10	0.062	1	06/26/17	06/26/17	KWG1705299	
1,2-Dichloroethane (EDC)	ND	U	0.50	0.15	0.080	1	06/26/17	06/26/17	KWG1705299	
Trichloroethene (TCE)	**6.6**		0.50	0.20	0.10	1	06/26/17	06/26/17	KWG1705299	
Toluene	**0.060**	J	0.50U	0.50	0.10	0.054	1	06/26/17	06/26/17	KWG1705299
1,1,2-Trichloroethane	ND	U	0.50	0.40	0.14	1	06/26/17	06/26/17	KWG1705299	
Tetrachloroethene (PCE)	**0.58**		0.50	0.20	0.099	1	06/26/17	06/26/17	KWG1705299	
Ethylbenzene	ND	U	0.50	0.10	0.050	1	06/26/17	06/26/17	KWG1705299	
m,p-Xylenes	ND	U	0.50	0.20	0.11	1	06/26/17	06/26/17	KWG1705299	
o-Xylene	ND	U	0.50	0.20	0.074	1	06/26/17	06/26/17	KWG1705299	
Styrene	ND	U	0.50	0.20	0.089	1	06/26/17	06/26/17	KWG1705299	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Dibromofluoromethane	98	80-119	06/26/17	Acceptable
Toluene-d8	97	89-112	06/26/17	Acceptable
4-Bromofluorobenzene	88	85-114	06/26/17	Acceptable

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Comments:

Analytical Results

Client:	Sealaska Environmental Services, LLC	**Service Request:**	K1706626
Project:	NAVBASE Kitsap Keyport Area 8/TO 46	**Date Collected:**	06/21/2017
Sample Matrix:	Water	**Date Received:**	06/23/2017

Volatile Organic Compounds

Sample Name:	TB-061917	**Units:**	ug/L
Lab Code:	K1706626-010	**Basis:**	NA
Extraction Method:	EPA 5030B	**Level:**	Low
Analysis Method:	8260C		

Analyte Name	Result	Q		LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
1,1-Dichloroethene	ND	U		0.50	0.20	0.080	1	06/29/17	06/29/17	KWG1705456	
Acetone	ND	U		20	10	3.3	1	06/29/17	06/29/17	KWG1705456	
trans-1,2-Dichloroethene	ND	U		0.50	0.20	0.072	1	06/29/17	06/29/17	KWG1705456	
1,1-Dichloroethane	ND	U		0.50	0.20	0.077	1	06/29/17	06/29/17	KWG1705456	
cis-1,2-Dichloroethene	ND	U		0.50	0.20	0.067	1	06/29/17	06/29/17	KWG1705456	
Chloroform	ND	U		0.50	0.20	0.072	1	06/29/17	06/29/17	KWG1705456	
1,1,1-Trichloroethane (TCA)	ND	U		0.50	0.20	0.075	1	06/29/17	06/29/17	KWG1705456	
Carbon Tetrachloride	ND	U	V5	0.20	0.20	0.096	1	06/29/17	06/29/17	KWG1705456	*
Benzene	ND	U		0.50	0.10	0.062	1	06/29/17	06/29/17	KWG1705456	
1,2-Dichloroethane (EDC)	ND	U		0.50	0.15	0.080	1	06/29/17	06/29/17	KWG1705456	
Trichloroethene (TCE)	ND	U		0.50	0.20	0.10	1	06/29/17	06/29/17	KWG1705456	
Toluene	**0.35**	J		0.50	0.10	0.054	1	06/29/17	06/29/17	KWG1705456	
1,1,2-Trichloroethane	ND	U		0.50	0.40	0.14	1	06/29/17	06/29/17	KWG1705456	
Tetrachloroethene (PCE)	ND	U		0.50	0.20	0.099	1	06/29/17	06/29/17	KWG1705456	
Ethylbenzene	ND	U		0.50	0.10	0.050	1	06/29/17	06/29/17	KWG1705456	
m,p-Xylenes	ND	U		0.50	0.20	0.11	1	06/29/17	06/29/17	KWG1705456	
o-Xylene	ND	U		0.50	0.20	0.074	1	06/29/17	06/29/17	KWG1705456	
Styrene	ND	U		0.50	0.20	0.089	1	06/29/17	06/29/17	KWG1705456	

* See Case Narrative

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Dibromofluoromethane	88	80-119	06/29/17	Acceptable
Toluene-d8	97	89-112	06/29/17	Acceptable
4-Bromofluorobenzene	87	85-114	06/29/17	Acceptable

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Comments:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Keyport, Area 8, TO 046

LDC Report Date: August 14, 2017

Parameters: 1,4-Dioxane

Validation Level: Level III

Laboratory: ALS Environmental

Sample Delivery Group (SDG): K1706626

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
AREA-8-17-204	K1706626-001	Water	06/21/17
AREA-8-17-203	K1706626-002	Water	06/21/17
AREA-8-17-202	K1706626-003	Water	06/21/17
AREA-8-17-205	K1706626-004	Water	06/21/17
AREA-8-17-201	K1706626-005	Water	06/21/17
AREA-8-17-200	K1706626-006	Water	06/21/17
AREA-8-17-206	K1706626-007	Water	06/21/17
AREA-8-17-205MS	K1706626-004MS	Water	06/21/17
AREA-8-17-205MSD	K1706626-004MSD	Water	06/21/17

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the NAVFAC Northwest Standard Operating Procedure: Field Procedures Manual (Naval Facilities Engineering Command Northwest, 2015) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

1,4-Dioxane by Environmental Protection Agency (EPA) SW 846 Method 8270D in Selected Ion Monitoring (SIM) mode

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0%.

Average relative response factors (RRF) were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0%.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0%.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

X. Field Duplicates

Samples AREA-8-17-203 and AREA-8-17-202 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD (Limits)
	AREA-8-17-203	AREA-8-17-202	
1,4-Dioxane	16	15	6 (≤50)

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Level III validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Level III validation.

XIV. System Performance

Raw data were not reviewed for Level III validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Keyport, Area 8, TO 046
1,4-Dioxane - Data Qualification Summary - SDG K1706626

No Sample Data Qualified in this SDG

Keyport, Area 8, TO 046
1,4-Dioxane - Laboratory Blank Data Qualification Summary - SDG K1706626

No Sample Data Qualified in this SDG

Keyport, Area 8, TO 046
1,4-Dioxane - Field Blank Data Qualification Summary - SDG K1706626

No Sample Data Qualified in this SDG

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Analytical Results

Client:	Sealaska Environmental Services, LLC	**Service Request:**	K1706626
Project:	NAVBASE Kitsap Keyport Area 8/TO 46	**Date Collected:**	06/21/2017
Sample Matrix:	Water	**Date Received:**	06/23/2017

1,4-Dioxane by GCMS

Sample Name:	AREA-8-17-204	**Units:**	ug/L
Lab Code:	K1706626-001	**Basis:**	NA
Extraction Method:	EPA 3535A	**Level:**	Low
Analysis Method:	8270D SIM		

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
1,4-Dioxane	**1.1**		0.40	0.20	0.16	1	06/28/17	07/18/17	KWG1705360	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
1,4-Dioxane-d8	81	64-120	07/18/17	Acceptable

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Analytical Results

Client:	Sealaska Environmental Services, LLC	**Service Request:**	K1706626
Project:	NAVBASE Kitsap Keyport Area 8/TO 46	**Date Collected:**	06/21/2017
Sample Matrix:	Water	**Date Received:**	06/23/2017

1,4-Dioxane by GCMS

Sample Name:	AREA-8-17-203	**Units:**	ug/L
Lab Code:	K1706626-002	**Basis:**	NA
Extraction Method:	EPA 3535A	**Level:**	Low
Analysis Method:	8270D SIM		

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
1,4-Dioxane	**16**		0.40	0.20	0.16	1	06/28/17	07/18/17	KWG1705360	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
1,4-Dioxane-d8	82	64-120	07/18/17	Acceptable

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Analytical Results

Client:	Sealaska Environmental Services, LLC	**Service Request:**	K1706626
Project:	NAVBASE Kitsap Keyport Area 8/TO 46	**Date Collected:**	06/21/2017
Sample Matrix:	Water	**Date Received:**	06/23/2017

1,4-Dioxane by GCMS

Sample Name:	AREA-8-17-202	**Units:**	ug/L
Lab Code:	K1706626-003	**Basis:**	NA
Extraction Method:	EPA 3535A	**Level:**	Low
Analysis Method:	8270D SIM		

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
1,4-Dioxane	**15**		0.40	0.20	0.16	1	06/28/17	07/18/17	KWG1705360	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
1,4-Dioxane-d8	80	64-120	07/18/17	Acceptable

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Analytical Results

Client:	Sealaska Environmental Services, LLC	**Service Request:**	K1706626
Project:	NAVBASE Kitsap Keyport Area 8/TO 46	**Date Collected:**	06/21/2017
Sample Matrix:	Water	**Date Received:**	06/23/2017

1,4-Dioxane by GCMS

Sample Name:	AREA-8-17-205	**Units:**	ug/L
Lab Code:	K1706626-004	**Basis:**	NA
Extraction Method:	EPA 3535A	**Level:**	Low
Analysis Method:	8270D SIM		

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
1,4-Dioxane	ND	U	0.40	0.20	0.16	1	06/28/17	07/18/17	KWG1705360	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
1,4-Dioxane-d8	83	64-120	07/18/17	Acceptable

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Analytical Results

Client:	Sealaska Environmental Services, LLC	**Service Request:**	K1706626
Project:	NAVBASE Kitsap Keyport Area 8/TO 46	**Date Collected:**	06/21/2017
Sample Matrix:	Water	**Date Received:**	06/23/2017

1,4-Dioxane by GCMS

Sample Name:	AREA-8-17-201	**Units:**	ug/L
Lab Code:	K1706626-005	**Basis:**	NA
Extraction Method:	EPA 3535A	**Level:**	Low
Analysis Method:	8270D SIM		

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
1,4-Dioxane	ND	U	0.40	0.20	0.16	1	06/28/17	07/18/17	KWG1705360	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
1,4-Dioxane-d8	85	64-120	07/18/17	Acceptable

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2:47 pm, Aug 11, 2017

Comments:

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Analytical Results

Client:	Sealaska Environmental Services, LLC	**Service Request:**	K1706626
Project:	NAVBASE Kitsap Keyport Area 8/TO 46	**Date Collected:**	06/21/2017
Sample Matrix:	Water	**Date Received:**	06/23/2017

1,4-Dioxane by GCMS

Sample Name:	AREA-8-17-200	**Units:**	ug/L
Lab Code:	K1706626-006	**Basis:**	NA
Extraction Method:	EPA 3535A	**Level:**	Low
Analysis Method:	8270D SIM		

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
1,4-Dioxane	**1.1**		0.40	0.20	0.16	1	06/28/17	07/18/17	KWG1705360	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
1,4-Dioxane-d8	80	64-120	07/18/17	Acceptable

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Comments:

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Analytical Results

Client:	Sealaska Environmental Services, LLC	**Service Request:**	K1706626
Project:	NAVBASE Kitsap Keyport Area 8/TO 46	**Date Collected:**	06/21/2017
Sample Matrix:	Water	**Date Received:**	06/23/2017

1,4-Dioxane by GCMS

Sample Name:	AREA-8-17-206	**Units:**	ug/L
Lab Code:	K1706626-007	**Basis:**	NA
Extraction Method:	EPA 3535A	**Level:**	Low
Analysis Method:	8270D SIM		

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
1,4-Dioxane	ND	U	0.40	0.20	0.16	1	06/28/17	07/18/17	KWG1705360	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
1,4-Dioxane-d8	79	64-120	07/18/17	Acceptable

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Comments:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Keyport, Area 8, TO 46

LDC Report Date: August 11, 2017

Parameters: Dissolved Metals

Validation Level: Level III

Laboratory: ALS Environmental

Sample Delivery Group (SDG): K1706626

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
AREA-8-17-204	K1706626-001	Water	06/21/17
AREA-8-17-203	K1706626-002	Water	06/21/17
AREA-8-17-202	K1706626-003	Water	06/21/17
AREA-8-17-205	K1706626-004	Water	06/21/17
AREA-8-17-201	K1706626-005	Water	06/21/17
AREA-8-17-200	K1706626-006	Water	06/21/17
AREA-8-17-206	K1706626-007	Water	06/21/17
AREA-8-17-207	K1706626-008	Water	06/22/17
AREA-8-17-208	K1706626-009	Water	06/22/17
AREA-8-17-205MS	K1706626-004MS	Water	06/21/17
AREA-8-17-205MSD	K1706626-004MSD	Water	06/21/17
AREA-8-17-207MS	K1706626-008MS	Water	06/22/17
AREA-8-17-207MSD	K1706626-008MSD	Water	06/22/17

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the NAVFAC Northwest Standard Operating Procedure: Field Procedures Manual (Naval Facilities Engineering Command Northwest, 2015) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Arsenic, Barium, Cadmium, Chromium, Copper, Lead, Nickel, Silver, and Zinc by Environmental Protection Agency (EPA) Methods 200.7/200.8

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detect): The compound or analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detect at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. ICPMS Tune

The mass calibration was within 0.1 AMU and the percent relative standard deviation (%RSD) was less than or equal to 5%.

III. Instrument Calibration

Initial and continuing calibrations were performed as required by the methods.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

IV. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks with the following exceptions:

Laboratory Blank ID	Analyte	Maximum Concentration	Associated Samples
PB (prep blank)	Copper	0.02 ug/L	All samples in SDG K1706626
ICB/CCB	Barium	0.8 mg/L	All samples in SDG K1706626

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration	Modified Final Concentration
AREA-8-17-206	Copper	0.10 ug/L	0.10UJ ug/L

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample.

For AREA-8-17-205MS/MSD, no data were qualified for Chromium percent recoveries outside the QC limits since the parent sample results were greater than 4X the spike concentration.

For AREA-8-17-207MS/MSD, no data were qualified for Cadmium percent recoveries outside the QC limits since the parent sample results were greater than 4X the spike concentration.

Relative percent differences (RPD) were within QC limits.

VIII. Duplicate Sample Analysis

The laboratory has indicated that there were no duplicate (DUP) analyses specified for the samples in this SDG, and therefore duplicate analyses were not performed for this SDG.

IX. Serial Dilution

Serial dilution analysis was performed on an associated project sample. Percent differences (%D) were within QC limits.

X. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

XI. Field Duplicates

Samples AREA-8-17-203 and AREA-8-17-202 and samples AREA-8-17-207 and AREA-8-17-208 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (ug/L)		RPD (Limits)
	AREA-8-17-203	AREA-8-17-202	
Arsenic	0.91	0.90	1 (≤50)
Barium	83.6	86.7	4 (≤50)

Analyte	Concentration (ug/L)		RPD (Limits)
	AREA-8-17-203	AREA-8-17-202	
Cadmium	135	134	1 (≤50)
Chromium	140	136	3 (≤50)
Copper	2.61	2.62	0 (≤50)
Lead	0.015	0.017	13 (≤50)
Nickel	14.3	14.6	2 (≤50)
Silver	2.69	2.70	0 (≤50)
Zinc	48	47	2 (≤50)

Analyte	Concentration (ug/L)		RPD (Limits)
	AREA-8-17-207	AREA-8-17-208	
Arsenic	0.77	0.93	19 (≤50)
Barium	42.9	43.6	2 (≤50)
Cadmium	9.99	10.5	5 (≤50)
Chromium	5.95	6.14	3 (≤50)
Copper	0.38	0.42	10 (≤50)
Lead	0.034	0.027	23 (≤50)
Nickel	6.76	6.78	0 (≤50)
Silver	0.038	0.039	3 (≤50)
Zinc	0.87	0.77	12 (≤50)

XII. Internal Standards (ICP-MS)

All internal standard percent recoveries (%R) were within QC limits.

XIII. Sample Result Verification

Raw data were not reviewed for Level III validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

Due to laboratory blank contamination, data were qualified as not detected and estimated in one sample.

Quality control criteria were met, other than those discussed above, and no significant issues impacting data quality were identified. The analytical data are acceptable for use as reported by the laboratory and qualified during data validation.

Keyport, Area 8, TO 46
Dissolved Metals - Data Qualification Summary - SDG K1706626

No Sample Data Qualified in this SDG

Keyport, Area 8, TO 46
Dissolved Metals - Laboratory Blank Data Qualification Summary - SDG K1706626

Sample	Analyte	Modified Final Concentration
AREA-8-17-206	Copper	0.10UJ ug/L

Keyport, Area 8, TO 46
Dissolved Metals - Field Blank Data Qualification Summary - SDG K1706626

No Sample Data Qualified in this SDG

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Analytical Report

Client:	Sealaska Environmental Services, LLC	**Service Request:**	K1706626
Project:	NAVBASE Kitsap Keyport Area 8/TO 46	**Date Collected:**	06/21/17 09:55
Sample Matrix:	Water	**Date Received:**	06/23/17 11:12
Sample Name:	AREA-8-17-204	**Basis:**	NA
Lab Code:	K1706626-001		

Dissolved Metals

Analyte Name	Analysis Method	Result	Units	LOQ	LOD	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	200.8	**0.45 J**	ug/L	0.50	0.13	0.03	1	07/20/17 10:31	07/17/17	
Barium	200.7	**9.9**	ug/L	4.2	2.1	0.6	1	07/05/17 09:43	07/03/17	
Cadmium	200.8	**0.352**	ug/L	0.020	0.010	0.003	1	07/20/17 10:31	07/17/17	
Chromium	200.8	**72.9**	ug/L	4.0	2.0	0.6	20	07/20/17 11:09	07/17/17	
Copper	200.8	**1.45**	ug/L	0.10	0.05	0.02	1	07/20/17 10:31	07/17/17	
Lead	200.8	**0.039**	ug/L	0.020	0.010	0.004	1	07/20/17 10:31	07/17/17	
Nickel	200.8	**0.79**	ug/L	0.20	0.10	0.03	1	07/20/17 10:31	07/17/17	
Silver	200.8	**0.045**	ug/L	0.020	0.010	0.004	1	07/20/17 10:31	07/17/17	
Zinc	200.8	**0.33 J**	ug/L	0.50	0.25	0.07	1	07/20/17 10:31	07/17/17	

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Analytical Report

Client:	Sealaska Environmental Services, LLC	**Service Request:**	K1706626
Project:	NAVBASE Kitsap Keyport Area 8/TO 46	**Date Collected:**	06/21/17 10:50
Sample Matrix:	Water	**Date Received:**	06/23/17 11:12
Sample Name:	AREA-8-17-203	**Basis:**	NA
Lab Code:	K1706626-002		

Dissolved Metals

Analyte Name	Analysis Method	Result	Units	LOQ	LOD	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	200.8	**0.91**	ug/L	0.50	0.13	0.03	1	07/20/17 10:34	07/17/17	
Barium	200.7	**83.6**	ug/L	4.2	2.1	0.6	1	07/05/17 09:46	07/03/17	
Cadmium	200.8	**135**	ug/L	0.40	0.20	0.06	20	07/20/17 11:13	07/17/17	
Chromium	200.8	**140**	ug/L	4.0	2.0	0.6	20	07/20/17 11:13	07/17/17	
Copper	200.8	**2.61**	ug/L	0.10	0.05	0.02	1	07/20/17 10:34	07/17/17	
Lead	200.8	**0.015**	J ug/L	0.020	0.010	0.004	1	07/20/17 10:34	07/17/17	
Nickel	200.8	**14.3**	ug/L	0.20	0.10	0.03	1	07/20/17 10:34	07/17/17	
Silver	200.8	**2.69**	ug/L	0.020	0.010	0.004	1	07/20/17 10:34	07/17/17	
Zinc	200.8	**48**	ug/L	10	5	1	20	07/20/17 11:13	07/17/17	

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Analytical Report

Client:	Sealaska Environmental Services, LLC	**Service Request:**	K1706626
Project:	NAVBASE Kitsap Keyport Area 8/TO 46	**Date Collected:**	06/21/17 10:40
Sample Matrix:	Water	**Date Received:**	06/23/17 11:12
Sample Name:	AREA-8-17-202	**Basis:**	NA
Lab Code:	K1706626-003		

Dissolved Metals

Analyte Name	Analysis Method	Result	Units	LOQ	LOD	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	200.8	**0.90**	ug/L	0.50	0.13	0.03	1	07/20/17 10:38	07/17/17	
Barium	200.7	**86.7**	ug/L	4.2	2.1	0.6	1	07/05/17 09:49	07/03/17	
Cadmium	200.8	**134**	ug/L	0.40	0.20	0.06	20	07/20/17 11:17	07/17/17	
Chromium	200.8	**136**	ug/L	4.0	2.0	0.6	20	07/20/17 11:17	07/17/17	
Copper	200.8	**2.62**	ug/L	0.10	0.05	0.02	1	07/20/17 10:38	07/17/17	
Lead	200.8	**0.017 J**	ug/L	0.020	0.010	0.004	1	07/20/17 10:38	07/17/17	
Nickel	200.8	**14.6**	ug/L	0.20	0.10	0.03	1	07/20/17 10:38	07/17/17	
Silver	200.8	**2.70**	ug/L	0.020	0.010	0.004	1	07/20/17 10:38	07/17/17	
Zinc	200.8	**47**	ug/L	10	5	1	20	07/20/17 11:17	07/17/17	

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Client:	Sealaska Environmental Services, LLC	**Service Request:**	K1706626
Project:	NAVBASE Kitsap Keyport Area 8/TO 46	**Date Collected:**	06/21/17 11:30
Sample Matrix:	Water	**Date Received:**	06/23/17 11:12
Sample Name:	AREA-8-17-205	**Basis:**	NA
Lab Code:	K1706626-004		

Dissolved Metals

Analyte Name	Analysis Method	Result	Units	LOQ	LOD	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	200.8	**1.47**	ug/L	0.50	0.13	0.03	1	07/20/17 09:25	07/17/17	
Barium	200.7	**18.6**	ug/L	4.2	2.1	0.6	1	07/05/17 09:52	07/03/17	
Cadmium	200.8	**5.91**	ug/L	0.020	0.010	0.003	1	07/20/17 09:25	07/17/17	
Chromium	200.8	**12.4**	ug/L	0.20	0.10	0.03	1	07/20/17 09:25	07/17/17	
Copper	200.8	**1.39**	ug/L	0.10	0.05	0.02	1	07/20/17 09:25	07/17/17	
Lead	200.8	**0.984**	ug/L	0.020	0.010	0.004	1	07/20/17 09:25	07/17/17	
Nickel	200.8	**4.37**	ug/L	0.20	0.10	0.03	1	07/20/17 09:25	07/17/17	
Silver	200.8	**0.210**	ug/L	0.020	0.010	0.004	1	07/20/17 09:25	07/17/17	
Zinc	200.8	**2.41**	ug/L	0.50	0.25	0.07	1	07/20/17 09:25	07/17/17	

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Analytical Report

Client:	Sealaska Environmental Services, LLC	**Service Request:**	K1706626
Project:	NAVBASE Kitsap Keyport Area 8/TO 46	**Date Collected:**	06/21/17 12:00
Sample Matrix:	Water	**Date Received:**	06/23/17 11:12
Sample Name:	AREA-8-17-201	**Basis:**	NA
Lab Code:	K1706626-005		

Dissolved Metals

Analyte Name	Analysis Method	Result	Units	LOQ	LOD	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	200.8	**0.49 J**	ug/L	0.50	0.13	0.03	1	07/20/17 10:43	07/17/17	
Barium	200.7	**66.4**	ug/L	4.2	2.1	0.6	1	07/05/17 10:36	07/03/17	
Cadmium	200.8	**0.284**	ug/L	0.020	0.010	0.003	1	07/20/17 10:43	07/17/17	
Chromium	200.8	**5.00**	ug/L	0.20	0.10	0.03	1	07/20/17 10:43	07/17/17	
Copper	200.8	**0.57**	ug/L	0.10	0.05	0.02	1	07/20/17 10:43	07/17/17	
Lead	200.8	**0.016 J**	ug/L	0.020	0.010	0.004	1	07/20/17 10:43	07/17/17	
Nickel	200.8	**1.51**	ug/L	0.20	0.10	0.03	1	07/20/17 10:43	07/17/17	
Silver	200.8	**0.439**	ug/L	0.020	0.010	0.004	1	07/20/17 10:43	07/17/17	
Zinc	200.8	**0.67**	ug/L	0.50	0.25	0.07	1	07/20/17 10:43	07/17/17	

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Analytical Report

Client:	Sealaska Environmental Services, LLC	**Service Request:**	K1706626
Project:	NAVBASE Kitsap Keyport Area 8/TO 46	**Date Collected:**	06/21/17 12:45
Sample Matrix:	Water	**Date Received:**	06/23/17 11:12
Sample Name:	AREA-8-17-200	**Basis:**	NA
Lab Code:	K1706626-006		

Dissolved Metals

Analyte Name	Analysis Method	Result	Units	LOQ	LOD	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	200.8	**0.33 J**	ug/L	0.50	0.13	0.03	1	07/20/17 10:46	07/17/17	
Barium	200.7	**4.7**	ug/L	4.2	2.1	0.6	1	07/05/17 10:39	07/03/17	
Cadmium	200.8	**0.057**	ug/L	0.020	0.010	0.003	1	07/20/17 10:46	07/17/17	
Chromium	200.8	**70.2**	ug/L	4.0	2.0	0.6	20	07/20/17 11:21	07/17/17	
Copper	200.8	**0.32**	ug/L	0.10	0.05	0.02	1	07/20/17 10:46	07/17/17	
Lead	200.8	**0.008 J**	ug/L	0.020	0.010	0.004	1	07/20/17 10:46	07/17/17	
Nickel	200.8	**0.41**	ug/L	0.20	0.10	0.03	1	07/20/17 10:46	07/17/17	
Silver	200.8	**0.466**	ug/L	0.020	0.010	0.004	1	07/20/17 10:46	07/17/17	
Zinc	200.8	**0.54**	ug/L	0.50	0.25	0.07	1	07/20/17 10:46	07/17/17	

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Analytical Report

Client:	Sealaska Environmental Services, LLC	**Service Request:**	K1706626
Project:	NAVBASE Kitsap Keyport Area 8/TO 46	**Date Collected:**	06/21/17 14:20
Sample Matrix:	Water	**Date Received:**	06/23/17 11:12
Sample Name:	AREA-8-17-206	**Basis:**	NA
Lab Code:	K1706626-007		

Dissolved Metals

Analyte Name	Analysis Method	Result		Units	LOQ	LOD	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	200.8	**2.17**		ug/L	0.50	0.13	0.03	1	07/20/17 10:50	07/17/17	
Barium	200.7	**144**		ug/L	4.2	2.1	0.6	1	07/05/17 10:42	07/03/17	
Cadmium	200.8	**0.006**	J	ug/L	0.020	0.010	0.003	1	07/20/17 10:50	07/17/17	
Chromium	200.8	**1.01**		ug/L	0.20	0.10	0.03	1	07/20/17 10:50	07/17/17	
Copper	200.8	**0.10**	J UJ	ug/L	0.10	0.05	0.02	1	07/20/17 10:50	07/17/17	
Lead	200.8	**0.016**	J	ug/L	0.020	0.010	0.004	1	07/20/17 10:50	07/17/17	
Nickel	200.8	**4.45**		ug/L	0.20	0.10	0.03	1	07/20/17 10:50	07/17/17	
Silver	200.8	**0.008**	J	ug/L	0.020	0.010	0.004	1	07/20/17 10:50	07/17/17	
Zinc	200.8	**0.50**	J	ug/L	0.50	0.25	0.07	1	07/20/17 10:50	07/17/17	

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Initials: CR

Client:	Sealaska Environmental Services, LLC	**Service Request:**	K1706626
Project:	NAVBASE Kitsap Keyport Area 8/TO 46	**Date Collected:**	06/22/17 09:35
Sample Matrix:	Water	**Date Received:**	06/23/17 11:12
Sample Name:	AREA-8-17-207	**Basis:**	NA
Lab Code:	K1706626-008		

Dissolved Metals

Analyte Name	Analysis Method	Result	Units	LOQ	LOD	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	200.8	**0.77**	ug/L	0.50	0.13	0.03	1	07/20/17 10:00	07/17/17	
Barium	200.7	**42.9**	ug/L	4.2	2.1	0.6	1	07/05/17 10:45	07/03/17	
Cadmium	200.8	**9.99**	ug/L	0.020	0.010	0.003	1	07/20/17 10:00	07/17/17	
Chromium	200.8	**5.95**	ug/L	0.20	0.10	0.03	1	07/20/17 10:00	07/17/17	
Copper	200.8	**0.38**	ug/L	0.10	0.05	0.02	1	07/20/17 10:00	07/17/17	
Lead	200.8	**0.034**	ug/L	0.020	0.010	0.004	1	07/20/17 10:00	07/17/17	
Nickel	200.8	**6.76**	ug/L	0.20	0.10	0.03	1	07/20/17 10:00	07/17/17	
Silver	200.8	**0.038**	ug/L	0.020	0.010	0.004	1	07/20/17 10:00	07/17/17	
Zinc	200.8	**0.87**	ug/L	0.50	0.25	0.07	1	07/20/17 10:00	07/17/17	

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Analytical Report

Client:	Sealaska Environmental Services, LLC	**Service Request:**	K1706626
Project:	NAVBASE Kitsap Keyport Area 8/TO 46	**Date Collected:**	06/22/17 09:45
Sample Matrix:	Water	**Date Received:**	06/23/17 11:12
Sample Name:	AREA-8-17-208	**Basis:**	NA
Lab Code:	K1706626-009		

Dissolved Metals

Analyte Name	Analysis Method	Result	Units	LOQ	LOD	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	200.8	**0.93**	ug/L	0.50	0.13	0.03	1	07/20/17 10:54	07/17/17	
Barium	200.7	**43.6**	ug/L	4.2	2.1	0.6	1	07/05/17 10:53	07/03/17	
Cadmium	200.8	**10.5**	ug/L	0.020	0.010	0.003	1	07/20/17 10:54	07/17/17	
Chromium	200.8	**6.14**	ug/L	0.20	0.10	0.03	1	07/20/17 10:54	07/17/17	
Copper	200.8	**0.42**	ug/L	0.10	0.05	0.02	1	07/20/17 10:54	07/17/17	
Lead	200.8	**0.027**	ug/L	0.020	0.010	0.004	1	07/20/17 10:54	07/17/17	
Nickel	200.8	**6.78**	ug/L	0.20	0.10	0.03	1	07/20/17 10:54	07/17/17	
Silver	200.8	**0.039**	ug/L	0.020	0.010	0.004	1	07/20/17 10:54	07/17/17	
Zinc	200.8	**0.77**	ug/L	0.50	0.25	0.07	1	07/20/17 10:54	07/17/17	

AUG 14 2017

Initials: CR

APPENDIX D

GRAPHS OF CONCENTRATION TRENDS

Figure D-1. MW8-8 PCE, TCE, and cis-1,2-DCE Concentration Trends Since 2007

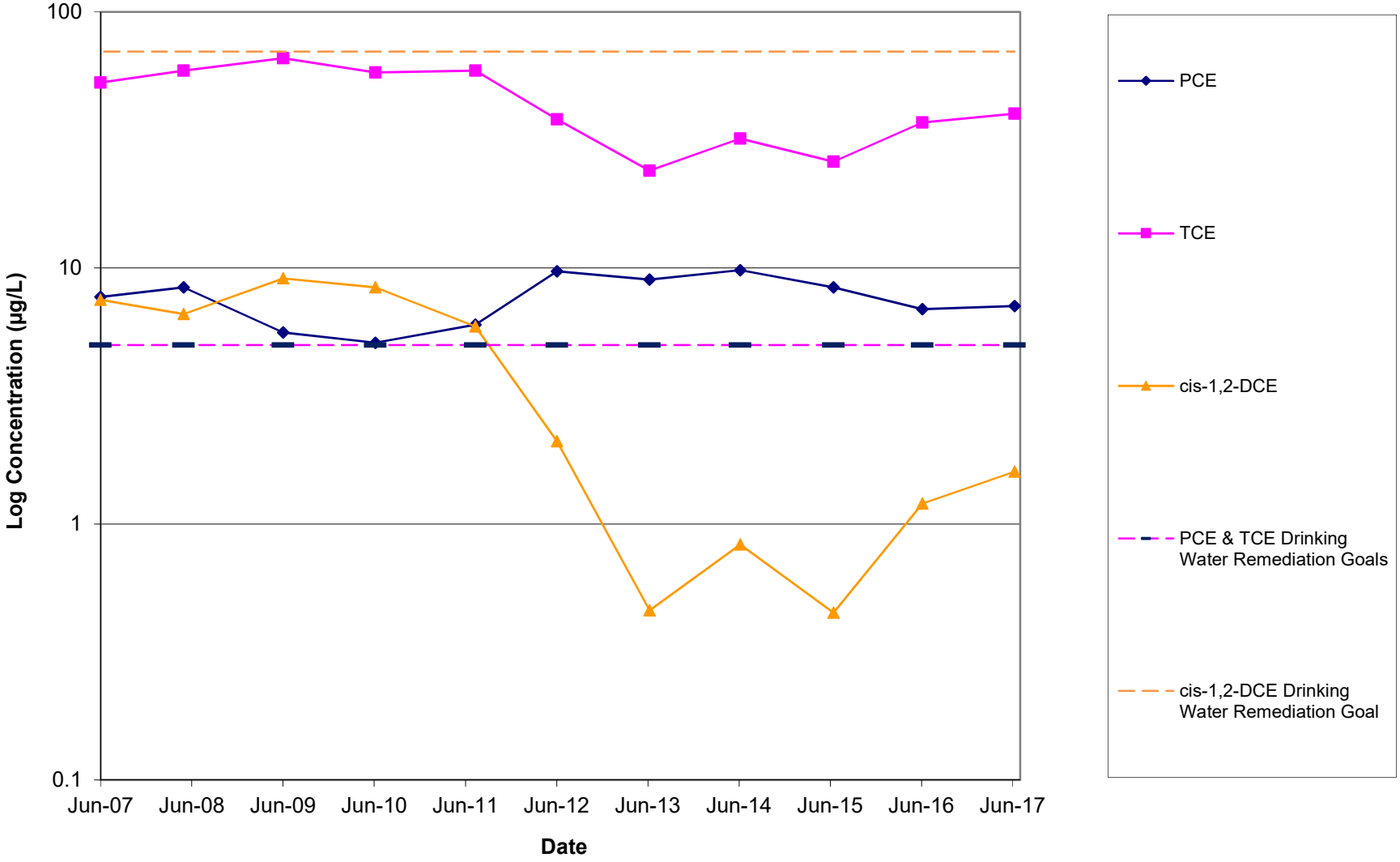


Figure D-1a. MW8-8 1,1,1-TCA and 1,1-DCE Concentration Trends Since 2007

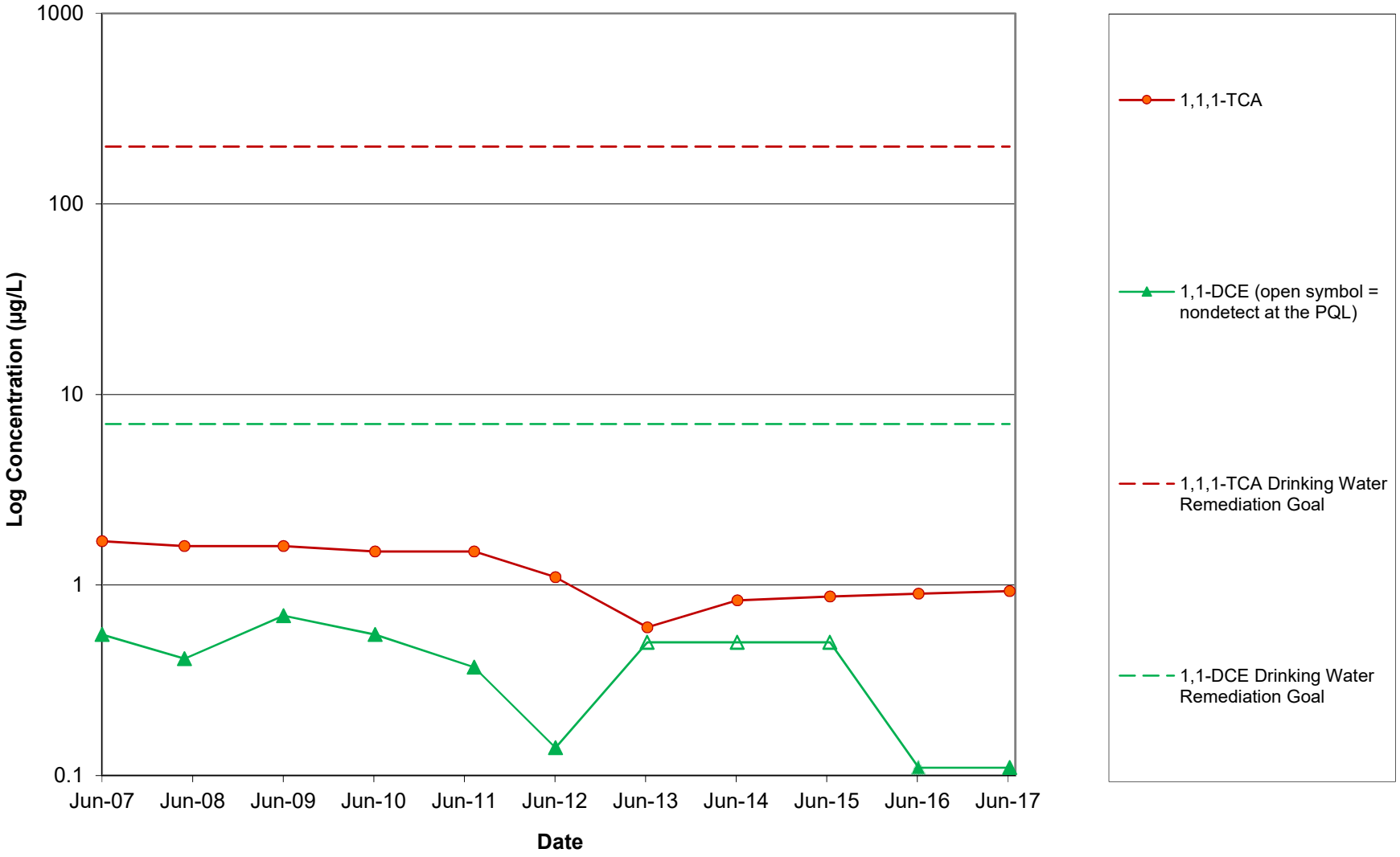


Figure D-2. MW8-9 PCE, TCE, and cis-1,2-DCE Concentration Trends Since 2007

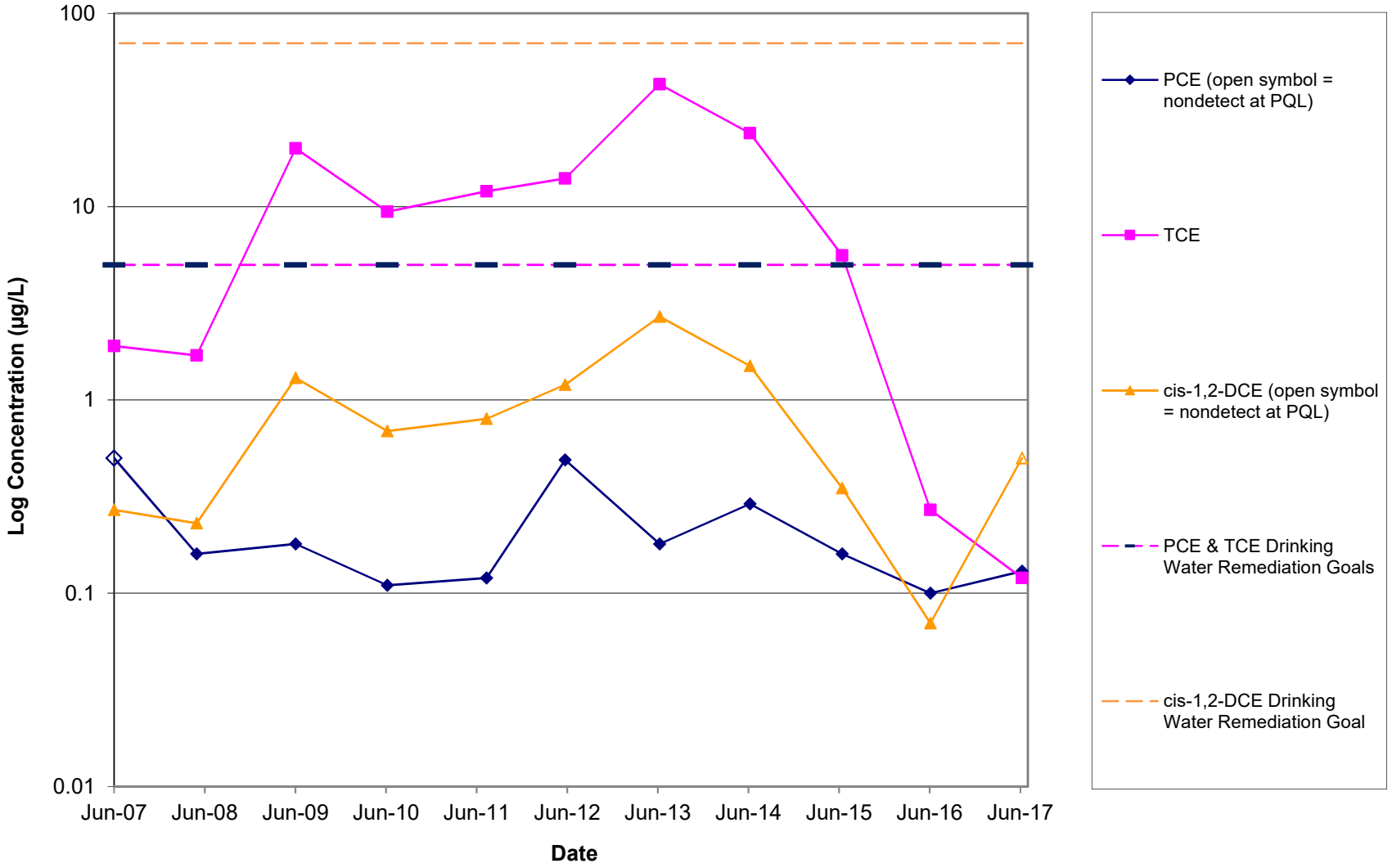


Figure D-2a. MW8-9 1,1,1-TCA and 1,1-DCE Concentration Trends Since 2007

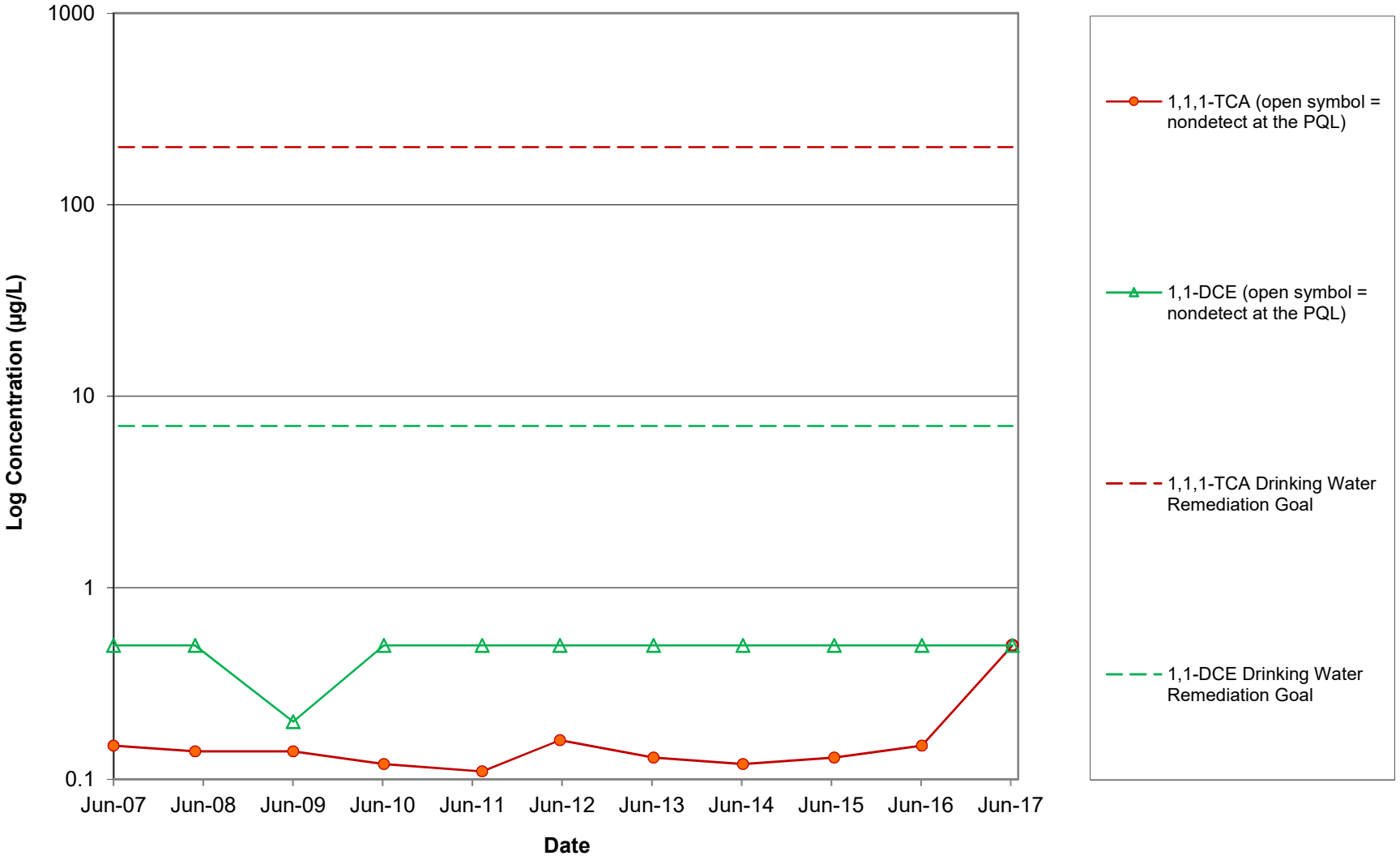


Figure D-3. MW8-11 PCE, TCE, and cis-1,2-DCE Concentration Trends Since 2007

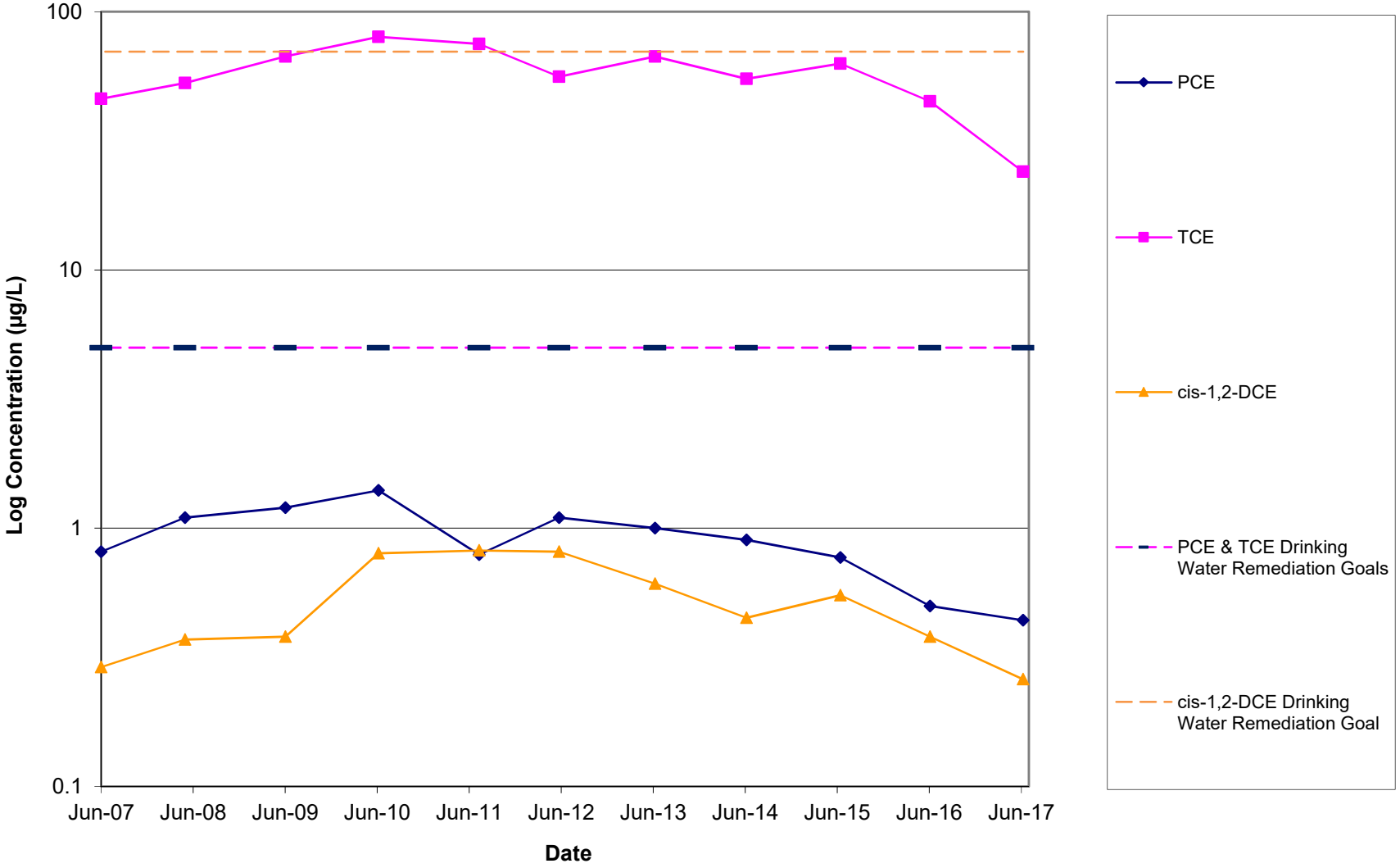


Figure D-3a. MW8-11 1,1,1-TCA and 1,1-DCE Concentration Trends Since 2007

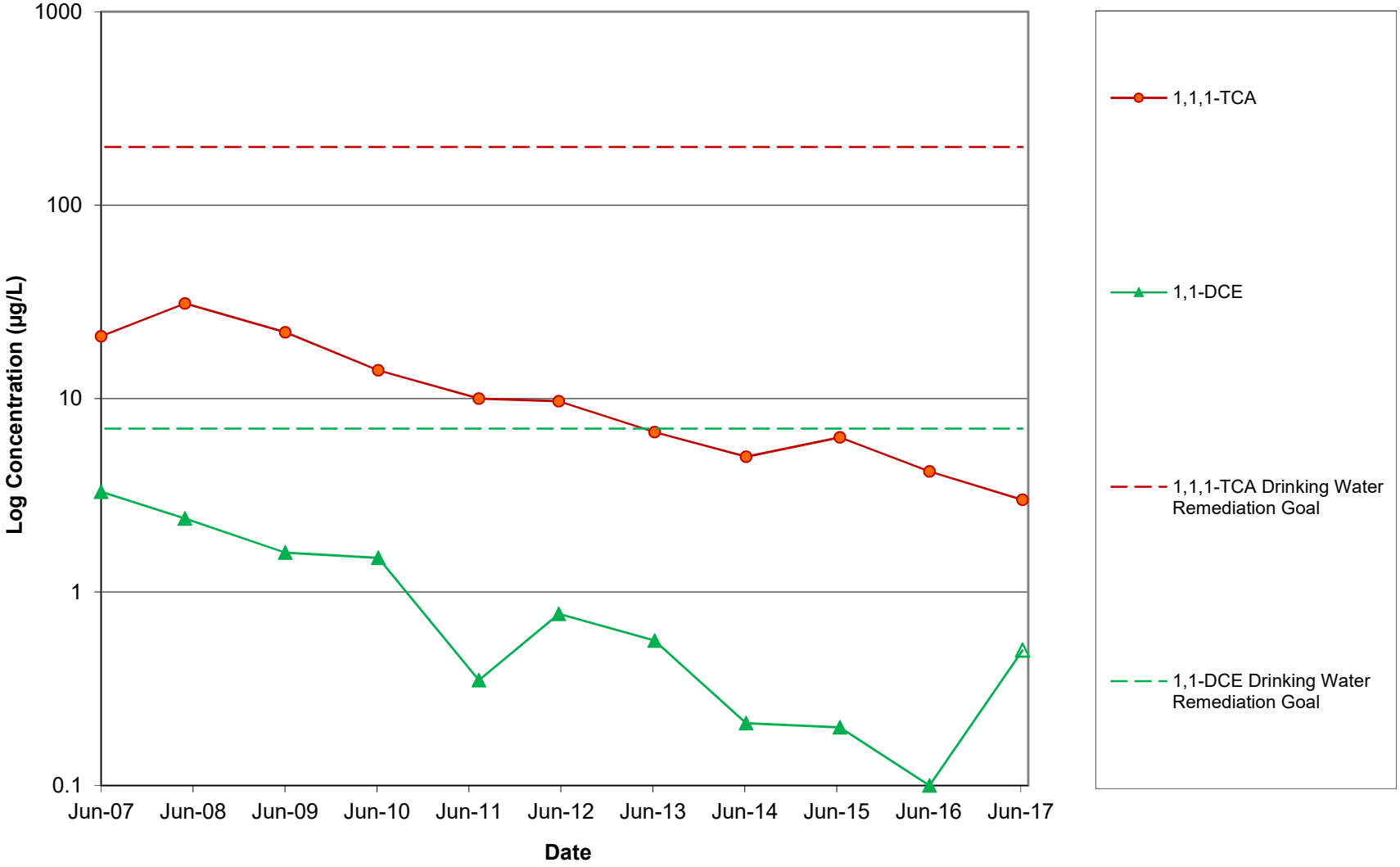


Figure D-4. MW8-12 PCE, TCE, and cis-1,2-DCE Concentration Trends Since 2007

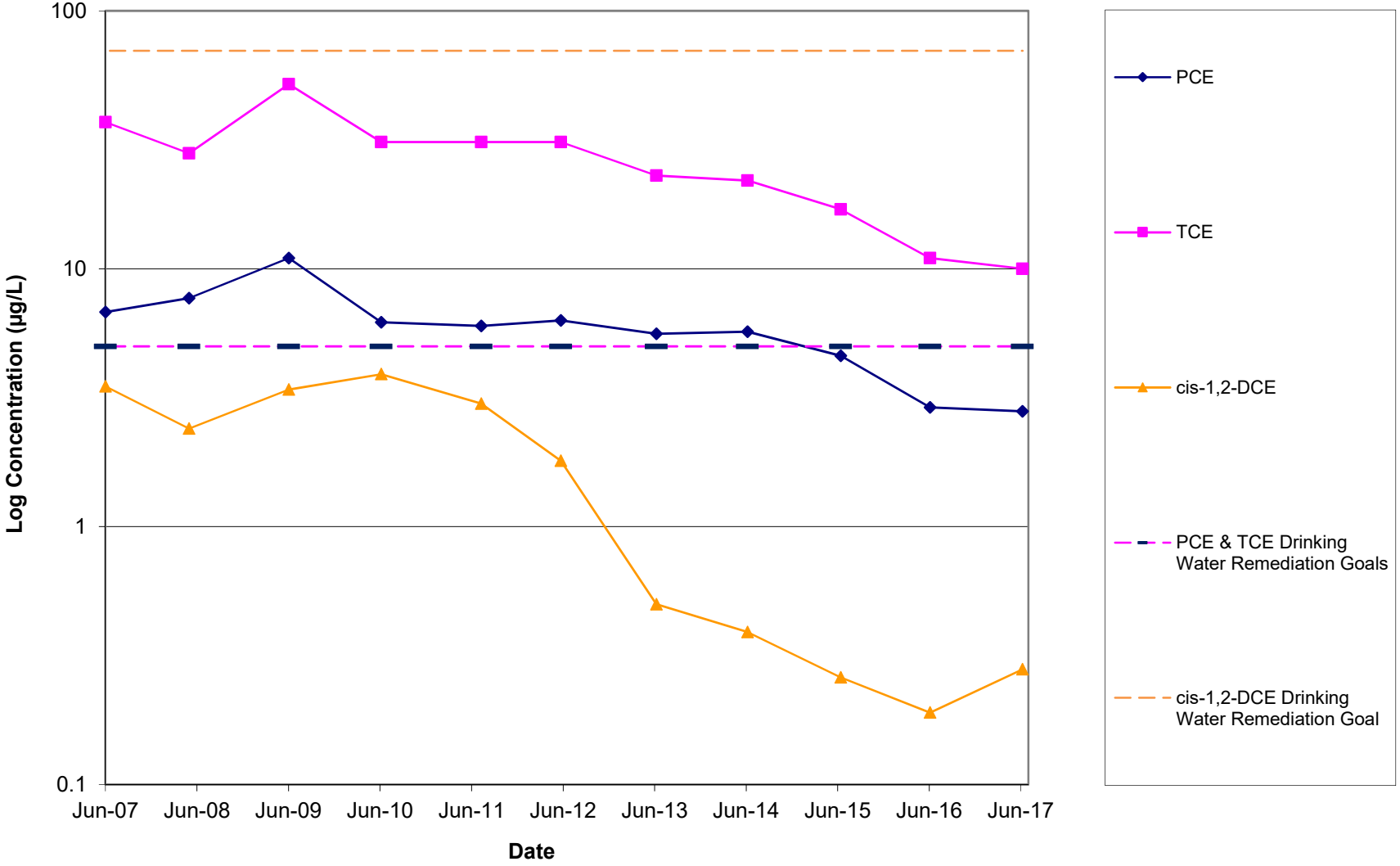


Figure D-4a. MW8-12 1,1,1-TCA and 1,1-DCE Concentration Trends Since 2007

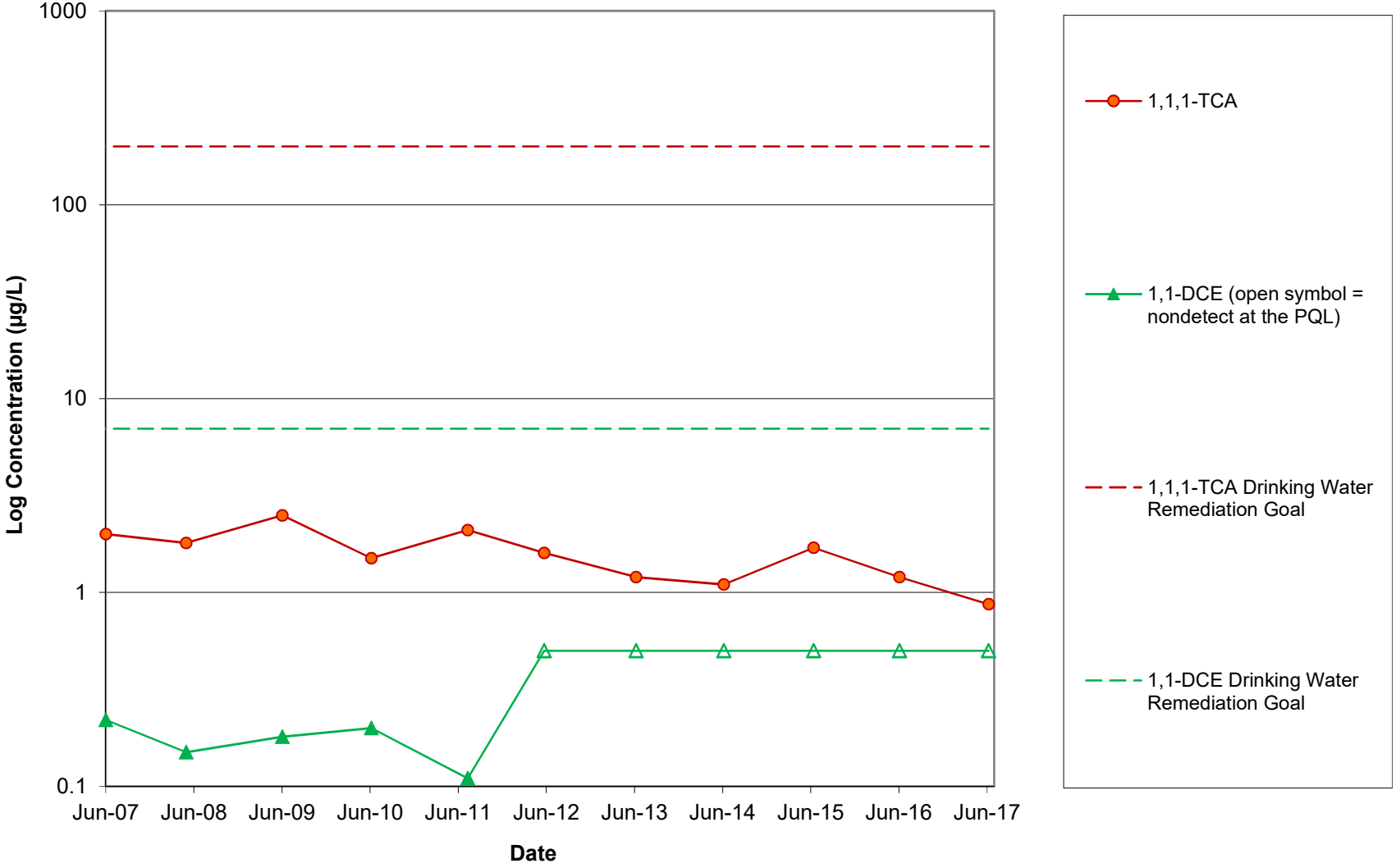


Figure D-5. MW8-16 PCE, TCE, and cis-1,2-DCE Concentration Trends Since 2007

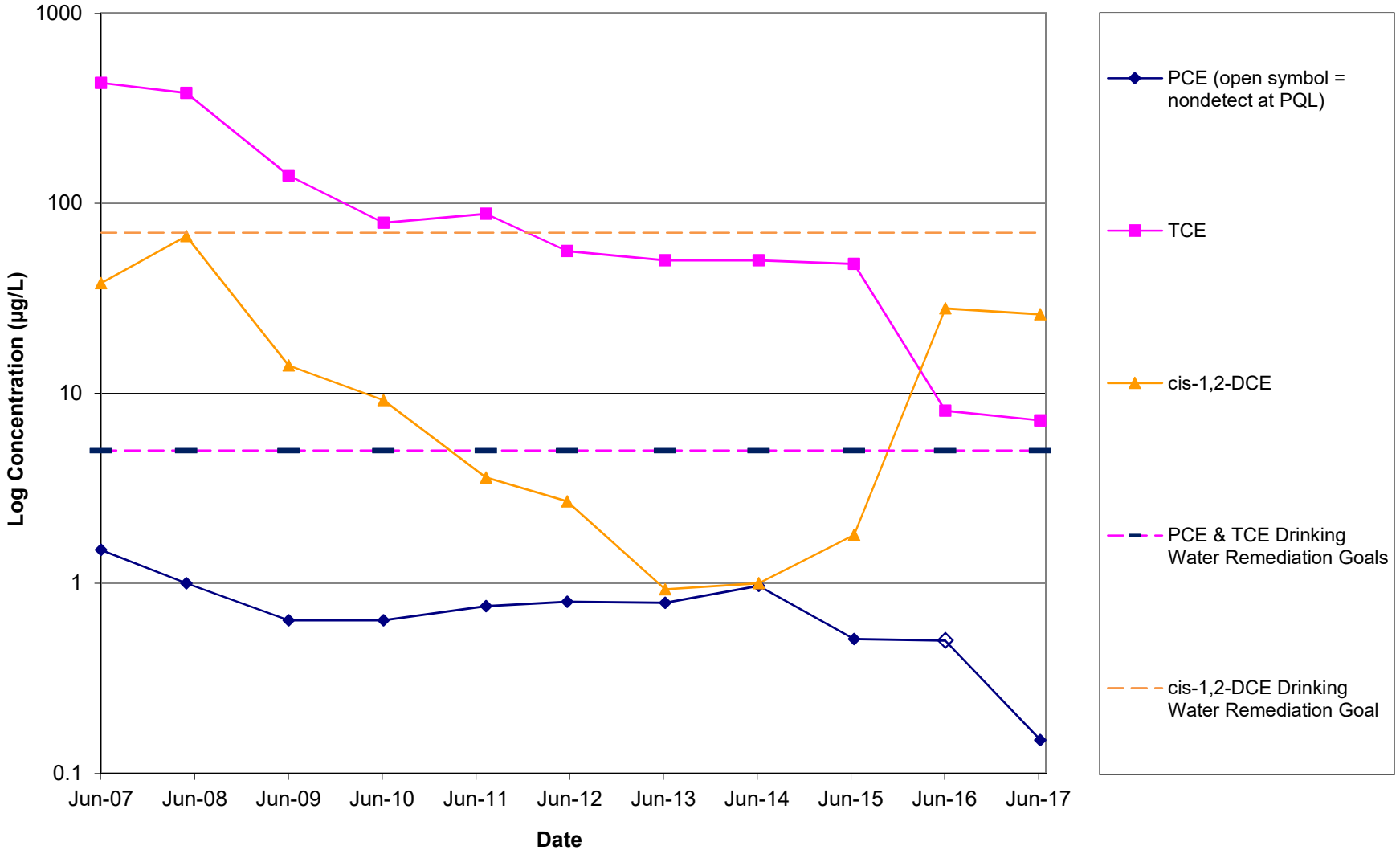


Figure D-5a. MW8-16 1,1,1-TCA and 1,1-DCE Concentration Trends Since 2007

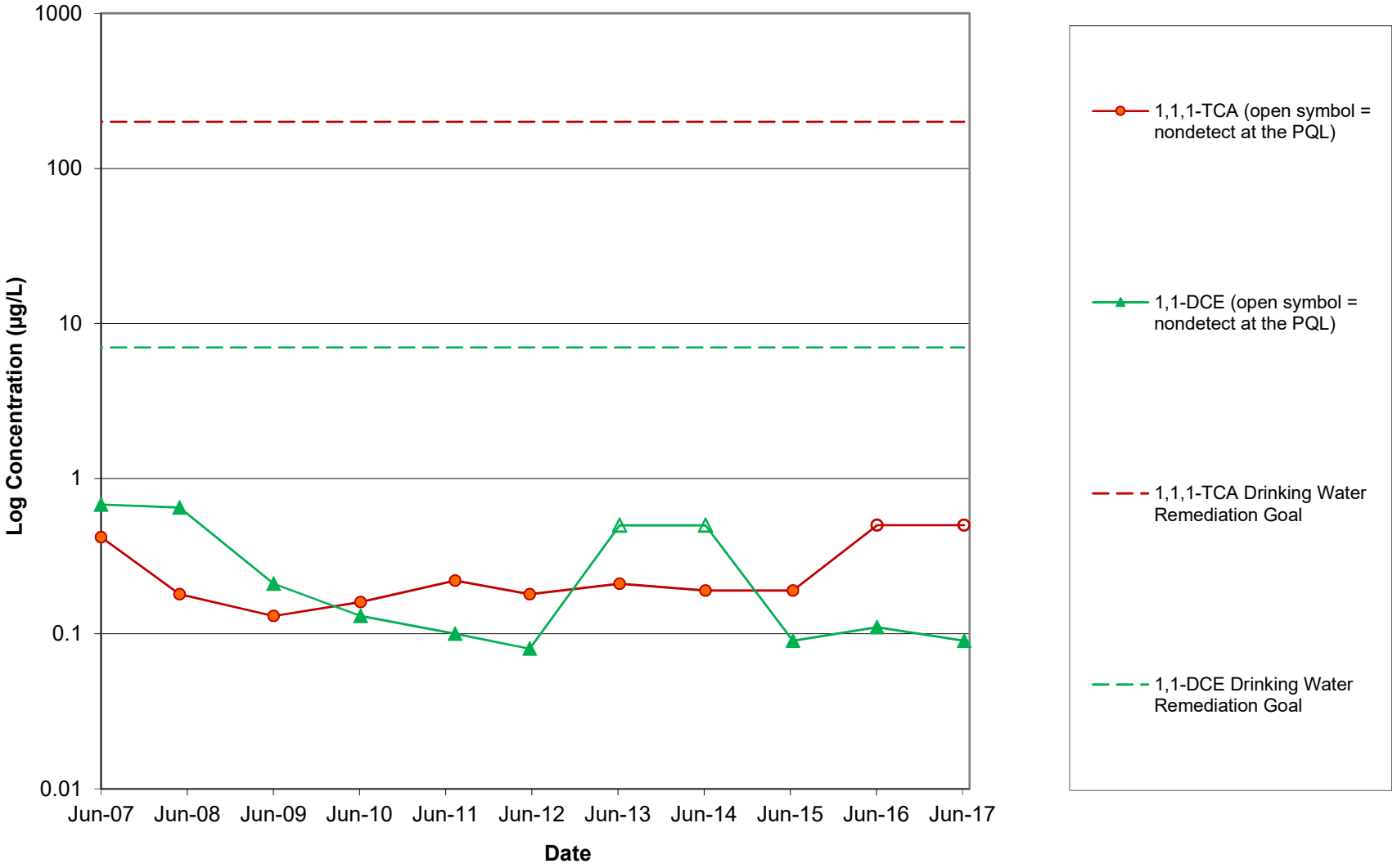


Figure D-6. Seep A PCE, TCE, and cis-1,2-DCE Concentration Trends Since 2007

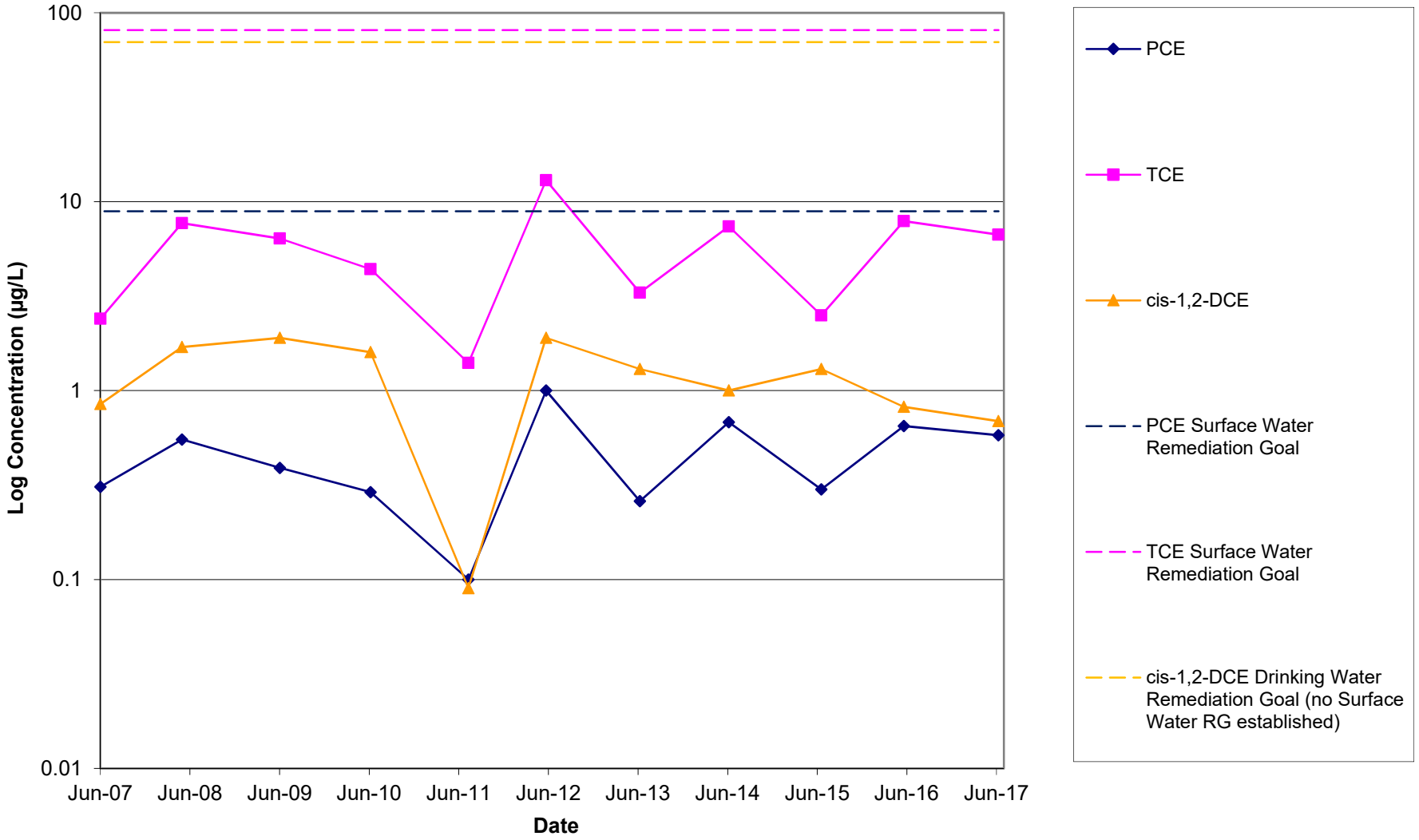


Figure D-6a. Seep A 1,1,1-TCA and 1,1-DCE Concentration Trends Since 2007

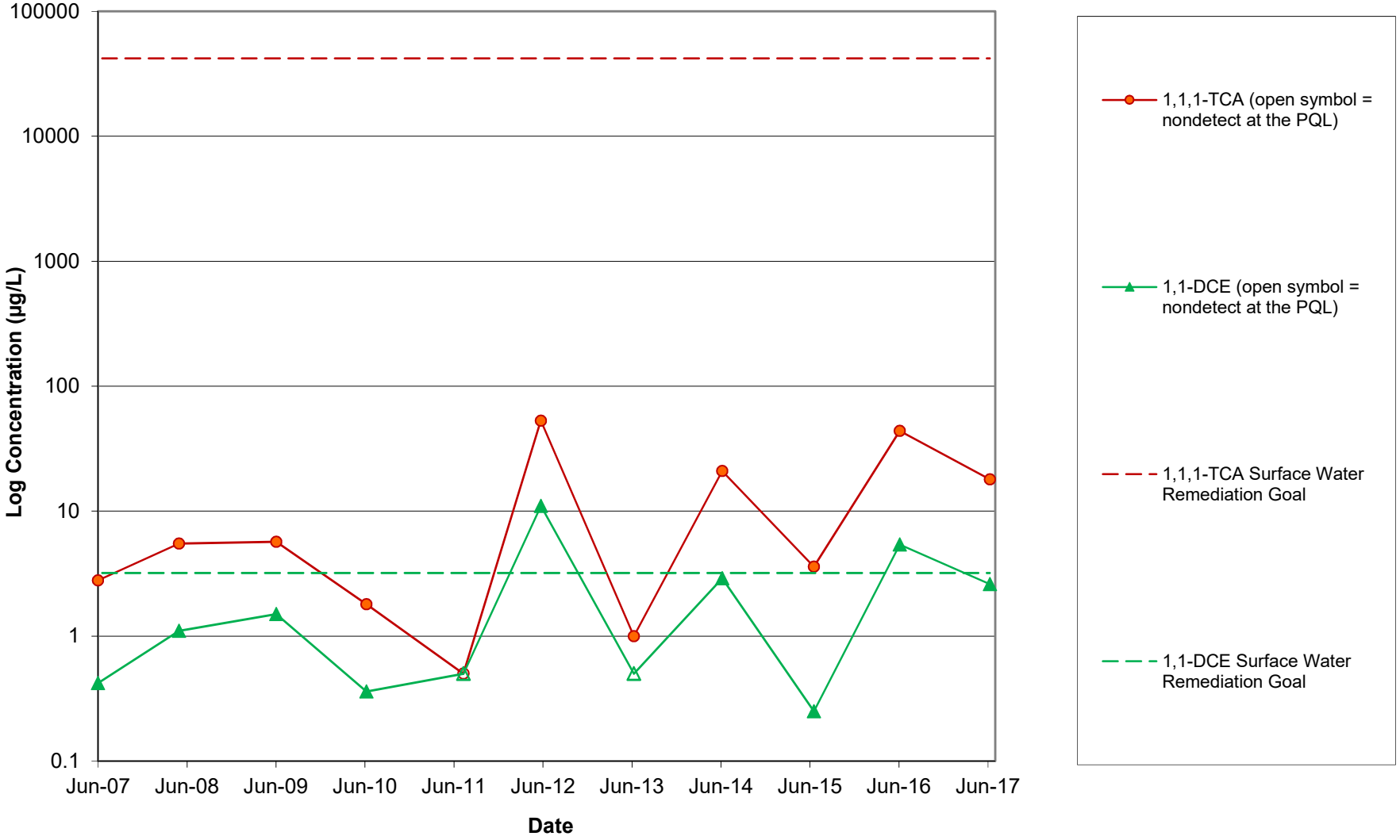


Figure D-7. MW8-8 Cd and Cr Concentration Trends Since 2007

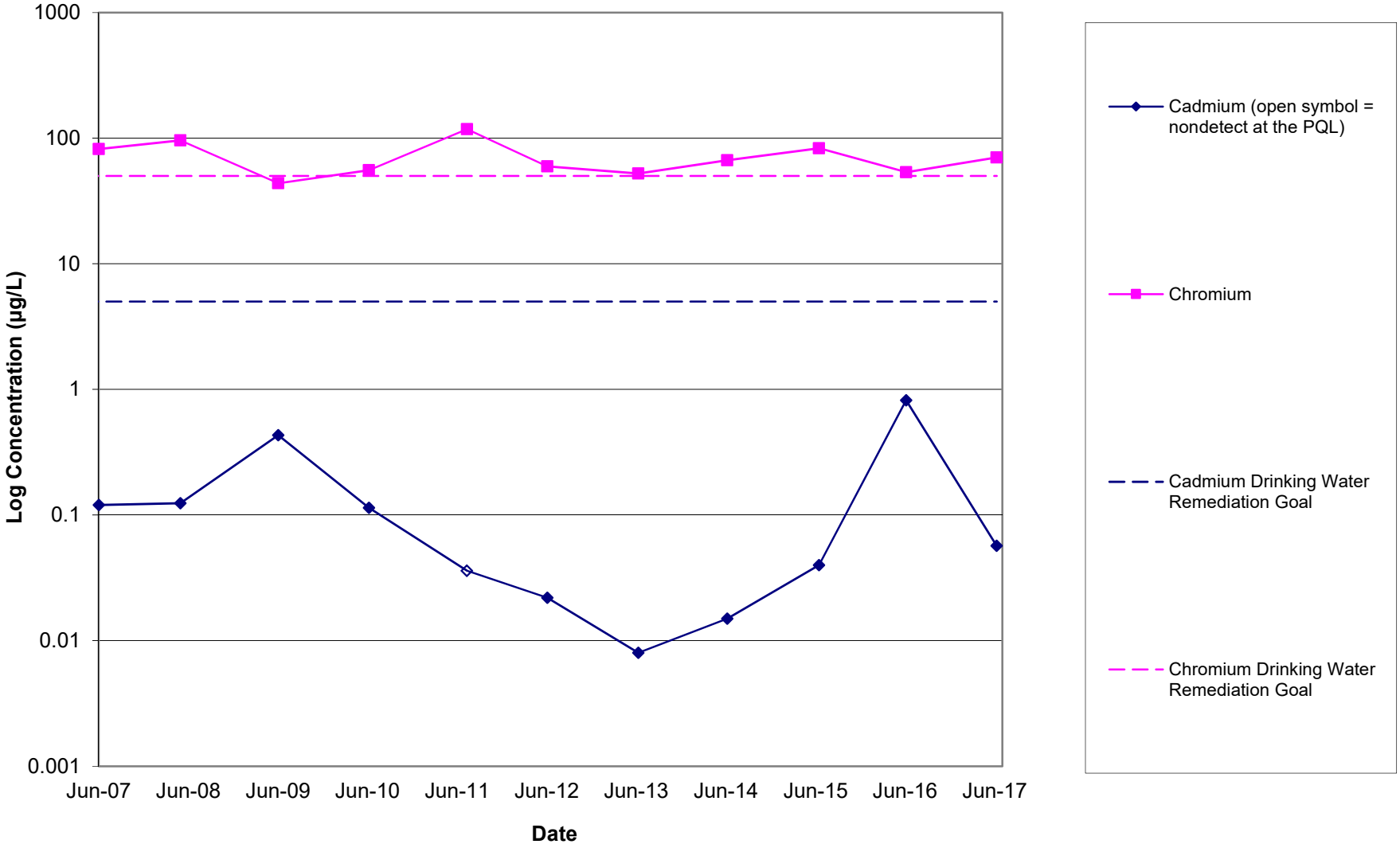


Figure D-8. MW8-9 Cd and Cr Concentration Trends Since 2007

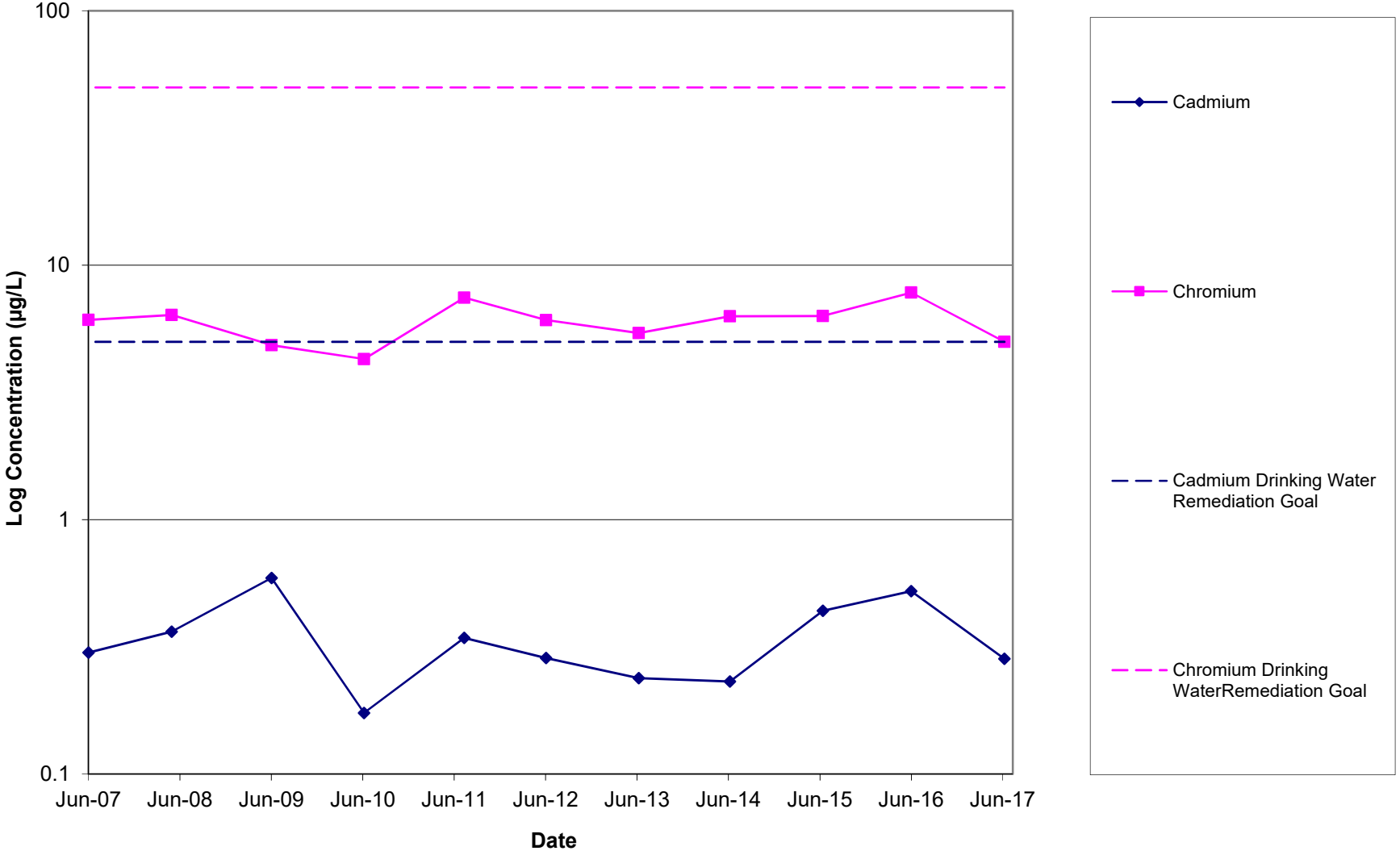


Figure D-9. MW8-11 Cd and Cr Concentration Trends Since 2007

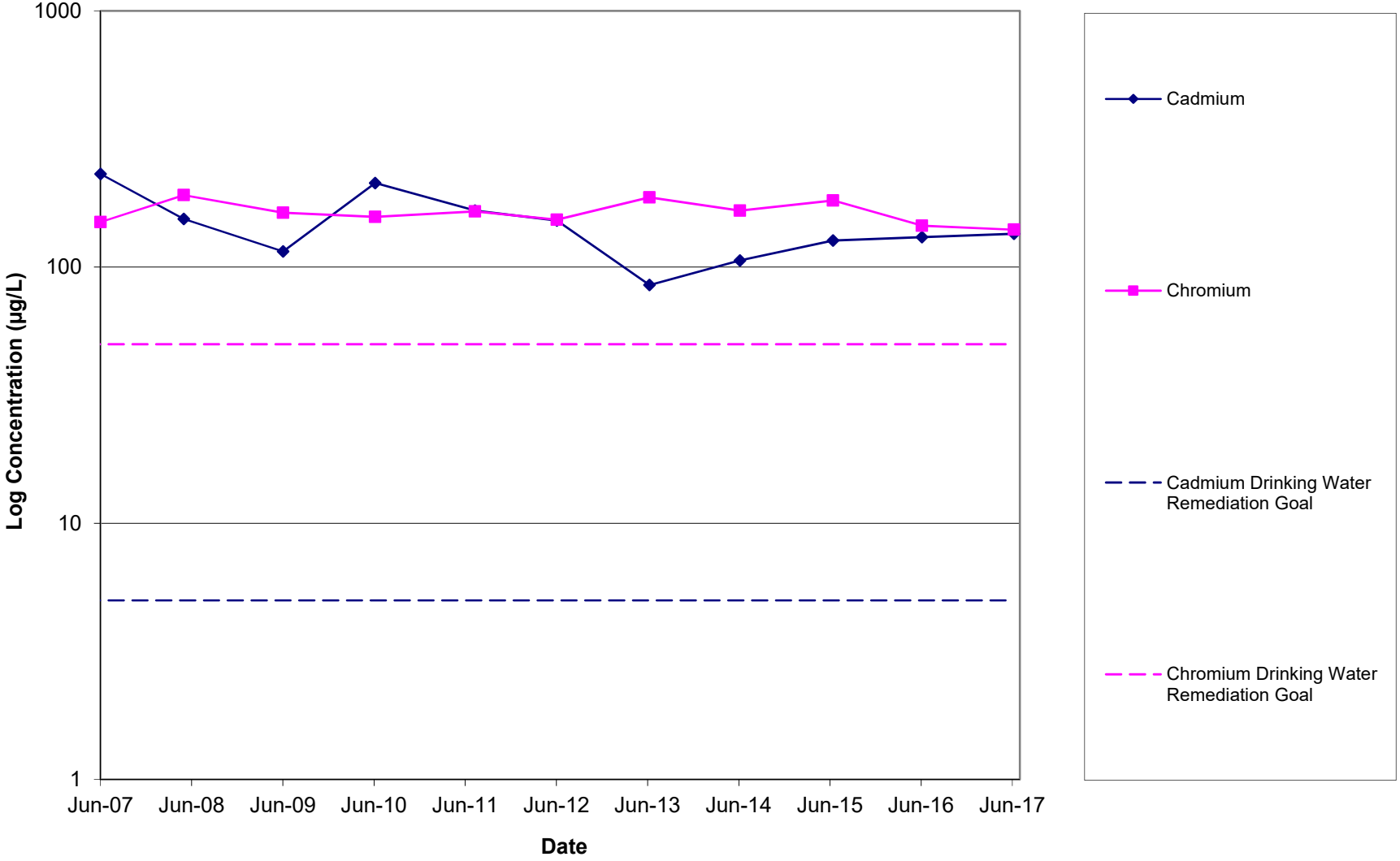


Figure D-10. MW8-12 Cd and Cr Concentration Trends Since 2007

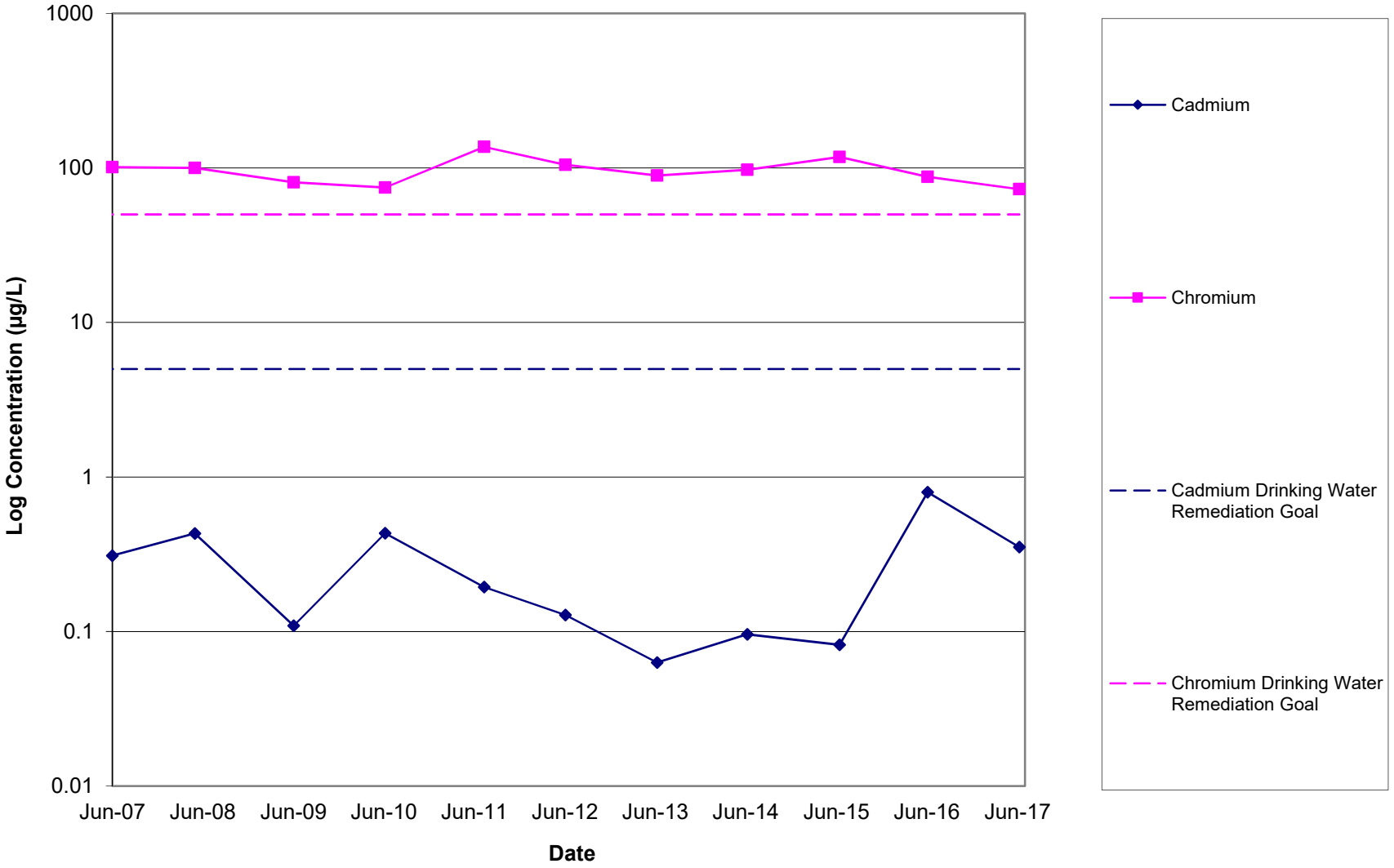


Figure D-11. MW8-14 Cd and Cr Concentration Trends Since 2007

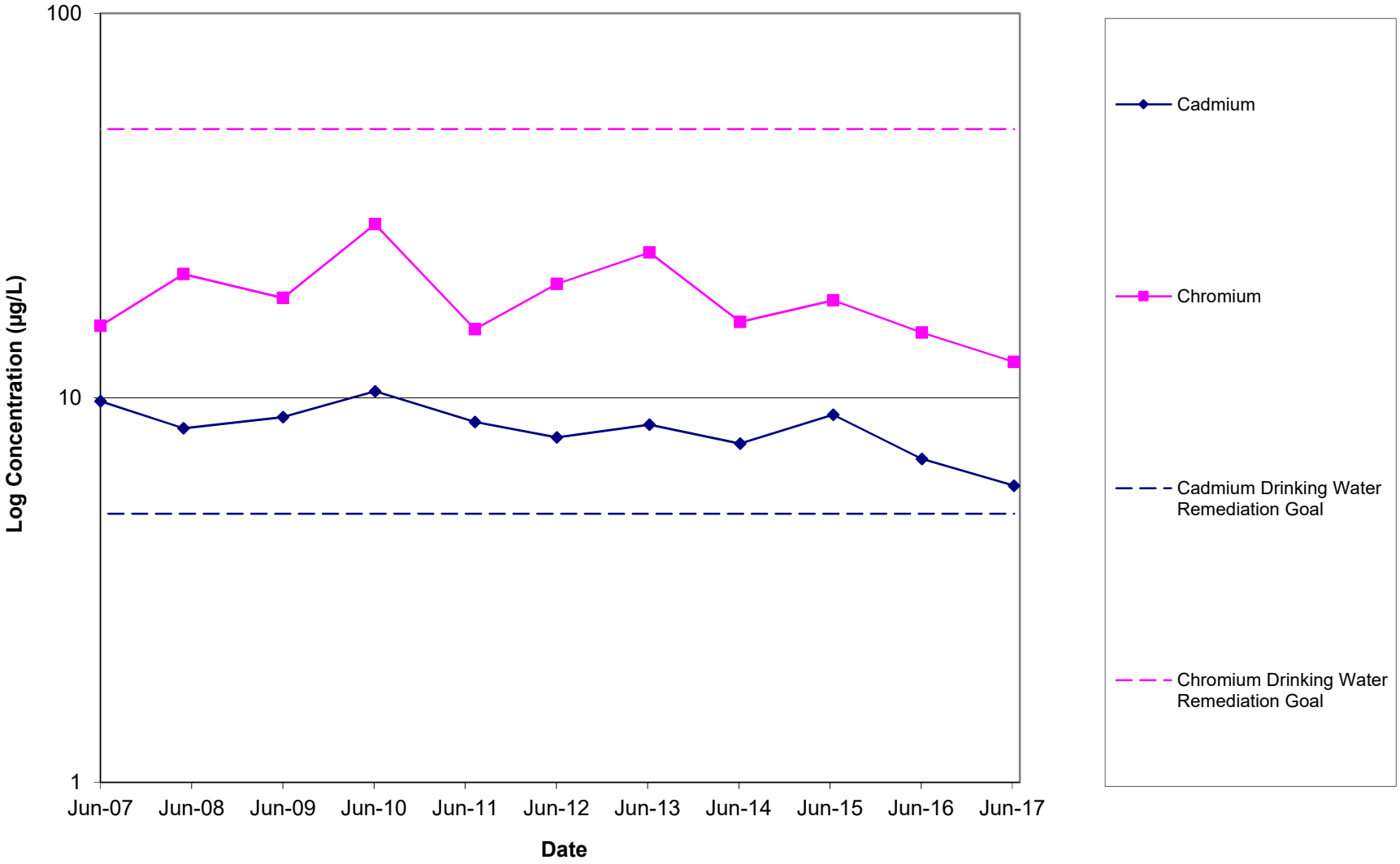


Figure D-12. Seep A Cd and Cr Concentration Trends Since 2007

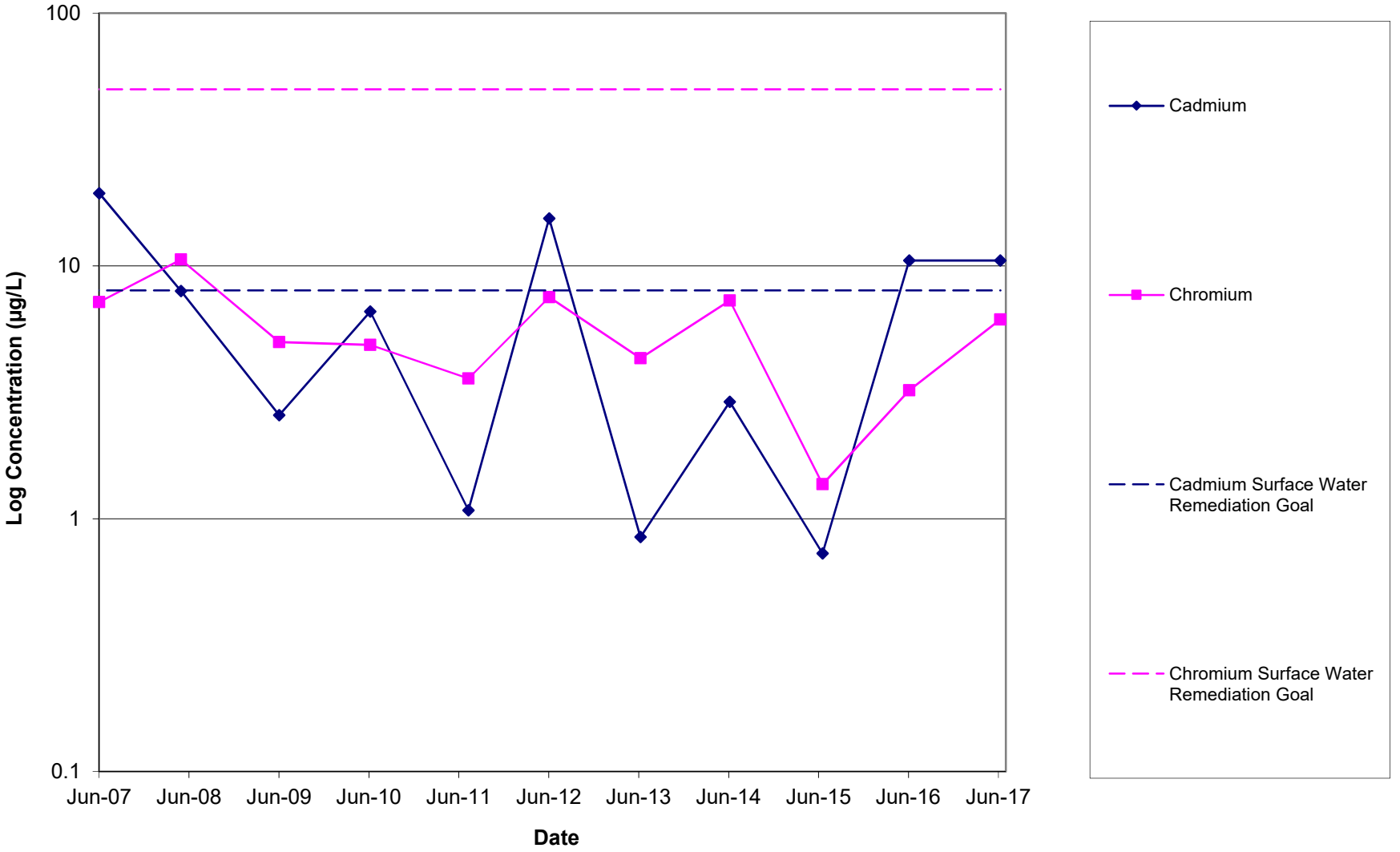
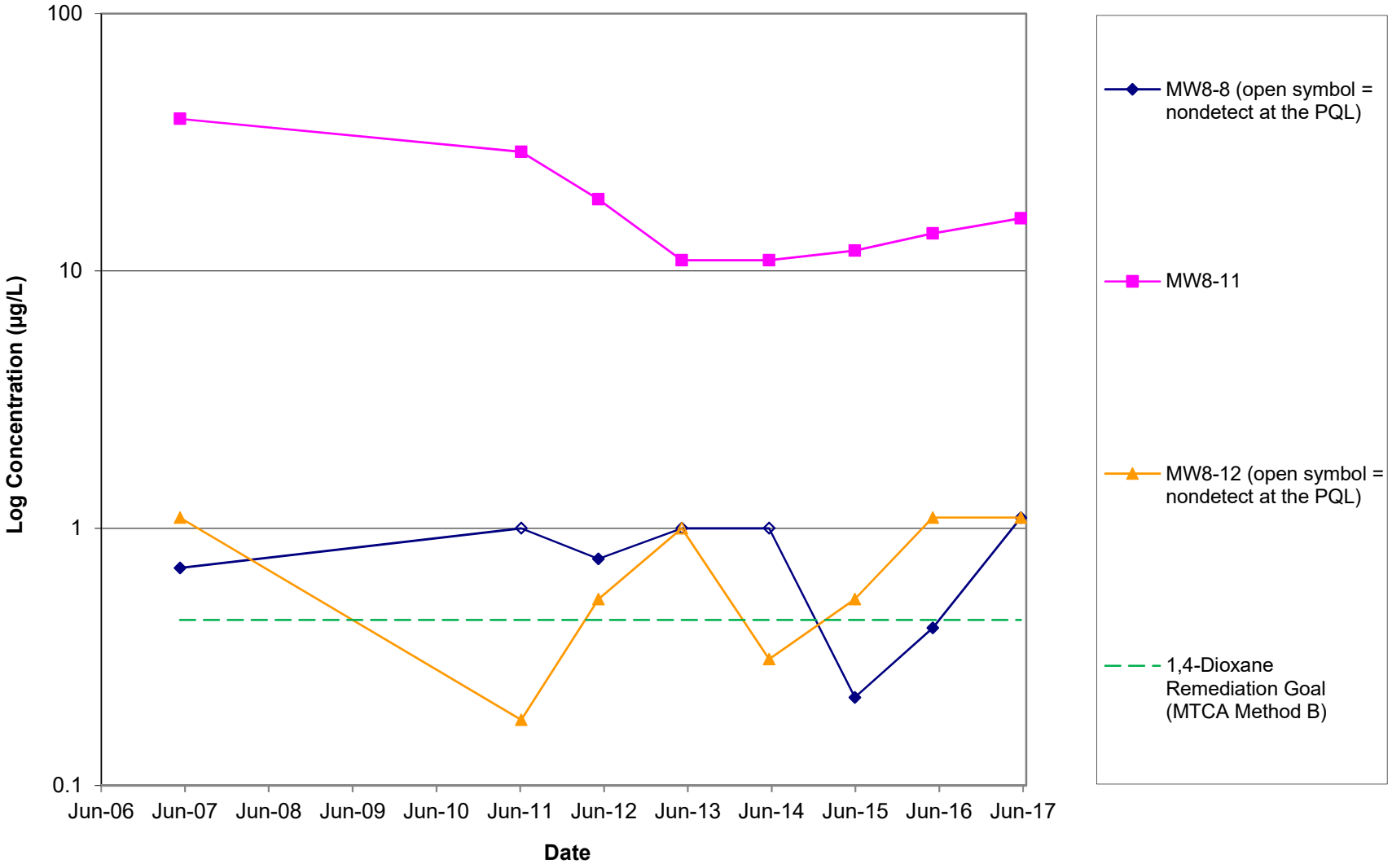


Figure D-13. SVOC 1,4-Dioxane Concentration Trends Since 2007



APPENDIX E

RESPONSE TO AGENCY COMMENTS ON DRAFT REPORT

Navy Responses to Ecology Comments on the Draft Spring 2017 Long-Term Monitoring Report, NBK Keyport Operable Unit 2, Area 8

Washington State Department of Ecology (Ecology) appreciates the opportunity to review and comment on this document. Ecology provides the following comments & suggestions:

Comment # 1: Page 1-5, Line 27

"Figure 2-4" could not be found.

Response: Corrected to Figure 1-4.

Comment # 2: Page 1-5, Line 27-30

These features could not be found in Figure 1-4.

Response: Results of sampling at seeps and outfalls other than Seeps A and B are not a part of the LTM sampling program reported in this Area 8 LTM Report or included in the current MMA SAP; they are reported under separate cover by the Navy. Therefore their locations are not shown on figures for this report, but are discussed briefly in the report text. The MMA SAP will be revised in early 2019. The locations of all seeps and outfalls will be shown on the figures included as a part of that update of the MMA SAP, and then will be included in figures and reporting for the subsequent LTM reports. The current report text will be revised to reference the separate report (Navy 2016a) for sampling at seeps and outfalls other than Seeps A and B.

Comment # 3: Page 1-13

The Table lists the remediation goals (RGs) for the site. The RGs for the parent compounds PCE & TCE are listed as well as some of degradation products such as 1,2-DCE. But the other degradation product vinyl chloride (VC), which is also a hazardous compound, doesn't have any RGs listed. Also, this chemical is not listed for any further monitoring. Was there a reason/rationale to exclude VC from cleanup consideration? A quick read of the 1994 OU2 ROD did not reveal much information. Any explanation/clarification/comments from the Navy on this exclusion of VC?

Response: This question was addressed during comment responses for the MMA SAP. VC was not listed in the OU 2 Record of Decision (ROD) as a contaminant of concern for Area 8 based upon remedial investigation studies prior to the ROD's implementation. Results of sampling conducted from implementation of the ROD through 2014 (the last year VC was tested and reported) have demonstrated that VC has been either undetected or detected at trace, estimated (j-flag) levels only below the practical quantitation limit). However, it is recognized that VC is a degradation by-product of PCE/TCE-family chemicals which are present in Area 8 groundwater and seep water. Therefore, it is recommended that the need for VC analysis and reporting be conducted during the upcoming early-2019 MMA SAP update, with appropriate implementation at that time.

Comment # 4: Page 2-3, Line 8-10

Thanks for preparing the EIM EDD. Has this been uploaded into the EIM system? This may not have been scoped but data from OU1 VI study, Area 8 marine investigation have been uploaded into the EIM previously. Tips for uploading the data in the EIM system can be found here:

https://ecology.wa.gov/Research-Data/Data-resources/Environmental-Information-Management-database/EIM-submit-data

Response: This issue was addressed during review and comments for the MMA SAP. This is not currently within the scope of sample data reporting under this Navy LTM contract or task order. Based on discussions between Navy and Ecology management held on March 29, 2017, this requirement may be added to future task orders at the direction of Navy management. Therefore, as discussed in the MMA SAP, the EIM package will be provided by the analytical laboratory in electronic format, and will be included on the compact disc provided with the paper copy of each report.

Comment # 5: Page 3-2, Line 2-5

It seems toluene and chloroform got mixed up. Clarify.

Response: Yes, toluene and not chloroform was detected in the trip blank. Therefore the word "chloroform" in lines 4 and 6 have been revised to "toluene".

Comment # 6: Page 4-2, Line 13

No information on field measurements (pH, conductivity, DO, and others) are provided or discussed in the text. Ecology suggests to add a Paragraph and a Table to present the data from field measurements. Field measurements are important and should also be preserved electronically for easier retrieval. For example in this study, conductivity and salinity are very important parameters as they depict the amount of tidal mixing present in the sample.

If field measurements are available electronically for the previous years, Ecology PM requests the electronic data to be sent separately.

Response: The field-measured water-quality parameters have historically been presented only in the report appendices (i.e., on the Well Inspection, Purging, and Field Measurement Forms and in the field logbook copies) and not discussed in the text unless data indicated parameters were not stabilizing. A table of current-year sampling parameters with brief discussion will be inserted into Section 2, the field activities sampling methodology discussion. A historical data table with field-measured water-quality parameters recorded from 2007 through 2017 will be attached in Appendix B as Table B-1.

Comment # 7: Page 4-12

Is there a reason why groundwater samples were filtered for metals analysis? MTCA generally requires that the samples are unfiltered unless there is a reason to believe unfiltered samples are not representative of groundwater quality. See Ch. 173-340-720 (9)(b) WAC for details.

Response: Yes, the ROD and list of COCs specifically includes dissolved-phase metals, not total metals. Therefore, the samples are filtered in accordance with directives of the MMA SAP (and earlier versions of the Area 8 SAP) which have been reviewed and approved by Ecology, the U.S. EPA, and the Suquamish Tribe.

Comment # 8: Page 4-25, Line 24-28 & Page 4-29, Line 26-28

Barium data: Why the Barium data is not presented in any of the Tables? The test refers to Appendix C, which are the data validation reports. The data needs to be presented in Tables and Graphs for easier interpretation.

Response: Data has historically been presented in tabular format for COCs with significant detections, with the target metals (the focus of metals LTM at Area 8) being cadmium and chromium. Barium levels have ranged from a maximum of 62.5 µg/L to 197 µg/L over the past decade. Thus, barium has not been detected at Area 8 at concentrations significantly above its background concentration (130 µg/L) or approaching the drinking water remediation goal for barium of 1,000 µg/L (there is no surface water remediation goal). For those reasons, barium has historically been discussed in the report results-sections text but not reported in a table or on graphs. We recommend inserting the summary for barium testing discussed above into the text in the results and recommendations sections of the LTM report; tables and graphs for barium appear to be unwarranted at this time.

Comment # 9: Page 4-26

It seems the sample dates are wrong.

Response: Revised all sampling dates to 06-17.

Comment # 10: Page 5-1

Data trends: It seems no statistical trend analyses were performed. It seems logical to perform statistical trend analyses when graphical charts do not clearly show any trends. In addition, the Navy needs to provide information on how long it will take to reach the remediation goals at the present pace if no additional remedial actions are performed.

Response: Statistical trend analysis and estimates of the time required for compliance with RGs are beyond the scope of work for this current LTM report and would appear to be premature at this time given the relatively high exceedances of remediation goals for several Area 8 analytes at several sampling locations. It is recommended that evaluation of the need for statistical trend analysis be conducted during the early-2019 update of the MMA SAP, with appropriate implementation at that time.