FINAL
October 2017

Fourth Five-Year Review

Puget Sound Naval Shipyard (PSNS) Complex Superfund Site
EPA ID: WA2170023418

Bremerton Naval Complex

Bremerton, Washington

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

EXECUTIVE SUMMARY

As lead agency for environmental cleanup of the Puget Sound Naval Shipyard (PSNS) Complex Superfund Site, referred to as the Bremerton Naval Complex (BNC) National Priorities List (NPL) site, Bremerton, Washington, the U.S. Navy (Navy) has completed this fourth five-year review of the remedial actions at Operable Unit (OU) A, OU B Marine, OU B Terrestrial, OU D, and OU Naval Supply Center (NSC), pursuant to Section 121(c) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP; 40 Code of Federal Regulations Part 300). The purpose of this five-year review is to ensure that the remedial actions selected in the Records of Decision (RODs) at BNC remain protective of human health and the environment. This review is required because contaminants have been left in place at BNC above levels that allow for unlimited use and unrestricted exposure.

This fourth five-year review was prepared in accordance with *Navy/Marine Corps Policy for Conducting Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Statutory Five-Year Reviews* (Navy, 2011a) and the U.S. Environmental Protection Agency's (EPA's) *Comprehensive Five-Year Review Guidance* (EPA, 2001). This review is considered a statutory, rather than a policy review. The triggering action for this review was the execution by the Navy of the third five-year review on October 12, 2012. In accordance with Navy guidance, this review covers the entire BNC, including both CERCLA and non-CERCLA sites. This review was conducted from October 2016 through June 2017 using analytical data generated between January 2012 and October 2016. In addition to data generated within this date range, this review considers key documents finalized in early 2017, including the Supplemental Mercury Investigation Report (SMIR; Navy, 2017c) and the Decision Framework Goals Document (Navy, 2017d).

There are six OUs at BNC. This report covers the remedies selected in the signed RODs for the five CERCLA OUs, including OU A, OU B Marine, OU B Terrestrial, OU D, and OU NSC. OU C is a petroleum-contaminated site and CERCLA does not address petroleum as a contaminant. Petroleum releases are addressed in Washington State under Subchapter IX of the Resource Conservation and Recovery Act (RCRA) and the state Model Toxics Control Act (MTCA). However, the Navy, as a matter of policy, follows the CERCLA process to the maximum extent practical at non-NPL sites. Additionally, because remedies for the sites include institutional controls (ICs) through land use restrictions, a five-year review for OU C is required pursuant to Navy policy and a periodic review by the Washington State Department of Ecology (Ecology) is required pursuant to MTCA. A cleanup action plan under MTCA was executed for OU C in 2007, and this five-year review includes an assessment of the OU C remedy protectiveness to address the periodic MTCA review requirements.

Since the third five-year review for BNC in October 2012, the Navy has completed eight of the 12 actions (one of the 10 recommendations had three sub-actions) recommended by that review,

with two actions ongoing and two actions pending. Ongoing and pending recommendations are carried forward with updated recommendation statements in this review. The Navy is working closely with the stakeholder group to make progress on these outstanding recommendations.

This five-year review concludes that the remedies at OU C, OU D, and OU NSC are functioning as intended. Remedies for OU A, OU B Terrestrial, and OU B Marine are not functioning as intended by the RODs. The Navy is engaged with stakeholders to develop a focused feasibility study and identify a remedy for OU B Marine that addresses mercury source control and considers additional remedial actions for total mercury in sediment to reduce human health risks. Table ES-1 provides a summary of the functionality and protectiveness evaluations performed on each of the OUs.

No applicable or relevant and appropriate requirement (ARAR) changes have affected the remedy protectiveness for OU A, OU C, OU D, or OU NSC, since the last five-year review. Surface water quality standards (Ecology, 2017) were revised since the last five-year review but after the period of this five-year review. This ARARs revision will be evaluated as part of the planned addendum that will address the protectiveness of OU B Terrestrial. For OU B Marine, studies have been initiated to address the data gaps that need to be filled before the protectiveness of the remedy can be assessed with respect to mercury in sediment and aquatic biota.

Concentrations of chemicals in groundwater remain above the remediation goals (RGs) at some monitoring locations for OU A, OU B Terrestrial, OU C, and OU NSC, resulting in the need for continued ICs to prevent exposure and the need for ongoing monitoring. Although some of the RGs might be lower if calculated today, the remedy components continue to protect against exposures, just as they did at the time the RODs were signed. ICs preventing exposure and ongoing monitoring will need to continue until concentrations of chemicals of concern (COCs) in groundwater are below the RGs.

An overall protectiveness determination of the remedies for the BNC site cannot be made at this time and will be deferred until further information for two OUs (OU B Terrestrial and OU B Marine) is obtained. Following collection and evaluation of the necessary additional information, protectiveness determinations will be made for the site as a whole and the individual OUs no later than March 2021. The protectiveness statements for each of the OUs are summarized in the Five-Year Review Summary Form located at the end of this Executive Summary.

Table ES-1. Functionality and Protectiveness Summary

Operable Unit	Question A: Is the remedy functioning as intended by the decision document?	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the decision document still valid?	Question C: Has any other information come to light that could call into question the protectiveness of the remedy?	Protectiveness Determination
OU A	No	Yes	Yes	Short Term Protective
OU B Marine	No	Yes	Yes	Deferred
OU B Terrestrial	No	Yes	Yes	Deferred
OU C	Yes	Yes	No	Protective
OU D	Yes	Yes	Yes	Protective
OU NSC	Yes	Yes	Yes	Protective

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Puget Sound Naval Shipyard Complex		
EPA ID: WA2170023418		
Region: 10	**State:** WA	**City/County:** Kitsap

SITE STATUS	
NPL Status: Final	
Multiple OUs? Yes	**Has the site achieved construction completion?** Yes

REVIEW STATUS
Lead agency: Other Federal Agency **If "Other Federal Agency" was selected above, enter Agency name:** U.S. Navy
Author name (Federal or State Project Manager): Pamela M. Sargent, P.E.
Author affiliation: Naval Facilities Engineering Command Northwest, Navy
Review period: 10/16 – 6/17
Date of site inspection: November 16, 2016
Type of review: Statutory
Review number: 4
Triggering action date: 10/12/2012
Due date *(five years after triggering action date):* 10/12/2017

Issues/Recommendations

OU(s) Without Issues/Recommendations Identified in the Five-Year Review:

None

Issues and Recommendations Identified in the Five-Year Review:

OU(s)	Issue Category / Issue / Recommendation
OU(s): OU A, OU B Terrestrial, and OU NSC	**Issue Category:** Operations and Maintenance
	Issue: Ongoing and completed maintenance and repairs to pavement and the storm water system are not documented in the BNC Terrestrial Annual Remedy Inspection Reports.
	Recommendation: Develop and add a new section to the BNC Terrestrial Annual Remedy Inspection Report to describe ongoing and completed maintenance and repairs to pavement and the storm water system.

Affect Current Protectiveness	Affect Future Protectiveness	Implementing Party	Oversight Party	Milestone Date
No	Yes	Navy	EPA, Ecology	December 2018

Five-Year Review Summary Form (Continued)

OU(s): OU A, OU B Terrestrial, OU D, and OU NSC	**Issue Category:** Operations and Maintenance			
	Issue: The terrestrial remedies adjacent to Sinclair Inlet at BNC may be vulnerable to climate change effects, including sea level rise and increasing storm intensity.			
	Recommendation: Leverage ongoing Navy regional planning to begin an assessment of the vulnerability of the BNC remedies to climate change, in support of a future adaptation plan for BNC OUs. Yearly climate change planning updates will be provided to the stakeholder team.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Navy	EPA, Ecology	October 2021
OU(s): OU A, OU B Terrestrial, OU D, and OU NSC	**Issue Category:** Remedy Performance			
	Issue: Changes to water quality criteria made after this five-year review period may impact protectiveness.			
	Recommendation: Evaluate how changes to Water Quality Criteria may impact protectiveness.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Navy	EPA, Ecology	December 2020
OU(s): OU A	**Issue Category:** Remedy Performance			
	Issue: The 100 percent design for the remedy repair at Charleston Beach is complete, but needs to be revised to account for climate change considerations and to comply with ARARs. Consultation with the stakeholders regarding design changes and remedy repair implementation is still pending.			
	Recommendation A. Revise the remedy repair design at Charleston Beach to account for climate change and compliance with ARARs, including performance of a habitat benefit analysis. Complete a consultation with the stakeholder group regarding plans for implementation of the remedy repair at Charleston Beach. B. Complete construction of the Charleston Beach remedy repair.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Navy	EPA, Ecology	A. December 2019 B. December 2020

Five-Year Review Summary Form (Continued)

OU(s): OU B Marine	**Issue Category:** Institutional Controls			
	Issue: OU B Marine IC inspection and reporting requirements are not clearly documented in an IC plan.			
	Recommendation: Prepare an OU B Marine IC plan to clearly document the OU B Marine IC requirements, and associated inspection, inspection frequency and reporting requirements.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
Yes	Yes	Navy	EPA, Ecology	June 2018
OU(s): OU B Marine	**Issue Category:** Remedy Performance			
	Issue: The magnitude and effects of the mercury source in the Outfall 15 drainage basin and the potential mercury source located between Dry Docks 5 and 6 where groundwater discharges directly to Sinclair Inlet are not sufficiently understood.			
	Recommendation: A. Perform a source control evaluation, focused on transport of mercury through the storm drain system and direct discharge of groundwater to OU B Marine, and prepare an EE/CA and Action Memorandum to address mercury source control. B. Implement source control actions selected in the Action Memorandum.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
Yes	Yes	Navy	EPA, Ecology	A. December 2019 B. December 2020
OU(s): OU B Marine	**Issue Category:** Remedy Performance			
	Issue: A remedy for OU B Marine that addresses mercury source control and considers additional remedial actions for total mercury in sediment to reduce human health risk has not yet been developed.			
	Recommendation: A. Prepare a focused feasibility study for mercury. B. Prepare a ROD amendment (or new ROD or ESD) for mercury after the focused feasibility study is completed.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
Yes	Yes	Navy	EPA, Ecology	A. January 2020 B. February 2021

Five-Year Review Summary Form (Continued)

OU(s): OU B Marine	**Issue Category:** Operations and Maintenance			
	Issue: Bathymetric survey data from the post-construction survey through the 2012 survey showed elevation changes and the reasons for these changes are not clearly understood.			
	Recommendation: Complete a review and revalidation of the bathymetric survey data from the post-construction survey through the 2012 survey in the CAD pit, ENR and thick cap areas to validate if the physical components are functioning as intended by the ROD.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
Yes	Yes	Navy	EPA, Ecology	June 2018
OU(s): OU B Terrestrial	**Issue Category:** Operations and Maintenance			
	Issue: Recent shoreline inspections indicate erosion along Segment 4.			
	Recommendation: A. Develop a plan to stabilize the shoreline along Segment 4, while considering actions needed in light of the USGS's finding that groundwater discharges to surface water in this area. Involve both the OU B Marine and BNC Terrestrial teams in planning for action along Segment 4. B. Implement the plan to stabilize the shoreline along Segment 4.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
Yes	Yes	Navy	EPA, Ecology	A. December 2018 B. December 2020
OU(s): OU B Terrestrial, OU C	**Issue Category:** Institutional Controls			
	Issue: In OU B Terrestrial, due to site sampling location limitations in the former Building 871 area, potential cyanide presence in soil and groundwater was not fully defined and the current IC and O&M Plan does not contain future use restrictions for the potentially affected areas. For OU C, the IC inspection frequency is not specified in the Cleanup Action Plan, and therefore IC inspections for OU C have not been included in the BNC IC and O&M Plan. This issue only affects protectiveness for OU B Terrestrial, not for OU C.			
	Recommendation: Update the BNC Terrestrial IC and O&M Plan to include the OU C ICs required by the Cleanup Action Plan and to include restrictions for future use of Building 871 area due to potential cyanide presence in soil and groundwater. This issue only affects protectiveness for OU B Terrestrial, not for OU C.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
Yes	Yes	Navy	EPA, Ecology	December 2018

Five-Year Review Summary Form (Continued)

Protectiveness Statement(s)		
Operable Unit: OU A	**Protectiveness Determination:** Short-Term Protective	**Addendum Due Date** ***(If applicable):*** Not applicable (NA)
Protectiveness Statement: The remedy implemented at OU A is protective in the short term, based on the recent intertidal sediment sampling and interim erosion protection measures being implemented at Charleston Beach. However, to achieve long-term protectiveness, a permanent remedy repair must be selected and implemented in consultation with stakeholders.		
Operable Unit: OU B Marine	**Protectiveness Determination:** Protectiveness Deferred	**Addendum Due Date** ***(If applicable):*** December 2020
Protectiveness Statement: A protectiveness determination of the remedy for OU B Marine cannot be made until further information is obtained. The polychlorinated biphenyl (PCB) sediment cleanup level specified in the ROD for OU B Marine was achieved in 2014, and this conclusion will be confirmed by an additional sampling event. However, the protectiveness of the OU B Marine remedy remains in question because of sources of mercury to OU B Marine. Mercury is a chemical of concern (COC) for OU B Marine. The magnitude and effects of the mercury source in the Outfall 15 drainage basin, and the potential mercury source located between Dry Docks 5 and 6 where groundwater discharges directly to Sinclair Inlet are not sufficiently understood. Source control evaluations are incomplete and a remedy has not been selected for mercury in the marine environment. The Navy is engaged with stakeholders to develop a focused feasibility study and identify a remedy for OU B Marine that addresses mercury source control and considers additional remedial actions for total mercury in sediment to reduce human health risk. At the completion of the additional sampling event and the mercury source control evaluation, the protectiveness of the remedy for OU B Marine will be reevaluated.		
Operable Unit: OU B Terrestrial	**Protectiveness Determination:** Protectiveness Deferred	**Addendum Due Date** ***(If applicable):*** December 2020
Protectiveness Statement: A protectiveness determination of the remedy for OU B Terrestrial cannot be made until further information is obtained. Evaluations of OU B Terrestrial as a source of mercury to the marine environment are incomplete. At the completion of source control evaluation, the protectiveness of the remedy for OU B Terrestrial will be reevaluated. In the interim, the pathways for human exposure are being controlled through ICs that control access to the site, control excavation in contaminated areas, prevent the consumption of groundwater, and limit activities on site to industrial use.		
Operable Unit: OU C	**Protectiveness Determination:** Protective	**Addendum Due Date** ***(If applicable):*** NA
Protectiveness Statement: The remedy implemented at OU C currently protects human health and the environment. The cleanup action implemented under the state MTCA regulation continues to prevent migration of free and dissolved phase petroleum hydrocarbon from affecting Dry Dock 6 and Sinclair Inlet in order to protect human health and the environment. ICs remain in place to prohibit activities that interfere with monitoring activities and prevent release of petroleum hydrocarbons.		
Operable Unit: OU D	**Protectiveness Determination:** Protective	**Addendum Due Date** ***(If applicable):*** NA
Protectiveness Statement: The remedy implemented at OU D is protective of human health and the environment. Exposure pathways and infiltration pathways that could increase contaminant migration and		

Five-Year Review Summary Form (Continued)

result in unacceptable risks are being controlled and monitored. The conditions and COC concentrations found today in groundwater are similar to those at the time the ROD was executed. Conditions at the time of ROD execution were found not to pose unacceptable risks to human health and the environment as long as exposures and contaminant migration were controlled.

Operable Unit:	**Protectiveness Determination:**	**Addendum Due Date**
OU NSC	Protective	***(If applicable):*** NA

Protectiveness Statement: The remedy implemented at OU NSC is protective of human health and the environment. Exposure pathways and infiltration pathways that could increase contaminant migration and result in unacceptable risks are being controlled and monitored. The conditions and COC concentrations found today in groundwater are similar to those at the time the ROD was executed. Conditions at the time of ROD execution were found not to pose unacceptable risks to human health and the environment as long as exposures and contaminant migration were controlled.

Sitewide Protectiveness Statement (if applicable)

Protectiveness Determination:	**Addendum Due Date** *(if applicable):*
Protectiveness Deferred	December 2020

Protectiveness Statement: An overall protectiveness determination of the remedies for the BNC site cannot be made at this time and will be deferred until further information for three OUs is obtained (i.e., additional mercury information for OU B Terrestrial and OU B Marine is obtained). Following collection and evaluation of the necessary additional information, protectiveness determinations will be made for the site as a whole and the individual OUs no later than December 2020.

SIGNATURE PAGE

Signature page for the Bremerton Naval Complex fourth five-year review report for Operable Units A, B Marine, B Terrestrial, C, D, and NSC.

E.A. Schrader
Captain, U.S. Navy
Commanding Officer, Naval Base Kitsap

10/11/2017
Date

CONTENTS

EXECUTIVE SUMMARY i

FIVE-YEAR REVIEW SUMMARY FORM iv

SIGNATURE PAGE x

ABBREVIATIONS AND ACRONYMS xviii

1.0 INTRODUCTION 1-1

2.0 SITE CHRONOLOGY 2-1

3.0 BACKGROUND 3-1

4.0 REMEDIAL ACTIONS 4-1

4.1 OU A 4-1
4.1.1 OU A Remedy Implementation 4-1
4.1.2 Actions Subsequent to OU A Remedy Implementation 4-2
4.1.3 OU A Operation, Maintenance, and Monitoring 4-3
4.1.3.1 Inspection and Maintenance of Pavement and Erosion Protection 4-3
4.1.3.2 Groundwater Monitoring 4-4
4.2 OU B MARINE 4-4
4.2.1 OU B Marine Remedy Implementation 4-4
4.2.2 OU B Marine Operation, Maintenance, and Monitoring 4-5
4.2.2.1 Measures to Assess Progress Towards Meeting RG 4-6
4.2.2.2 Measures to Assess Remedy Integrity 4-7
4.2.3 OU B Marine Sediment Sampling Associated with Military Construction Projects 4-8
4.2.4 Post-ROD Mercury Sampling and Investigation 4-9
4.3 OU B TERRESTRIAL 4-11
4.3.1 OU B Terrestrial Remedy Implementation 4-11
4.3.1.1 Institutional Controls 4-11
4.3.1.2 Long-Term Monitoring Requirements 4-12
4.3.2 OU B Terrestrial Operation, Maintenance, and Monitoring 4-13
4.3.2.1 Inspection and Maintenance 4-13
4.3.2.2 Long-Term Groundwater Monitoring 4-13
4.3.2.3 TCE Northern Plume Area Investigation 4-14
4.3.2.4 Non-LTM Monitoring 4-14

CONTENTS (Continued)

4.4 OU C 4-15
4.4.1 Cleanup Action Plan for OU C 4-15
4.4.2 OU C Operation, Maintenance, and Monitoring 4-16
4.5 OU D 4-16
4.5.1 OU D Remedy Implementation 4-17
4.5.1.1 Site-Wide Capping 4-17
4.5.1.2 Stormwater System Contaminated Sediment Removal 4-17
4.5.1.3 Institutional Controls 4-18
4.5.1.4 Groundwater Monitoring 4-18
4.5.2 OU D Operation, Maintenance, and Monitoring 4-19
4.6 OU NSC 4-19
4.6.1 OU NSC Remedy Implementation 4-19
4.6.2 OU NSC Operation, Maintenance, and Monitoring 4-20
4.6.2.1 Inspection and Maintenance of Pavement and Storm Drains 4-20
4.6.2.2 Groundwater Monitoring 4-20
4.7 INSTITUTIONAL CONTROLS IMPLEMENTATION 4-21

5.0 PROGRESS SINCE LAST FIVE-YEAR REVIEW 5-1

6.0 FIVE-YEAR REVIEW PROCESS 6-1
6.1 FIVE-YEAR REVIEW TEAM 6-1
6.2 COMMUNITY NOTIFICATION AND INVOLVEMENT 6-1
6.3 DOCUMENT REVIEW 6-2
6.4 DATA REVIEW 6-2
6.4.1 Groundwater Data Review 6-2
6.4.1.1 OU A Groundwater Monitoring Data 6-3
6.4.1.2 OU B Terrestrial Groundwater Monitoring Data 6-4
6.4.1.3 OU C Groundwater Monitoring Data 6-10
6.4.1.4 OU D Groundwater Monitoring Data 6-10
6.4.1.5 OU NSC Groundwater Monitoring Data 6-11
6.4.2 Non-LTM Data Summary 6-12
6.4.2.1 Assessment of Non-LTM Data 6-13
6.4.3 OU B Marine Monitoring Data 6-14
6.4.3.1 Marine Sediment Sampling 6-14
6.4.3.2 Hydrographic Survey 6-15
6.4.3.3 CAD Pit Coring 6-16
6.4.3.4 Sub-Bottom Profiling Survey 6-16
6.4.3.5 Beach Sediment Sampling at Charleston Beach 6-17

CONTENTS (Continued)

6.4.3.6 Sediment Sampling Associated with Military Construction Projects 6-17
6.4.3.7 Tissue Sampling 6-18
6.4.3.8 Other OU B Marine Sampling and Investigation Data 6-18
6.4.3.9 OU B Marine Monitoring Status and Ongoing Efforts 6-18
6.5 RESULTS OF SITE INSPECTIONS 6-19
6.5.1 OU A Inspection Results 6-20
6.5.2 OU B Terrestrial Inspection Results 6-20
6.5.3 OU D Inspection Results 6-20
6.5.4 OU NSC Inspection Results 6-21
6.5.5 Site-Wide Institutional Controls Inspection Results 6-21
6.6 RESULTS OF INTERVIEWS 6-22
6.6.1 Navy Personnel 6-23
6.6.2 Agency Personnel 6-24
6.6.2.1 Environmental Protection Agency 6-24
6.6.2.2 Washington State Department of Ecology 6-24
6.6.3 Natural Resource Trustee Personnel 6-25
6.6.3.1 Suquamish Tribe 6-25
6.6.3.2 Washington State Department of Fish and Wildlife 6-26
6.6.3.3 City of Bremerton 6-26

7.0 TECHNICAL ASSESSMENT 7-1
7.1 QUESTION A – IS THE REMEDY FUNCTIONING AS INTENDED BY THE DECISION DOCUMENTS? 7-1
7.1.1 Functionality of Remedy for OU A 7-1
7.1.1.1 Remedial Action Performance 7-1
7.1.1.2 System Operation and Monitoring 7-2
7.1.1.3 Implementation of Institutional Controls 7-2
7.1.2 Functionality of Remedy for OU B Marine 7-2
7.1.2.1 Remedial Action Performance 7-2
7.1.2.2 System Operation and Monitoring 7-3
7.1.2.3 Implementation of Institutional Controls 7-4
7.1.3 Functionality of Remedy for OU B Terrestrial 7-4
7.1.3.1 Remedial Action Performance 7-4
7.1.3.2 System Operation and Monitoring 7-4
7.1.3.3 Implementation of Institutional Controls 7-5
7.1.4 Functionality of Cleanup Action for OU C 7-5
7.1.5 Functionality of Remedy for OU D 7-5
7.1.5.1 Remedial Action Performance 7-5
7.1.5.2 System Operation and Monitoring 7-5

CONTENTS (Continued)

7.1.5.3 Implementation of Institutional Controls 7-5
7.1.6 Functionality of Remedy for OU NSC 7-6
7.1.6.1 Remedial Action Performance 7-6
7.1.6.2 System Operation and Monitoring 7-6
7.1.7 Implementation of Institutional Controls 7-6
7.1.8 Operation and Maintenance Costs 7-6
7.2 QUESTION – ARE THE EXPOSURE ASSUMPTIONS, TOXICITY DATA, CLEANUP LEVELS, AND RAOS USED AT THE TIME OF REMEDY SELECTION STILL VALID? 7-7
7.2.1 Changes in Standards or TBCs 7-7
7.2.1.1 Operable Unit A 7-8
7.2.1.2 Operable Unit B Marine 7-10
7.2.1.3 Operable Unit B Terrestrial 7-13
7.2.1.4 Operable Unit C 7-14
7.2.1.5 Operable Unit D 7-14
7.2.1.6 Operable Unit NSC 7-15
7.2.2 Changes in Toxicity or Other Contaminant Characteristics 7-18
7.2.3 Changes in Risk Assessment Methods 7-19
7.2.4 Changes in Exposure Pathways 7-19
7.2.5 Expected Progress Towards Meeting RAOs 7-20
7.3 HAS ANY OTHER INFORMATION COME TO LIGHT THAT COULD CALL INTO QUESTION THE PROTECTIVENESS OF THE REMEDY? 7-20
7.4 TECHNICAL ASSESSMENT SUMMARY 7-21
7.5 ISSUES 7-22
7.6 OTHER FINDINGS 7-22
7.6.1 OU A Monitoring Recommendations 7-22
7.6.2 OU B Terrestrial Monitoring Recommendations 7-23
7.6.3 OU B Marine Monitoring Recommendations 7-23
7.6.4 OU D Monitoring Recommendations 7-24
7.6.5 OU NSC Monitoring Recommendations 7-24
7.6.6 Recommendations Regarding Trend Analyses for COCs in Groundwater 7-25

8.0 RECOMMENDATIONS AND FOLLOW-UP ACTIONS 8-1

9.0 CERTIFICATION OF PROTECTIVENESS 9-1

10.0 NEXT REVIEW 10-1

11.0 REFERENCES 11-1

CONTENTS (Continued)

APPENDICES

A Data from Additional Investigations and Monitoring
B Site Inspection Documentation
C Interview Responses
D Crosswalk between CERCLA and MTCA Requirements
E Stakeholder Comment Resolution (not included in the Draft)

FIGURES

Figure 1-1. Bremerton Naval Complex Vicinity Map 1-3
Figure 1-2. Bremerton Naval Complex Operable Units 1-4
Figure 2-1. Bremerton Naval Complex Chronology of Events 2-2
Figure 4-1. Bremerton Naval Complex OU A Extent 4-25
Figure 4-2. Bremerton Naval Complex OU A Map 4-26
Figure 4-3. Remedial Actions in OU B Marine (2000-2001) 4-27
Figure 4-4. TCE Northern Plume Area Soil and Groundwater Sampling Locations 4-28
Figure 4-5. Locations of Monitoring Wells 4-29
Figure 6-1. OU A Concentrations and Trends, Metals 6-27
Figure 6-2. OU B Terrestrial Concentrations and Trends, Metals and TCE 6-28
Figure 6-3. OU B Terrestrial Concentrations, Pesticides 6-29
Figure 6-4. PMP Concentrations and Trends, Petroleum Hydrocarbons 6-30
Figure 6-5. OU C Concentrations and Trends, Petroleum Hydrocarbons 6-31
Figure 6-6. OU NSC Concentrations and Trends, Metals 6-32
Figure 6-7. Location of Wells with Non-LTM Sampling and Analysis 6-33
Figure 6-8. Excavation, Groundwater and Soil samples and Well Locations 6-34
Figure 6-9. OU B Marine Surface Sediment 500-Foot Sampling Grid 6-35
Figure 6-10. Outside OU B Marine Surface Sediment 1,500-Foot Sampling Grid 6-36
Figure 6-11. Sediment Sampling Locations at Charleston Beach 6-37
Figure 6-12. Shoreline Segments 6-38

TABLES

Table ES-1. Functionality and Protectiveness Summary iii
Table 3-1. Background Information Summary for BNC 3-3
Table 4-1. Summary of Remedial Actions at BNC 4-30
Table 4-2. Monitoring during this Five-Year Review Period for Operable Unit A 4-33
Table 4-3. Monitoring during this Five-Year Review Period for Operable Unit B Terrestrial 4-34

CONTENTS (Continued)

TABLES (Continued)

Table 4-4. Non-LTM Monitoring during Fourth Five-Year Review Period 4-36
Table 4-5. Monitoring during this Five-Year Review Period for Operable Unit NSC..... 4-37
Table 4-6. BNC Institutional Controls..... 4-38
Table 5-1. Summary of Progress Since Last Five-Year Review 5-2
Table 6-1. Documents Reviewed during this Five-Year Review 6-39
Table 6-2. OU C Product Thickness Measurements – Spring 2012 through Fall 2016 6-41
Table 6-3. OU B Terrestrial Non-LTM Data Summary 6-42
Table 6-4. OU NSC Non-LTM Data Summary..... 6-44
Table 6-5. OU B Marine 500-Foot Grid Sediment Sampling..... 6-45
Table 6-6. OU B Marine 1,500-Foot Grid Sediment Sampling..... 6-47
Table 6-7. Area-Weighted Average Concentrations for Sediment Sampling in 2012 and 2014..... 6-49
Table 6-9. Summary of Sinclair Inlet English Sole Sampling, 2012 and 2015 6-51
Table 6-10. OU A Inspection Results..... 6-52
Table 6-11. OU B Terrestrial Inspection Results..... 6-54
Table 6-12. OU D Inspection Results..... 6-56
Table 6-13. OU NSC Inspection Results 6-57
Table 6-15. Summary of Marginal and Poor Pavement Conditions 2011-2016..... 6-59
Table 7-1. Technical Assessment Summary..... 7-26
Table 7-2. Operation and Maintenance Cost Summary..... 7-26
Table 7-3. Soil Cleanup Levels for OU A 7-27
Table 7-4. Groundwater Cleanup Levels for Protection of Surface Water for OU A 7-28
Table 7-5. Groundwater Cleanup Levels for Protection of Surface Water for OU B Terrestrial..... 7-29
Table 7-6. Groundwater Trigger Levels for Protection of Surface Water for OU C..... 7-30
Table 7-7. Soil Cleanup Levels for Protection of Surface Water for OU D..... 7-31
Table 7-8. Groundwater Monitoring Levels for Protection of Surface Water for OU D 7-32
Table 7-9. Soil Cleanup Levels for OU NSC 7-33
Table 7-10. Groundwater Cleanup Levels for Protection of Surface Water for OU NSC 7-34
Table 7-11. Issues 7-35
Table 7-12. Historical Range of Analytical Results for OU A Groundwater Sampling..... 7-36
Table 7-13. Historical Range of Analytical Results for OU B Terrestrial Groundwater Sampling – Metals 7-37
Table 7-14. Historical Range of Analytical Results for OU B Terrestrial Groundwater Sampling – TCE..... 7-38
Table 7-15. Historical Range of Analytical Results for OU B Terrestrial Groundwater Sampling – Petroleum..... 7-39
Table 7-16. Historical Range of Analytical Results for OU C 7-40

CONTENTS (Continued)

TABLES (Continued)

Table 7-17. Summary of Analytical Results for OU NSC Groundwater Sampling 7-41
Table 8-1. Recommendations and Follow-Up Actions..... 8-2

ABBREVIATIONS AND ACRONYMS

ARAR	applicable or relevant and appropriate requirement
AWA	area-weighted average
BHC	benzene hexachloride
BNC	Bremerton naval complex
BTEX	benzene, toluene, ethylbenzene, and xylenes
CAD	confined aquatic disposal
CAP	cleanup action plan
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CGSL	calculated groundwater screening level
cm	centimeter
COC	chemical of concern
COI	chemical of interest
CLARC	Cleanup Levels and Risk Calculation
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CSL	cleanup screening level
DCE	dichloroethene
DCA	dichloroethane
DDE	dichlorodiphenyldichloroethene
DDT	dichlorodiphenyltrichloroethane
DNR	(Washington State) Department of Natural Resources
DRMO	Defense Reutilization Management Office
Ecology	Washington State Department of Ecology
ENR	enhanced natural recovery
ENVVEST	Environmental Investment
EPA	U.S. Environmental Protection Agency
ESD	Explanation of Significant Differences
FISC	Fleet and Industrial Supply Center
FS	feasibility study
geomean	geometric mean
HQ	hazard quotient
IC	institutional control
IMF	Intermediate Maintenance Facility

ABBREVIATIONS AND ACRONYMS (Continued)

IRIS	Integrated Risk Information System
LOQ	limit of quantitation
LTM	long-term monitoring
LUC	land use control
MCL	maximum contaminant level
MCUL	minimum cleanup level
MeHg	methylmercury
µg/L	microgram per liter
mg/kg	milligram per kilogram
mg/kgOC	milligram per kilogram of organic carbon
mg/L	milligram per liter
MOA	memorandum of agreement
MTCA	Model Toxics Control Act
Navy	U.S. Navy
NAVFAC	Naval Facilities Engineering Command
NBK	Naval Base Kitsap
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priorities List
NSC	Naval Supply Center
O&M	operations and maintenance
OM&M	operations, maintenance, and monitoring
OSWER	Office of Solid Waste and Emergency Response
OU	operable unit
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PFAS	per- and polyfluoroalkyl substances
PFC	perfluorinated chemical
PMP	petroleum management plan
PQL	practical quantitation limit
PSEMP	Puget Sound Ecosystem Monitoring Program
PSNS	Puget Sound Naval Shipyard

ABBREVIATIONS AND ACRONYMS (Continued)

QSM	Quality Systems Manual
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RG	remediation goal
RI	remedial investigation
ROD	Record of Decision
RSL	regional screening level
SAP	Sampling and Analysis Plan
SCO	sediment cleanup objective
SI	site inspection
SIM	selected ion monitoring
SMIR	Supplemental Mercury Investigation Report
SMS	Sediment Management Standards
SQS	Sediment Quality Standards
SVOC	semivolatile organic compound
TBC	to be considered
TCE	trichloroethene
THg	total mercury
TOC	total organic carbon
TPH	total petroleum hydrocarbons
TPH-D	total petroleum hydrocarbons—diesel
TPH-O	total petroleum hydrocarbons as diesel and heavy oil
TPH-G	total petroleum hydrocarbons—gasoline
TPH-R	total petroleum hydrocarbons as residuals
TSS	total suspended solids
TTEC	total toxicity equivalent concentration
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
VOC	volatile organic compound
WAC	Washington Administrative Code
WDFW	Washington State Department of Fish and Wildlife
WQC	water quality criteria

1.0 INTRODUCTION

This report presents the results of the fourth five-year review performed for the Puget Sound Naval Shipyard (PSNS) Complex National Priorities List (NPL) site, more commonly known as the Bremerton Naval Complex (BNC). BNC includes Naval Base Kitsap (NBK) at Bremerton, the PSNS and Intermediate Maintenance Facility (IMF), and associated tenants. BNC is located along the shoreline of Sinclair Inlet in Bremerton, Washington (Figure 1-1).

The purpose of a five-year review is to determine whether the remedies selected for implementation in the Record of Decision (ROD) for a site remain protective of human health and the environment. The methods, findings, and conclusions of five-year reviews are documented in five-year review reports, which identify issues and provide recommendations to address them. This is the fourth five-year review performed for the BNC site. The triggering action for this review was the completion of the third five-year review in October 2012. Contaminants have been left at BNC above levels that allow for unlimited use and unrestricted exposure.

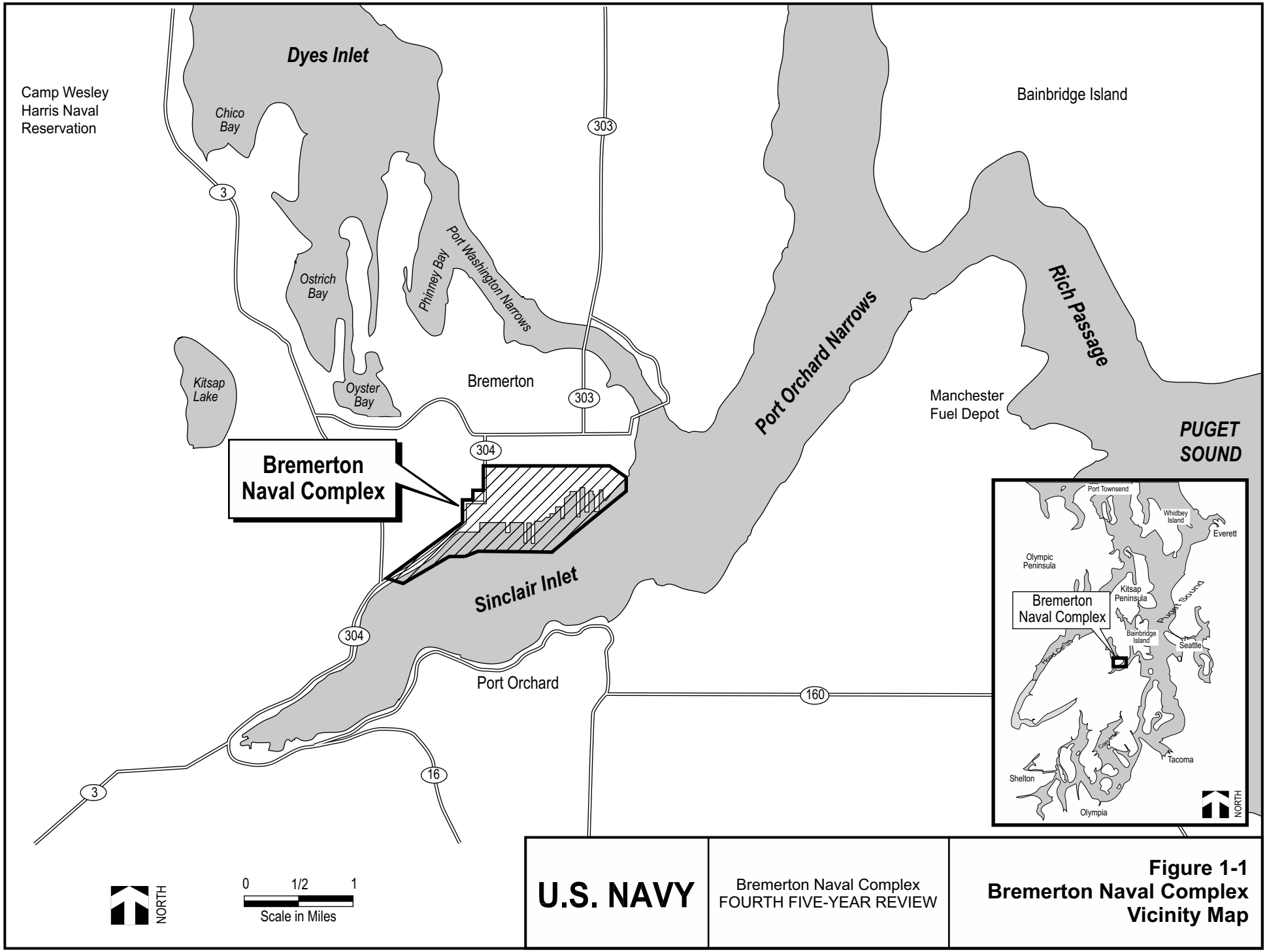
This five-year review is conducted by the United States Navy (Navy) in accordance with Navy policy, Navy/Marine Corps Policy for Conducting Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Five Year Reviews, dated May 2011, the Department of Defense Manual 4715.20, "Defense Environmental Restoration Program Management," dated March 9, 2012 with update dated May 16, 2014, U.S. Environmental Protection Agency (EPA) Comprehensive Five-Year Review Guidance, Office of Solid Waste and Emergency Response (OSWER) No. 9355.7-03B-P, dated June 2001, and EPA's 2012 memoranda for clarifying the use of protectiveness determinations and assessing protectiveness at sites for vapor intrusion for CERCLA five-year reviews (EPA, 2012a,b). This five-year review also provides information to the Washington State Department of Ecology (Ecology) for the periodic review pursuant to Washington Administrative Code (WAC) 173-340-420.

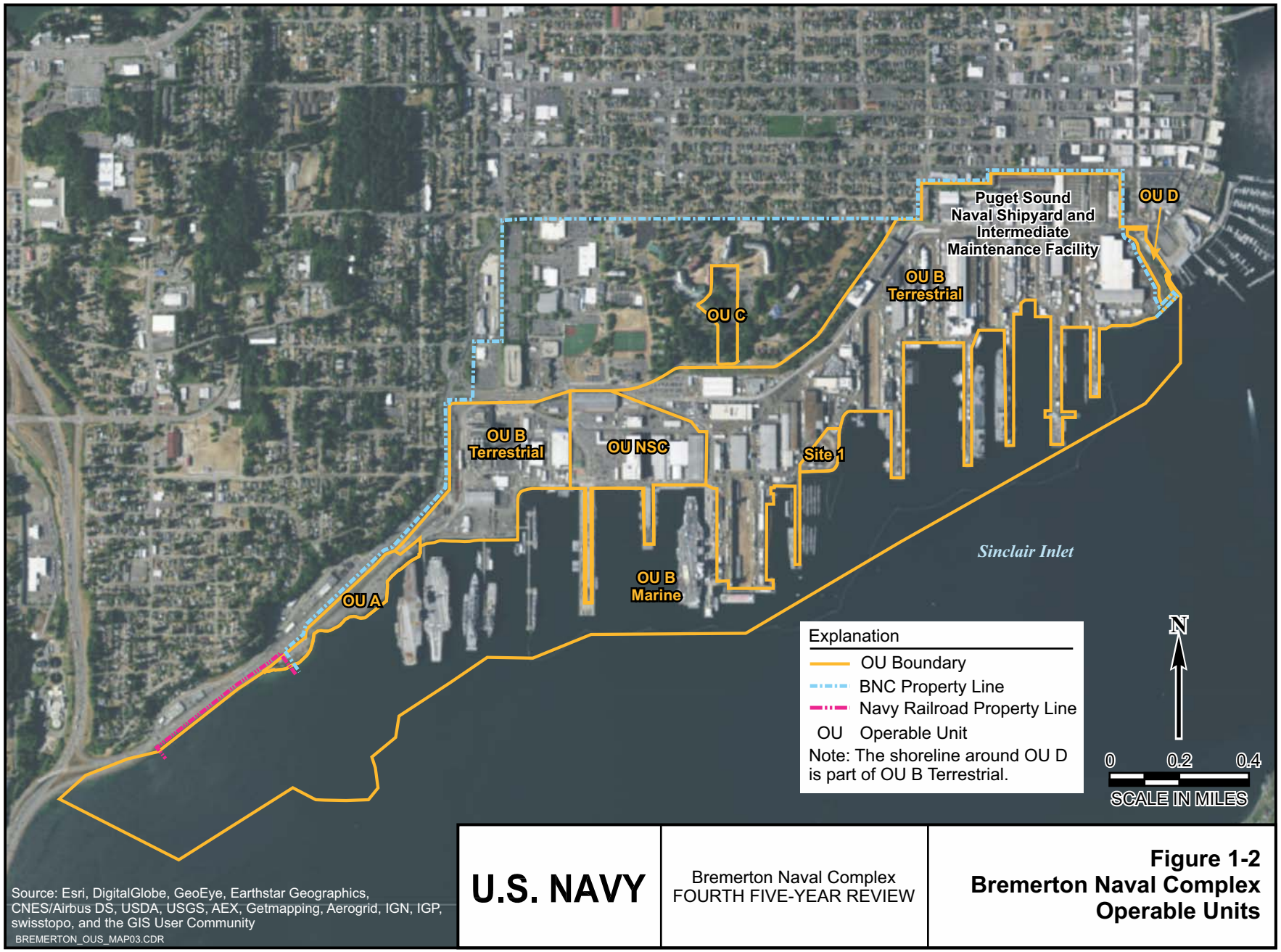
There are six operable units (OUs) at BNC. This report covers the remedies selected in the signed RODs for the five CERCLA OUs, including OU A, OU B Marine, OU B Terrestrial, OU D, and OU NSC. OU C is a petroleum-contaminated site and CERCLA does not address petroleum as a contaminant. Petroleum releases are addressed in Washington State under Subchapter IX of the Resource Conservation and Recovery Act (RCRA) and the state Model Toxics Control Act (MTCA). However, the Navy, as a matter of policy, follows the CERCLA process to the maximum extent practical at non-NPL sites. Additionally, because remedies for the sites include institutional controls (ICs) through land use restrictions, a five-year review for OU C is required pursuant to Navy policy and a periodic review by the Washington State Department of Ecology (Ecology) is required pursuant to MTCA. A cleanup action plan under MTCA was executed for OU C in 2007, and this five-year review includes an assessment of the OU C remedy protectiveness to address the periodic MTCA review requirements.

The RODs documenting the remedies implemented at BNC were signed after October 17, 1986. Therefore, this is considered a statutory, rather than a policy, review.

The Navy has conducted this five-year review of the remedial actions implemented at BNC in Bremerton, Washington. This review was conducted from October 2016 through June 2017 using analytical data generated between January 2012 and October 2016. In addition to data generated within this date range, this review considers key documents finalized in early 2017, including the Supplemental Mercury Investigation Report (SMIR; Navy, 2017c) and the Decision Framework Goals Document (Navy, 2017d). This report documents the results of the review, issues identified, and recommended actions.

This report was prepared as part of the CERCLA five-year review process using Navy and EPA guidance (Navy, 2011a; EPA, 2001).


Dyes Inlet
Camp Wesley Harris Naval Reservation
Chico Bay
Ostrich Bay
Phinney Bay
Port Washington Narrows
Kitsap Lake
Oyster Bay
Bremerton
Bainbridge Island
Port Orchard Narrows
Rich Passage
Manchester Fuel Depot
PUGET SOUND
Bremerton Naval Complex
Sinclair Inlet
Port Orchard
3
303
304
160
16
Port Townsend
Whidbey Island
Everett
Olympic Peninsula
Kitsap Peninsula
Bremerton Naval Complex
Puget Sound
Bainbridge Island
Seattle
Hood Canal
Tacoma
Shelton
Olympia
NORTH
0 1/2 1
Scale in Miles
U.S. NAVY
Bremerton Naval Complex
FOURTH FIVE-YEAR REVIEW
Figure 1-1
Bremerton Naval Complex
Vicinity Map



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

BREMERTON_OUS_MAP03.CDR

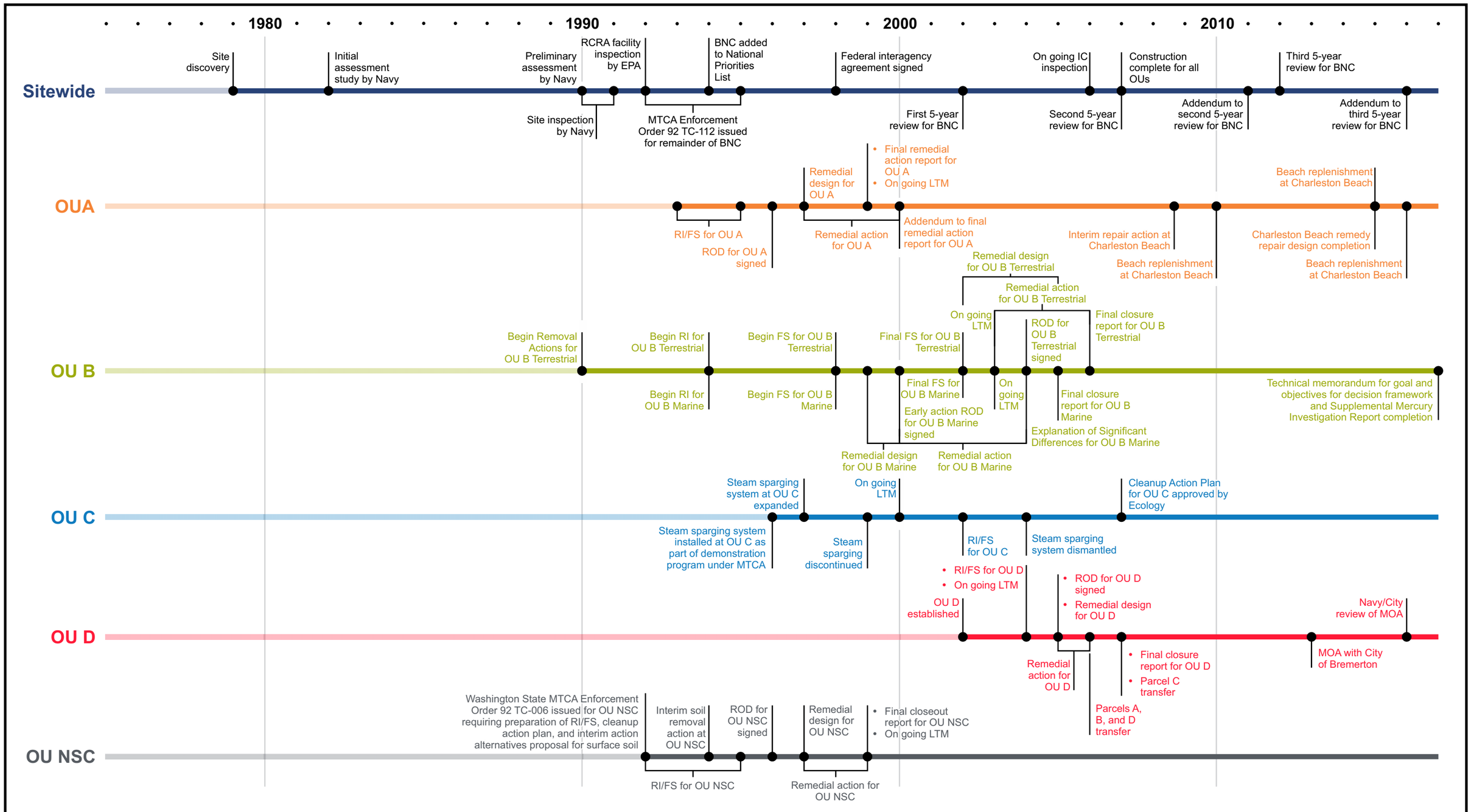
U.S. NAVY

Bremerton Naval Complex
FOURTH FIVE-YEAR REVIEW

Figure 1-2
Bremerton Naval Complex
Operable Units

2.0 SITE CHRONOLOGY

This section summarizes dates of major events at the site. Figure 2-1 depicts the primary events in the chronology of BNC related to site discovery, investigation, and remediation. Additional information can be obtained by reviewing Section 2 of the second and third five-year reviews (Navy, 2007c and 2012a).



U.S. NAVY

Bremerton Naval Complex
FOURTH FIVE-YEAR REVIEW

Figure 2-1
Bremerton Naval Complex Chronology of Events

BREMERTON_TIMELINE06.CDR

3.0 BACKGROUND

BNC is located on Sinclair Inlet, a part of Puget Sound. It is surrounded to the west and north by the City of Bremerton's commercial and residential areas, to the northeast by a Washington State Ferry System terminal, and to the southeast by Sinclair Inlet. The active industrial shipyard site contains approximately 380 acres of terrestrial area and 270 acres of submerged land. The Navy also owns approximately 1,000 acres of railroad area that is contiguous with the shipyard area. The terrestrial portion of the site consists of a relatively flat, low-lying waterfront area created through gradual filling of tideland and marshes and a higher upland area connected to the waterfront area by a moderately steep escarpment.

The site was first used as a resource base and seasonal camp location for the ancestors of the present-day Suquamish Tribe. The area was visited and eventually settled by Euroamericans in the 1700s and 1800s. In 1891, the Navy purchased 190 acres of land on Sinclair Inlet for construction of a ship drydock, repair, and overhaul base. The original area was substantially expanded beginning in the early 1900s by filling and grading shallow areas with soils, dredged material, and construction debris and through the purchase of additional adjacent property.

In over 115 years of industrial shipyard operations, primary land uses at BNC have included the following:

- Heavy industry (shipbuilding, ship maintenance and repair, and ship conversion)
- Light industry (vehicle maintenance)
- Ship berthing/homeporting
- Commercial (providing for purchase of supplies, meals)
- Residential (officers' and other quarters)

Current land use is much the same as it was historically. Ships have not been constructed at BNC since the early 1970s. Instead, the shipyard engages in ship and submarine maintenance, modernization, repair, inactivation and recycling, and provides technical and logistics support. BNC facilities include six major piers, six large drydocks, and more than 100 major buildings. Land use in the vicinity of BNC currently consists of commercial and residential districts in the City of Bremerton and, to the northeast, water transportation (Washington State Ferries terminal).

Groundwater at BNC has not historically been, nor is it expected in the future to be, a source of drinking water. The overall groundwater flow at BNC is toward the drydocks and Sinclair Inlet. Groundwater modeling (Jones et al., 2016) indicates that tidal influence affects groundwater flow directions within approximately 700 feet of the shoreline. No perennial streams or freshwater bodies are located within the BNC site boundaries.

Some of the fill material historically used to expand the shipyard area is believed to have included wastes containing hazardous substances. BNC has been the site of substantial shipbuilding, ship repair and overhaul, and other fleet support services. Miscellaneous waste materials have been a normal byproduct of shipyard industrial activities since the early 1900s. Before the establishment of environmental regulations, some wastes were disposed of at BNC using practices considered acceptable at the time, but which later were found to have resulted in adverse chemical impacts to soil and groundwater. The waste materials reportedly have included metal plating wastes, metal filings and shavings, transformers and other electrical components containing polychlorinated biphenyls (PCBs), batteries, acids, oxidizing materials, paint and paint chips, degreasing and cleaning solvents, miscellaneous materials from shipbuilding and ship demolition, and petroleum products. Disposal of wastes, particularly in conjunction with the placement of fill during shipyard expansion, as well as spills and leaks of industrial materials, has led to elevated levels of various chemicals in the subsurface.

Table 3-1 summarizes background information on OU A, OU B Marine, OU B Terrestrial, OU C, OU D, and OU NSC, including physical characteristics, land and resource use, and history of contamination. No removal actions were performed at OU A or OU B Marine prior to the signature of the RODs for these OUs. Removal actions were performed at OU B Terrestrial, OU D, and OU NSC prior to the signature of the RODs for these OUs, as well as at OU C prior to the finalization of the OU C CAP. More detailed site background information is included in the third five-year review (Navy, 2012a).

Table 3-1. Background Information Summary for BNC

Operable Unit	History of Contamination	Physical Characteristics	Primary Threat	Land and Resource Use	Removal Actions Performed[1]
A	• Fill placed from 1946 through early 1970s • Disposal of liquid wastes in unlined pits, copper slag grit, dredge spoils, open burning, construction debris, industrial waste • Oil sprayed to reduce dust on a former gravel surface	• Located in the most southwestern portion of BNC, approximately 12 acres • Boundaries extend beyond BNC boundary but is still on Navy property • Consists of small area of intertidal area at Charleston Beach and adjacent upland approximately 10 feet above mean sea level • Shoreline includes armored segments and a constructed pocket beach • Shallow groundwater is present above sea level, with flow toward Sinclair Inlet during low tide, and from Sinclair Inlet at high tide	• Risk of contact with contaminated soil and potential release of contaminants to the marine environment (via groundwater transport or erosion of fill material)	• Used for parking, with a railroad transecting the northern portion • Groundwater is not a potential source of drinking water	• None
B-Marine	• Historical over-water shipyard activities • Transport of contaminants present in upland fill materials to the marine environment via stormwater and erosion	• All nearshore marine environment associated with BNC, reaching generally east and west along the shorelines of OUs A, NSC, B Terrestrial, and D and extending an average of approximately 1,500 feet outward into Sinclair Inlet	• Human health risk associated with the presence of PCBs in marine tissues. • Human health risk for subsistance consumers	• Active over-water shipyard • Suquamish Tribe's Usual and Accustomed Fishing Area[2]	• None

Table 3-1 (Continued). Background Information Summary for BNC

Operable Unit	History of Contamination	Physical Characteristics	Primary Threat	Land and Resource Use	Removal Actions Performed[1]
B-Marine (Con't)	• Historical shoreline spills and releases to the marine environment	(the exclusion zone for public access to shipyard waters) • Approximately 230 acres of subtidal land • Water depth approximate 40 feet • Moderately steep shorelines protected by a combination of riprap, gravel mixes, and quay walls	associated with the presence of mercury in marine tissues		
B-Terrestrial	• Miscellaneous wastes included in fill materials used in developing the shoreline area • Historical spills and releases from industrial operations • Off-site, upgradient source of tetrachloroethene (PCE) and trichloroethene (TCE)	• All land area of BNC not included in other OUs, except north of Farragut Avenue in the western portion of BNC and north and northwest of Decatur Avenue in the eastern portion of the complex (approximately 200 acres) • Almost entirely covered by a combination of pavement and buildings	• Potential for contaminants to be transported to Sinclair Inlet and possibility of human contact with contaminated soil • Contaminant pathways to Sinclair Inlet include groundwater and intruding seawater entering storm drain lines, direct groundwater discharge and slumping or erosion along the shoreline	• Industrial shipyard activities • Roadways, railways, buildings, crane tracks • Complex network of utility systems • Groundwater is not a potential source of drinking water	• 1998-2000 – Paving of several previously unpaved areas (approximately 11,000 square yards)

Table 3-1 (Continued). Background Information Summary for BNC

Operable Unit	History of Contamination	Physical Characteristics	Primary Threat	Land and Resource Use	Removal Actions Performed[1]
C	• Aboveground Storage Tank 315, removed in the 1990s • UST 316, closed in place in 1986, filled with soil and industrial debris • UST 317, closed in place – filled with soil • 80,000 gallons of primarily bunker C fuel oil estimated to be present in subsurface from release from UST 317	• Located in the north-central upland portion of BNC • Topographically higher than most of industrialized waterfront of BNC • 60 to 100 feet above mean sea level • Centered on a steep ravine • Approximately 500 feet from Sinclair Inlet shoreline • Depth to groundwater 85 to 130 feet	• Potential for migration of free and dissolved phase petroleum hydrocarbon contamination towards Dry Dock 6 and Sinclair Inlet	• Parking • Undeveloped land • Groundwater is not a source of drinking water	• Steam sparging 1996-1999 recovered approximately 30,000 gallons of total petroleum hydrocarbons (TPH)
D	• Miscellaneous wastes included in fill materials used in developing the shoreline area • Historical spills and releases from industrial operations	• Located at the east end of BNC • Approximately 2.5 acres transferred to the City of Bremerton for use as a City park • Immediately adjacent to the Washington State Ferry dock • Approximately 50 percent covered with paving stones, asphalt, or buildings, with the remaining area landscaping or grass • Does not include the shoreline, which remains part of OU B Terrestrial	• Pathways include leaching of contaminants by site groundwater moving toward Sinclair Inlet and direct discharge in dissolved or particulate form through the storm drain lines serving the site	• City Park • History museum	• 2004 – Upgrades to paving and storm drain system infrastructure

Table 3-1 (Continued). Background Information Summary for BNC

Operable Unit	History of Contamination	Physical Characteristics	Primary Threat	Land and Resource Use	Removal Actions Performed[1]
D (Con't)		• Approximately 25 feet above mean sea level and relatively flat, with a rise towards the north side			
NSC	• Fill material used to expand working area into tidelands • Historical spills and releases from site operations - scrapping and recycling, petroleum storage and oil reclamation	• Located just west of the north-south centerline of BNC, between Farragut Avenue and the waterfront • Consists of a roughly square-shaped portion of the BNC uplands, approximately 28 acres • Almost entirely paved or covered by buildings • Concrete and steel quay wall to an estimated 10 feet below ground surface along full length of waterfront • Approximately 15 storm drains with discharge to Sinclair Inlet • Limited groundwater exchange with Sinclair Inlet because of presence of quay wall and drydock pumping	• Potential contact with site soils and risk of transport of contaminants to the adjacent marine environment	• Warehouse and office space for fleet supply • Groundwater is not a potential source of drinking water	• 1994 - Removal of 5,000 cubic yards of contaminated surface soils at the DRMO scrap metal stockpile – excavation of soil to approximately 4 feet below ground surface, removing acid pit and drain slab, placing impermeable cap on floor of excavation, and upgrading drainage for the stockpile area

Notes:
[1] Remedial actions performed after the RODs were signed are presented in Section 4 of this Five-Year Review.
[2]Sinclair Inlet is an exclusive portion of the Suquamish Tribe's adjudicated usual and accustomed fishing area that is reserved under the 1855 Treaty of Point Elliott. The Tribe's treaty reserved fishing rights are firmly established as a matter of federal law and are collocated with the Navy's facilities in Sinclair Inlet. The Tribe harvests several species of finfish within Sinclair Inlet and intends to harvest shellfish that is safe to consume in the future. The Navy and Tribe work on a government-to-government basis to respectfully and fairly address each party's federal interests without interference.
Data sources: Navy, 2007c and 2012a

4.0 REMEDIAL ACTIONS

The CERCLA RODs for BNC required remedial actions for OU A, OU B Marine, OU B Terrestrial, OU D, and OU NSC. This section summarizes the remedial action objectives (RAOs), selected remedy components, and operation, maintenance, and monitoring (OM&M) requirements for each of the CERCLA OUs and OU C (Table 4-1).

OU C is a petroleum-contaminated site. Petroleum products are not included in the definition of hazardous substances under CERCLA. Although excluded from CERCLA, cleanup of petroleum contamination is addressed, in Washington State, under Subchapter IX of RCRA and MTCA. The Navy, as a matter of policy, follows the CERCLA process to the maximum extent practical at non-CERCLA sites. Additionally, because the remedy for OU C includes ICs through land use restrictions, a five-year review is required pursuant to Navy policy and a periodic review by Ecology is required pursuant to MTCA. For OU C, the cleanup objectives from the CAP are presented in this section, along with the cleanup action implementation and monitoring requirements.

The RODs for OU A, OU B Terrestrial, and OU NSC contain requirements that the Navy address petroleum contamination through a BNC-wide petroleum management plan (PMP). The initial PMP was developed in 2002, amended in 2003, and revised in 2017. The PMP sampling requirements have been included in the long-term monitoring (LTM) Sampling and Analysis Plans (SAPs) throughout this review period, with the most recent SAP dated September 2016 (Navy, 2016f). As PMP monitoring is being conducted concurrently with LTM, a brief discussion of PMP monitoring is included as part of this section.

4.1 OU A

The RAOs and components of the selected remedy established in the ROD for OU A are listed in Table 4-1.

4.1.1 OU A Remedy Implementation

Completion of pavement upgrading, erosion protection, and habitat enhancements was documented in the final remedial action report for OU A (Navy, 1999b) and the addendum to the final remedial action report for OU A (Navy, 2000a). Shoreline erosion protection and beach habitat enhancement consisting of placing additional armor rock and gravel, reducing slopes, and creating a vegetated corridor were carried out between January 26 and March 4, 1998. Terrestrial habitat enhancement included a vegetated soil pocket and bird nest boxes that were constructed between March 9 and April 28, 1998. Asphalt repair and sealing were performed between July 11 and August 1, 1998. Additional shoreline erosion protection was constructed between July 10 and November 28, 2000, consisting of the replacement of a failing seawall.

The remedy for OU A did not involve any remedial actions along Charleston Beach, the southwestern end of OU A. The toe of the riprap embankment along Charleston Beach and the remainder of the OUA shoreline is the waterward extent of OU A.

Institutional control requirements for BNC (including OU A) were addressed by completion of the final institutional control work plan (Navy, 2006b). The IC work plan was updated in 2008, 2009, 2014, and 2015 (Navy, 2008a, 2009c, 2014c, and 2015c). The IC plan was combined with the operations and maintenance (O&M) plan into a single, updated plan in 2016 (Navy, 2016b). The ICs include access control, groundwater restrictions, excavation management, and land use restrictions. IC implementation details are included in Section 4.7.

Creation of a monitoring program that examines and reports on all elements of the remediation was satisfied by publication of the final monitoring plan for OU A in October 2000 (Navy, 2000b) and annual monitoring events, which began in 1998 (see Section 4.1.3). The OU A ROD required review of environmental data no less frequently than every 5 years and is addressed by this five-year review report.

Inspection and maintenance of pavement and erosion protection had been implemented at the time of the first five-year review. Inspection requirements for pavement and shoreline protection were originally implemented as part of the LTM process (Navy, 2000b). However, the 2006 O&M plan consolidated the requirements and procedures for pavement cap and shoreline inspection for all applicable OUs (Navy, 2006a). The most current O&M plan has been consolidated with the IC plan into a single document (Navy, 2016b).

4.1.2 Actions Subsequent to OU A Remedy Implementation

Subsequent to completion of the OU A remedy, the Charleston Beach area was designated as a mitigation site for the Pier D military construction project (Ecology, 2000). The mitigation involved expanding the intertidal habitat along approximately 120 linear feet of Charleston Beach between December 2001 and February 2002. This action included excavating a portion of the riprap embankment and replacing it with a combination of soft bank and sheet pile, as well as placing fish-mix gravel on the excavated surface to provide a more gently sloped beach. The intertidal area created by the removal of the riprap and excavation that was in the original footprint of OU A is still considered to be part of OU A. The mitigation activities were conducted at a CERLCA site but were not part of a CERCLA action.

The analytical results for the fill material to be exposed after the excavation for the mitigation revealed exceedances of sediment quality standards (SQS) criteria. However, the placement of 3 feet of beach mix on top of the exposed surface (as performed during the mitigation action) was deemed by Ecology to be protective of human health and the environment as the existing remedy as long as scouring was not excessive. A feeder berm of beach mix and erosion gauges were installed as part of this mitigation action (Navy, 2002i).

Subsequent to the mitigation action, the fish mix and bank eroded, and landfill debris was observed on the beach during the 2007 storm season. An interim action in August 2008 included placement of additional fish mix as a temporary erosion control measure while a more lasting alternative approach was sought (Navy, 2007f). Additional fish mix was placed in this area during interim erosion control actions in 2010, 2015, and 2016 in response to further loss of beach material as required by the IC work plans (Navy, 2009c, 2014c, and 2015c). Navy studies triggered by the observation of beach erosion have included sediment and soil sampling and analysis to approximate the physical extent of fill material in the intertidal and adjacent upland areas at Charleston Beach (Navy, 2010b) and an investigation of beach dynamics (Navy, 2010c). These studies culminated in a remedy repair evaluation report (Navy, 2012d). Based on these studies, a design for a permanent remedy repair was completed during this five-year review period (Navy, 2015g) but not implemented. The remedies and the actions subsequent to OU A remedy implementation are depicted in Figures 4-1 and 4-2.

The remedy repair related activities during this five-year review period are summarized below:

- The stakeholders reviewed and provided comments in November 2013 on the 90% design submittal. Stakeholders identified potential habitat loss and the need for mitigation in their comment on the 90% design submittal.
- The Navy finalized the 100% remedy repair design in October 2015 without further stakeholder input.
- The Navy awarded a habitat benefit analysis in September 2016 to quantify any habitat loss based on the 100% remedy repair design.
- The Navy awarded a remedy repair construction contract in December 2016 and subsequently terminated the contract in April 2017.
- The internal Draft Habitat Benefit Analysis dated December 2016 shows habitat loss of 0.5 acres between the Post-Pier D Mitigation condition and the Post-Construction Condition of 100% remedy repair design.

The remedy repair project has been reprogramed for late FY 2019 award. This allows for consultation with the project stakeholders, revision of the design and associated habitat benefit analysis ahead of project implementation. Project closeout is estimated in October 2021.

4.1.3 OU A Operation, Maintenance, and Monitoring

4.1.3.1 Inspection and Maintenance of Pavement and Erosion Protection

Annual inspection of the pavement cap and shoreline protection has been conducted since 1998. During this five-year review period, semiannual and annual inspections were conducted. The inspections included annual inspections of the pavement cap and vegetated covers along the upper edge of the shoreline, semiannual inspection of Charleston Beach, and wet and dry season inspections of storm drain catch basins. During this five-year review period, a small paving repair was completed in the Charleston Beach parking lot.

4.1.3.2 Groundwater Monitoring

LTM during this five-year review period consisted of groundwater sampling conducted annually in 2012 through 2016 at two to five monitoring well locations (including background well 346). Sampling was conducted in accordance with the comprehensive LTM plans covering terrestrial OUs (Navy, 2011b, 2012i, 2013g, 2014g, and 2016f). LTM performed at OU A during this five-year review period (2012 through 2016) is summarized in Table 4-2.

Under the current groundwater monitoring plan for OU A (Navy, 2016f), all five wells are sampled for arsenic and copper. In addition, four of the five wells (including background well 346) are monitored for nickel and zinc. Background well 346 also is sampled for lead each year.

4.2 OU B Marine

The ROD for OU B Marine was signed on June 13, 2000 (Navy et al., 2000). An explanation of significant differences (ESD) signed on February 19, 2004 identified changes in the boundary of OU B Marine and action levels for the response action on the state-owned aquatic land next to the Navy's confined aquatic disposal (CAD) pit (Navy et al., 2004b). The ESD did not change any of the RAOs stated in the ROD.

The RAOs and remedy components established in the ROD for OU B Marine are listed in Table 4-1.

As documented in the *Goals and Objectives for Decision Framework Process for PCBs and Mercury in OU B Marine* (Navy, 2017d), the Navy and stakeholders are in the process of developing a "Decision Framework" to guide future decision-making for OU B Marine, reflecting the results of LTM, findings from ongoing assessment of mercury contamination, and new information from other investigations and studies.

4.2.1 OU B Marine Remedy Implementation

The primary components of the remedy for OU B Marine were implemented between the summer of 2000 and fall of 2001 as shown in Figure 4-3(Navy, 2002f). New sheetpile was installed at Site 1 in the central part of the BNC shoreline, riprap placed to improve armoring and limit erosion, and gravel mix placed to enhance nearshore habitat quality.

A total of approximately 225,000 cubic yards of contaminated sediment was dredged and placed in the CAD pit. The CAD pit was capped with approximately 17,000 cubic yards of sand and 69,000 cubic yards of clean sediment. Approximately 57,000 cubic yards of clean sediment were used to form the cap and surrounding enhanced natural recovery (ENR) area offshore of OU A. A total of approximately 5,000 tons of engineered rock and gravel mixes was used to enhance nearshore habitat in the OU A vicinity. Operation and maintenance was not required by the OU B Marine ROD for the marine and terrestrial habitat enhancements (Navy et al., 2000). Section 12.2.8 of the OU B Marine ROD states, "Monitoring and maintenance will not be

conducted for the physical habitat restoration features at OU B. These include the final cover at the CAD cap and the shoreline habitat restoration features."

In the latter stages of the remedial action, evidence was found suggesting that contaminated sediment had been released during the process of filling the CAD pit. A layer of clean sediment was placed in an arc around the three sides of the CAD pit that are Navy property to cover sediment found to have elevated levels of PCBs. The Navy then undertook a more extensive evaluation of the extent of contaminant release onto the state -owned aquatic lands adjacent to the fourth side of the CAD pit. Based on this investigation, clean sediment was used to cover the contaminated sediment found on the adjacent state -owned aquatic lands. The results of the investigation and the actions to be taken in response were documented in an ESD (Navy et al., 2004b), and the work was completed in February and March 2004.

A monitoring plan for OU B Marine was created in 2003 (Navy, 2003c) based on the monitoring requirements identified in the ROD (Navy et al., 2000). The 2003 plan was updated for each subsequent LTM event. Following the 2003 LTM event, monitoring has been conducted approximately every two to three years (see Section 4.2.2). Review of monitoring data collected during the last 5 years is addressed by this five-year review report. Implementation of ICs throughout the BNC, including OU B Marine, was addressed through the development of a site-wide IC program, and the ICs are documented in the original IC work plan (Navy, 2006b). The IC work plan was updated as an independent document in 2008, 2009, 2014, and 2015 (Navy, 2008a, 2009c, 2014c, and 2015c). The IC plan was combined with the O&M plan into a single, updated plan in 2016 (Navy, 2016b). The ICs required in the OU B Marine ROD are not included in the current IC plan, and an IC plan specific to OU B Marine is needed.

The OU B Marine ROD IC requirement was that 'Land-use restrictions will be implemented by the Navy to maintain the integrity of the CAD cells and the shoreline stabilization measures.' The ESD for the OU B Marine ROD stated that 'No land use restrictions will be required on the state owned aquatic lands portion of OU B Marine. This ESD does not change the ROD specified land use restrictions.'

There is currently no IC plan covering OU B Marine, and this five-year review recommends that an OU B Marine IC plan be developed. Currently, base instructions covering port operations protect the CAD pit and other capped areas, and a floating boom with prominent signage controls access to the central part of BNC where Site 1 is located.

Because the CAD pit is within a Navy-controlled area, the Coast Guard and National Oceanic and Atmospheric Administration (NOAA) indicated that they would be making no changes to their information (such as navigation charts).

4.2.2 OU B Marine Operation, Maintenance, and Monitoring

Monitoring at OU B Marine during this five-year review period included both measures to verify the remedy integrity, and measures to assess progress towards meeting cleanup goals.

Measures to assess progress towards meeting cleanup goals included:

- Sampling of marine surface sediment (2012 and 2014)
- Sampling of fish tissues (English sole, 2012 and 2015)

Measures to assess remedy integrity included:

- Charleston Beach sediment sampling (subtidal 2014 and intertidal 2015) to provide information to support ongoing beach stabilization work (OU A remedy repair) and to assess whether landfill materials are impacting the adjacent marine sediment;
- Hydrographic surveys in the CAD pit area and the thick cap and ENR areas offshore of OU A (2012) to assess potential changes in the sea floor profile in these two areas from consolidation or erosion since 2001;
- Sub-bottom profiling of the CAD pit (2012 and 2014) to assess potential changes in cap material thickness since placement of the cap; and
- Core sampling of the CAD pit (2012) to verify the continuing functionality of the cap.

The first four rounds of LTM for OU B Marine were conducted in 2003, 2005, 2007, and 2010 were described in the third five-year review for BNC. The results of the fifth through seventh rounds of sampling conducted in summer 2012, fall 2014, and summer 2015 are documented in three marine monitoring reports (Navy, 2016c, 2016d, 2016g). The sampling was conducted in accordance with the 2012 and 2014 Navy sampling and analysis plans (Navy, 2012k, 2014i), the 2013 Sinclair Inlet Marine Monitoring Sampling and Analysis Plan (Navy, 2013j), and the Sample Plan Alteration Form for the 2014 Marine Long-Term Monitoring Plan (Navy, 2016c).

4.2.2.1 Measures to Assess Progress Towards Meeting RG

Marine Sediment Sampling

The primary component of the OU B Marine monitoring program is the collection and analysis of surface (0 to 10 cm) marine sediment samples based on two regular square grids that together cover the entirety of Sinclair Inlet. These data are used to characterize surface sediment quality on an area-weighted average (AWA) basis. This sediment sampling is guided by two grids laid out across the area of Sinclair Inlet. One grid, composed of 71 ("cells") 500 feet on a side, covers OU B Marine. A coarser grid, composed of thirty-two 1,500-foot cells, covers the remainder of Sinclair Inlet. One sample is prepared for each grid cell as a composite of three individual 0-10 cm grab samples collected within the cell. The placement and angle of rotation of the sampling grids, as well as the locations of the three individual grab samples from within each grid cell were randomly selected, resulting in a nonbiased sampling scheme. This scheme was developed for the 2003 LTM event and has been carried forward for subsequent events. By combining the results from sampling of the two grids on an area-weighted basis, AWA measures of the sediment quality of the entire inlet can be computed.

Marine surface sediment in the 500-foot and 1,500-foot grids was sampled in 2012 and 2014. The same randomly-identified individual grab sample locations used during previous LTM rounds were used to create composites during the 2012 and 2014 LTM events.

Each sample was analyzed for PCB Aroclors, total mercury, total organic carbon (TOC), percent moisture, and grain size. A subset of the sediment grid samples was also analyzed for methylmercury in 2012 to support an ongoing study of mercury in Sinclair Inlet.

Tissue Sampling

A second component of the OU B Marine monitoring program is the collection and analysis of marine tissue samples. Tissue sampling during this five-year review period consisted of English sole sampling in 2012 and 2015. English sole are collected using a trawl net, with samples made up from skin-off fillets. The Puget Sound Ecosystem Monitoring Program (PSEMP) performed English sole sampling in May 2015 and provided samples from this collection to the Navy. English sole samples were analyzed for PCB Aroclors, total mercury, and lipids.

4.2.2.2 Measures to Assess Remedy Integrity

Hydrographic Survey

Precision hydrographic (bathymetric) surveys were conducted at the CAD pit and along the OU A shoreline in 2012 to assess potential changes in the sea floor profile in these two areas from consolidation or erosion since 2001. The bathymetry was measured with precision multi-beam hydrographic survey techniques, in accordance with the U.S. Army Corps of Engineers (USACE) Hydrographic Surveying Manual (USACE, 1994).

Sub-Bottom Profiling Survey

Sub-bottom profile surveys were conducted at the CAD pit in 2012 and 2014 to assess potential changes in cap thickness since placement of the cap. The sub-bottom data were acquired concurrently with the hydrographic data. Sub-bottom profiling identifies and measures various marine sediment layers that exist below the sediment-water interface.

CAD Pit Sampling

Sediment cores are collected at the CAD pit to verify the continuing functionality of the cap. In 2012, a vibracore was used to collect through-cap cores at four locations at the CAD pit. A total of 12 samples were prepared and analyzed, three from each of four sediment cores. The coring locations were evenly spaced along a diagonal of the pit. Discrete samples from the cores were analyzed for PCB Aroclors, total mercury, TOC, percent moisture, and grain size.

Sediment Sampling Near Charleston Beach

In addition to the grid-based sampling of Sinclair Inlet in 2012 and 2014, sampling of sediment near Charleston Beach at the southwest end of BNC was performed in September 2014 (subtidal sediment) and May 2015 (intertidal sediment). The objectives of the sediment sampling near Charleston Beach were to provide information to support ongoing beach stabilization work (OU A remedy repair) and to assess whether landfill materials are impacting the adjacent marine sediment.

A single subtidal sample was collected in September 2014 using a van Veen grab sampler from a marine research vessel. Five intertidal samples were collected from the beach using hand methods in May 2015. The samples were analyzed for PCB Aroclors, TOC, seven metals (including total mercury), percent moisture and grain size. The analysis of the single subtidal sample was performed in 2014 together with the 2014 LTM sediment samples. The intertidal samples were analyzed in 2015.

4.2.3 OU B Marine Sediment Sampling Associated with Military Construction Projects

Since the completion of the OU B Marine remedy, marine sediment sampling has been a requirement for permits associated with construction projects that include in-water work within OU B Marine. This sampling involves analyzing pre- and post-construction sets of individual 0- to 10-cm grab samples in close proximity to the in-water construction areas to document whether construction activities have degraded surface sediment quality in the vicinity of the construction. In some cases, when the construction has involved removal of piers, the sampling has also included one-time collection of underpier samples to characterize portions of OU B Marine that were not previously accessible for sampling.

The Navy prepares separate sampling and analysis plans, subject to agency review and approval, for each in-water construction project. The sediment samples are analyzed for PCB Aroclors, total mercury, TOC, and grain size for consistency with the ongoing OU B Marine monitoring program. To provide data to support Ecology's assessment of compliance with the state antidegradation statute, in accordance with the terms of the project water quality certifications, the samples are also analyzed for the metals arsenic, cadmium, chromium, copper, lead, nickel, silver, and zinc.

The third five-review stated that the data from these construction project sampling activities will be incorporated into the database being assembled through the OU B Marine monitoring program and used to assess the long-term performance of the remedy. Subsequent to the third five-year review, the Goals and Objectives for Decision Framework Process for PCBs and Mercury in OU B Marine Technical Memorandum was finalized (Navy, 2017d). This technical memorandum states, "Until the Decision Framework is updated, only data collected for the LTM program (grids) will be used to calculate area-weighted averages. Other data may be evaluated

for use as weight of evidence to further understand site conditions, such as identifying contaminant sources or evaluating areas not previously characterized."

During the review period for this fourth five-year review, non-LTM sampling was performed in association with the Pier 6 fender pile replacement project (reporting pending), and in response to the saltwater main break (Navy, 2016i). The Pier 6 data are not included in this five-year review because the data report has not yet been finalized. The data from the saltwater main break are included in Appendix A. All non-LTM data will be evaluated under the Decision Framework.

4.2.4 Post-ROD Mercury Sampling and Investigation

After the OU B Marine ROD was published, new information regarding Suquamish Tribal subsistence seafood consumption rates became available. These new consumption rates were higher than the rates used in the earlier risk assessment (Suquamish Tribe, 2000). Subsequently, the Second Five-Year Review for BNC (Navy, 2007c) identified potential risks from mercury via the seafood consumption pathway as potentially calling into question the protectiveness of the OU B Marine remedy and recommended additional analysis of these risks. In 2010, the Navy completed a supplemental human health risk evaluation for two future populations potentially exposed to mercury in Sinclair Inlet sediment and seafood: a general sport fishing population, and the Suquamish Tribe population (Navy, 2010d). This evaluation was performed using existing marine tissue data collected from 1991 to 2007 from Sinclair Inlet and non-urban reference areas.

The supplemental human health risk evaluation reported incremental mercury hazard quotients (HQs) of 3.9 for an adult and 3.4 for a child, above target levels for subsistence-level consumption by the Suquamish tribal members. Hazards for a general sport fishing population met target health goals. The greatest concerns were the consumption of rockfish and the potential increased hazards to children consuming seafood containing both mercury and PCBs. However, significant risks were also associated with consumption of shellfish and salmon. The shellfish species contributing most to the shellfish HQ were clams and crabs.

The findings of the supplemental risk evaluation (Navy, 2010d) re-emphasized the role of mercury as a chemical of concern for BNC based on subsistence-level consumption of seafood collected in Sinclair Inlet. A preliminary conceptual site and exposure model indicates that a portion of the total mercury (THg) from BNC and other sources is methylated under anoxic conditions in sediment, where appropriate bacteria are present and other conditions are met. Methylmercury is an important parameter because of its high toxicity and because methylmercury concentrations biomagnify through aquatic food webs to the extent that almost all of the mercury found in finfish is methylmercury (Bloom, 1992).

The supplemental risk evaluation recommended additional tissue mercury data collection to evaluate current baseline conditions and support a planned focused feasibility study. This recommendation was reiterated in the Third Five-Year Review for BNC (Navy, 2012a).

In response to the supplemental human health risk evaluation findings and the Third Five-Year Review recommendations, the 2013 marine monitoring event was conducted, including collection of sediment and biota samples from Sinclair Inlet and several reference areas (Navy, 2015b). The monitoring was intended to address data concerns regarding the concentration and speciation of mercury in sediment and serve as a baseline for comparison to data collected in the future, allowing monitoring of trends of tissue mercury levels. The scope of the 2013 biota sampling included collection of tissue from multiple species representing different trophic levels, namely clams, crab, and two species of demersal fish (shiner perch and staghorn sculpin) from OU B Marine, Sinclair Inlet outside OU B Marine, and references areas. Clam and crab samples were analyzed for both total and methylmercury; shiner perch and staghorn sculpin were analyzed for total mercury only. These species were selected based on (1) high site fidelity, (2) differing food chain connections to water and sediment, (3) likelihood that mercury levels in site organisms can be distinguished from background, and (4) responsiveness of tissue mercury levels to changes in the environment. English sole sampling was not included in the 2013 biota sampling because the Supplemental Risk Evaluation (Navy, 2010d) concluded that mercury concentrations in English sole from Sinclair Inlet were similar to reference area mercury concentrations (i.e., not distinguished from background).

Marine sediment samples (some co-located with clam and crab samples) were also collected and analyzed for both total and methylmercury. Methylmercury data were gathered to:

- Improve understanding of how mercury moves through Sinclair Inlet into biota,
- Help determine whether there is a link between releases of mercury from terrestrial BNC and methylmercury in biota, and
- Improve decision-making on remedial actions to reduce risks for people eating fish and shellfish.

Statistical analyses were used to identify the numbers of samples needed to support project decision-making.

In addition to the 2013 marine monitoring work described above and the extensive sediment total mercury data collected during six rounds of OU B Marine long-term monitoring, the Navy has also been engaged in other mercury investigative work in Sinclair Inlet. Other mercury investigation work includes the investigations by the U.S. Geological Survey (USGS) of mercury distribution and fate and transport processes within Sinclair Inlet and adjacent areas and the Navy's Environmental Investment (ENVVEST) project, which is a cooperative effort involving the Navy, Ecology, EPA, and other stakeholders that collected mercury and other environmental data from the Sinclair-Dyes Inlet watershed.

4.3 OU B Terrestrial

The RAOs and remedial action components established in the ROD for OU B Terrestrial are listed in Table 4-1.

4.3.1 OU B Terrestrial Remedy Implementation

Some elements of the OU B Terrestrial remedy were initiated prior to finalizing the ROD. The last elements of the remedy were completed in 2006.

Approximately 80,000 feet of storm drain piping were inspected, leading to cleaning of approximately 75,000 feet of piping. Details on remedial actions on storm drains are documented in closure and remedial action reports (Navy, 2002h, 2004f, 2006c).

Approximately 2,000 feet of piping were replaced and another 2,000 feet were repaired. Eighteen catch basins and manholes were replaced or repaired. Approximately 112,000 square feet of asphalt were placed throughout BNC. Details on the paving upgrades and capping are available in the closure and remedial action reports (Navy, 1998a, 2000d, 2004g, 2005a, 2007d).

A total of 11,200 feet of seawall was inspected, leading to actions to reduce over-steep slopes, augment armoring, control erosion, and enhance shoreline habitat in selected areas. Details on shoreline protection are described in the final remedial action report (Navy, 2006f).

An IC work plan was prepared to document the procedures to be used to implement the ICs throughout BNC, including those included in the remedy for OU B Terrestrial (Navy, 2006b). Details of the remedy implementation are available in the third five-year review (Navy, 2012a). More detail is provided in the subsections below regarding OU B Terrestrial ICs and LTM.

4.3.1.1 Institutional Controls

The ICs for OU B Terrestrial are intended to meet the RAO of "continue to limit human exposure to site soils and groundwater." The ICs are applicable throughout the OU B Terrestrial site and, because contaminated soil and groundwater are left on site, must be maintained until contaminant levels allow for unlimited use and unrestricted exposure.

The IC objectives for OU B Terrestrial are the following:

- Ensure that access to the site is controlled.
- Ensure that the sole use of groundwater from the site is for monitoring purposes.
- Ensure that excavations carried out at the site are managed appropriately given the contaminants left in place.
- Ensure that the established industrial use of the site is maintained.

The OU B Terrestrial ROD required development of a BNC-wide IC remedial design to define the specific implementation actions necessary to achieve these IC objectives (Navy et al., 2004a). As described in Section 4.7, an initial BNC-wide IC work plan (Navy, 2006b) was prepared to describe procedures for implementing the IC remedial objectives for OUs A, B Marine, B Terrestrial, D, and NSC at BNC. The IC work plan was updated in 2008, 2009, 2014, and 2015 (Navy, 2008a, 2009c, 2014c, and 2015c). The IC plan was combined with the O&M plan into a single, updated plan in 2016 (Navy, 2016b).

4.3.1.2 Long-Term Monitoring Requirements

The long-term groundwater monitoring requirement of the OU B Terrestrial ROD was satisfied by the initiation of monitoring in 2004. The long-term groundwater monitoring conducted during this five-year review period is described in Section 4.3.4. There is no current or expected future beneficial use of groundwater at OU B Terrestrial. It has been concluded through analyses of primary fate and transport mechanisms that site groundwater is sufficiently protective of the marine environment and that no active groundwater remediation is warranted (Navy et al., 2004a). It has been demonstrated that it is not practicable to meet cleanup levels throughout the site within a reasonable restoration timeframe. On this basis, a conditional point of compliance was selected for groundwater at OU B Terrestrial in the OU B Terrestrial ROD. The point of compliance is along the shoreline, immediately upgradient of the dry docks. Groundwater monitoring is intended to meet the RAO of "reduce potential for chemical transport and control the threat of recontamination of the adjacent marine environment" by providing information to verify predictions that site groundwater is protective of the marine environment.

The Navy, EPA, and Ecology selected constituents for groundwater monitoring based on a review of the nature and extent of the chemicals of interest (COIs) throughout OU B Terrestrial. The chemicals monitored in OU B Terrestrial groundwater are:

- trichloroethene (TCE)
- 4,4′-dichlorodiphenyltrichloroethane (DDT)
- 4,4′-dichlorodiphenyldichloroethene (DDE)
- aldrin
- dieldrin
- heptachlor epoxide
- arsenic
- copper
- lead
- mercury
- nickel
- zinc

During preparation of the original LTM plan for OU B Terrestrial in July 2004 (Navy, 2004b), the Navy, EPA, and Ecology agreed on an approach for estimating the extent of attenuation between the drydock compliance monitoring wells and the groundwater discharge points to Sinclair Inlet. To determine whether compliance has been achieved, groundwater results from the wells are adjusted based on the estimated attenuation and compared to the conditional point of compliance groundwater criteria established in the ROD.

The Navy is addressing petroleum impacts through a separate BNC-wide petroleum management program as required by the ROD (Navy et al., 2004a). Groundwater monitoring relative to petroleum was initiated in 2002.

The original PMP documented petroleum management activities prior to the execution of the OU B Terrestrial ROD (Navy, 2002b). The PMP was amended in 2003 to establish ongoing petroleum monitoring requirements for OU A, OU B Terrestrial, and OU NSC (Navy, 2003a). The PMP monitoring has been incorporated into the BNC-wide monitoring plan (Navy, 2016f). The current petroleum monitoring program satisfies the ROD requirement that petroleum contamination be managed through a separate BNC-wide petroleum management program. The amended PMP requires free product monitoring of in wells 392 within OU NSC, and wells 428R and 406R in OU B Terrestrial (Navy, 2016f).

4.3.2 OU B Terrestrial Operation, Maintenance, and Monitoring

4.3.2.1 Inspection and Maintenance

During this five-year review period, the Navy conducted annual inspections and maintenance of the OU B Terrestrial remedy under the O&M plans updated in 2009, 2014 and 2015 (Navy, 2009e, 2014c, 2015c), the IC work plan updated in 2009, 2014 and 2015 (Navy, 2009c, 2014b, 2015d), and the consolidated O&M and IC plan (Navy, 2016b). The O&M and IC plan includes inspection and maintenance requirements identified in the ROD for OU B Terrestrial. During this five-year review period, annual inspections were conducted as required by the OU B Terrestrial ROD and included:

- Inspection of the pavement cap and vegetated covers
- Shoreline inspections
- Wet and dry season inspections of catch basins and manholes

The results of the inspections are summarized in Section 6.5. These inspection results are forwarded to the NBK - Bremerton Public Works Department for maintenance action.

4.3.2.2 Long-Term Groundwater Monitoring

LTM during this five-year review period consisted of groundwater sampling conducted either semiannually or annually at seven to 10 monitoring well locations. Sampling has been conducted under the requirements of the comprehensive LTM plans covering all terrestrial OUs

(Navy, 2011b, 2012i, 2013g, 2014g, and 2016f). Recommendations for adjusting monitoring frequencies for chemicals of concern (COCs) were made through application of the decision criteria included in the OU B Terrestrial ROD (Navy et al., 2004a). A summary of the groundwater monitoring performed in OU B Terrestrial during this five-year review period is presented in Table 4-3.

4.3.2.3 TCE Northern Plume Area Investigation

Based on the results of the vapor intrusion studies performed in the TCE northern plume area (Navy, 2009a, 2009b, and 2012c), the Navy conducted a plume characterization in this area in 2013 (Figure 4-4) (Navy, 2013b). The objective of this work was to improve the level and quality of data to fully characterize the northern volatile organic compound (VOC) plume on Navy property at NBK- Bremerton. These additional characterization data were intended to be used in the event that a future land use change was planned, though no land use change was planned at the time or is currently planned. Soil and groundwater samples were collected in the area of Building 427 and 435 (Figure 4-4) and the results are presented in Section 6.4.1. The report for this work recommended that a time-dependent groundwater data set be developed to establish groundwater concentration trends in this area for chloroform, tetrachloroethene (PCE), and TCE. Development of the data set needed to satisfy this recommendation is discussed in Section 4.3.2.4 below.

As part of the work performed to further characterize the TCE northern plume area, work was also conducted in response to a finding by contractors involved in the closure of underground tanks in connection with the demolition of former Building 871 in this area. The contractors noted the possibility of previous cyanide contamination from a removed pipeline. In response to this possibility, the Navy also investigated soil and groundwater in the area of the underground tank closure to assess the potential presence and concentration of cyanide (Navy, 2013b). This was accomplished by collecting soil and groundwater samples using hollow-stem auger drilling methods from borings in the area of former Building 871 (Figure 4-4), and the results are summarized in Section 6.4.1.

4.3.2.4 Non-LTM Monitoring

During this five-year review period, groundwater monitoring was performed supplemental to the LTM program in support of groundwater investigations to assess (Navy, 2013c):

- Vapor intrusion
- Mercury presence, concentration, and extent
- VOC presence, concentration, and extent
- Protectiveness of the OU D remedy and potential infiltration of contaminants into OU B Terrestrial

The vapor intrusion investigation was performed to generate a time-dependent groundwater data set as recommended by the 2013 investigation report (Navy, 2013c). These time-dependent data were intended to contribute to multiple lines of evidence to assess vapor intrusion.

Non-LTM monitoring to assess mercury presence, concentration, and extent was performed during this five-year review period. This monitoring is conducted in response to a recommendation and follow-up action from the second five-year review for OU B Terrestrial. to revisit RI/FS groundwater-to-surface water transport evaluations in light of mercury concentrations in wells LTMP-3 and LTMP-5. Monitoring to evaluate this pathway included surface water samples from Sinclair Inlet, and the data were used to support the USGS studies of this pathway (Huffman et al., 2012).

Non-LTM monitoring was also conducted to assess VOC presence, concentration, and extent wells in OU NSC.

Well 903, located near the eastern boundary of OU B Terrestrial and adjacent to OU D, is sampled for pesticides and metals to evaluate remedy protectiveness in OU D (Navy, 2013c).

The non-LTM groundwater sampling occurred in wells located within OU B Terrestrial and OU NSC as shown in Table 4-4 in addition to the background well and Sinclair Inlet. Non-LTM monitoring was performed on an annual or semiannual basis from October 2009 through February 2014 (Table 4-4). The non-LTM investigation was discontinued after February 2014, having met the program objectives.

4.4 OU C

4.4.1 Cleanup Action Plan for OU C

In September 2006, the Navy submitted a CAP for OU C to Ecology for review and approval (Navy, 2007e). The objective of the CAP was to prevent migration of free and dissolved phase petroleum hydrocarbon contamination from affecting Dry Dock 6 and Sinclair Inlet in order to protect human health and the environment. The CAP described a selected remedy of No Action with monitoring and ICs for OU C and outlined the criteria for reassessment and modification of the selected remedy based on the monitoring results. The CAP was approved by Ecology in December 2007 (Ecology, 2007). ICs required by the CAP are the following:

- Prohibit activities at OU C that interfere with monitoring activities.
- Prohibit activities at OU C that may result in the release of petroleum hydrocarbon contamination, which is contained on site as part of the cleanup action.
- Notify Ecology of the Navy's intent to convey any interest in the site.
- Notify Ecology of any proposal to use the site in a manner inconsistent with the land use restrictions.

Annual inspection of these ICs (as is performed at the other OUs) is not required by the OU C CAP. These ICs are reviewed as part of the five-year review site inspection.

4.4.2 OU C Operation, Maintenance, and Monitoring

The Navy has conducted monitoring at OU C since the 1990s (prior to execution of the CAP). In January 2001, the Navy implemented a five-year groundwater monitoring program at OU C to monitor and further evaluate the dissolved- and free-phase petroleum hydrocarbon plumes, as well as to prevent migration of contaminants from OU C to Sinclair Inlet. The five-year groundwater monitoring program consisted of: (1) collecting quarterly product thickness measurements in accessible groundwater monitoring wells throughout OU C, and (2) conducting quarterly groundwater sampling and analysis at five sentinel wells located downgradient of the free- and dissolved-phase contaminant plume at OU C (Navy, 2007e). During the OU C LTM program, the Navy continued quarterly sampling for TPH parameters at the five sentinel wells and measured free-product thickness at accessible groundwater monitoring wells until 2006.

The sentinel wells are used to detect whether petroleum hydrocarbon contamination is migrating from OU C towards Sinclair Inlet. The trigger level for diesel-range petroleum hydrocarbons is 0.5 milligrams per liter (mg/L). Detection in a sentinel well above the trigger level is to be followed by four quarters of monitoring to confirm the result (Navy, 2007e).

Monitoring at OU C is now integrated into the site-wide LTM program. Monitoring is conducted at sentinel wells in accordance with the CAP, with reductions in the sampling regime as allowed by the CAP and approved through regulatory review of the monitoring plans. During this five-year review period monitoring consisted of the following:

- Collection of annual groundwater samples from two to three sentinel monitoring wells (with a fourth alternate well), with analysis for diesel-range petroleum hydrocarbons and oil range petroleum hydrocarbons.
- Temporary collection of quarterly groundwater samples from one monitoring well (GWMT-9), as a result of a trigger level exceedance.
- Gauging of free-product thickness in six monitoring wells on an annual basis for the entire five-year review period with the exception of 2015.

Monitoring data for OU C are included in the LTM data summary reports. The most recent report was prepared in March 2017 (Navy, 2017b).

4.5 OU D

The RAOs and remedial action components established in the ROD for OU D are listed in Table 4-1.

4.5.1 OU D Remedy Implementation

4.5.1.1 Site-Wide Capping

Prior to beginning cap construction, numerous existing utilities and other site features were removed, abandoned, or modified. These features included concrete foundations, asphalt pavement, a railroad spur line, sanitary sewer/storm drain systems, power/communication manholes, irrigation lines, compressed air lines, asbestos insulated steam lines, and light poles and fixtures. One monitoring well (OU B-MW-13) was decommissioned by a licensed well driller (Navy, 2007d).

Where required, the perimeter of the area receiving a vegetative cover was excavated to accommodate the transition in grade between the cap and the surrounding area and allow placement of the required cap materials. A low-permeability cap layer was then placed as planned. The cap was tested to ensure a vertical permeability of 10^{-4} centimeters per second or less. Hydroseed or sod was then placed on 6 inches of top soil over most of the low-permeability cap (Navy, 2007d).

With EPA approval, topsoil placement and vegetation were deferred in one OU D area, where the City of Bremerton still planned extensive construction activities. The City of Bremerton was responsible for completing the cap in this area. The slope along the westerly edge of the vegetative cover was covered with an impermeable polyethylene membrane and a layer of crushed rock (Navy, 2007d).

The area planned for asphalt paving was prepared with minor excavation, grading, capping with 3 inches of crushed surfacing top course, and compacting. Asphalt was then placed as planned (Navy, 2007d).

These actions met the RAO of reducing the potential for chemical transport from infiltration of surface water into soil.

4.5.1.2 Stormwater System Contaminated Sediment Removal

Stormwater system components in the vicinity of OU D were cleaned, repaired, or removed as part of the stormwater system work at OU B Terrestrial (Navy, 2006c) and during the reconfiguration of the eastern property boundary during OU D cap installation (Navy, 2007d). At the conclusion of this work, no Navy storm drain component remained within the boundaries of OU D.

4.5.1.3 Institutional Controls

The IC objectives for OU D are as follows:

- For the property that is transferred to the City of Bremerton or made available for use, ensure property use is restricted to recreation, and prohibit the development and use of the property for residential housing, schools, or any land use other than recreational.
- Ensure the integrity of the pavement and vegetative cover.
- Ensure groundwater is not withdrawn except for monitoring purposes.

As described in Section 4.7, a BNC-wide IC work plan (Navy, 2006b) was prepared to describe procedures for implementing the IC RAOs for OUs A, B Marine, B Terrestrial, D, and NSC at BNC. The IC work plan was updated as an independent document in 2008, 2009, 2014, and 2015 (Navy, 2008a, 2009c, 2014c, and 2015c). The IC plan was combined with the O&M plan into a single, updated plan in 2016 (Navy, 2016b).

The ICs meet the RAO of "continue to limit human exposure to site soils and groundwater." The ICs are applicable throughout the OU D site and, because contaminated soil and groundwater are being left on site, must be maintained until contaminant levels allow for unlimited use and unrestricted exposure. A discussion of the status and effectiveness of these ICs is included in Section 6.5.

Parcels A, B, C, and D comprising OU D were transferred to the City between February 2006 and May 2007 (Navy, 2010a). Land use restrictions were included in the property transfer deed to prohibit development inconsistent with recreational use and to prohibit the use of groundwater except for monitoring purposes. The deed also included specific requirements for construction activities at the site to protect the installed vegetative cover.

4.5.1.4 Groundwater Monitoring

The objective of monitoring the groundwater is to verify that the remedy is effective in minimizing the migration of chemicals into Sinclair Inlet via the groundwater pathway. There is no current or expected future beneficial use of groundwater at OU D (Navy et al., 2005).

OU D groundwater monitoring is being conducted in conjunction with the groundwater monitoring for OU B Terrestrial (Navy, 2010a). One monitoring well (point of compliance well LTMP-5, installed as part of the OU B Terrestrial monitoring) was installed in 2004 and is being used to monitor groundwater from below OU D. This well serves as the conditional point of compliance for groundwater. This monitoring well is sampled to measure concentrations of chemicals in groundwater near the point of discharge to the marine environment. Groundwater monitoring associated with OU D is being performed in accordance with the current LTM plan (Navy, 2016f) (see Section 4.3.2). Well 903 was monitored during this five-year review period as part of the non-LTM sampling program (see Section 4.3.2.4) to evaluate remedy protectiveness in OU D and the potential migration of contaminants into OU B Terrestrial (Navy, 2013c).

The Navy, EPA, and Ecology selected constituents for groundwater monitoring based on a review of the COIs identified for soil at OU D (Navy et al., 2005). The chemicals monitored in groundwater are generally a subset of those monitored for OU B Terrestrial and consist of:

- 4,4′-DDT
- 4,4′-DDE
- aldrin
- dieldrin
- endrin
- cadmium
- mercury

Because OU D monitoring is conducted concurrently with OU B Terrestrial, long-term groundwater monitoring was initiated in August 2004, prior to execution of the OU D ROD.

Groundwater monitoring meets the RAO of "reduce the potential for chemical transport to the adjacent marine environment" by providing information to verify predictions that site groundwater is protective of the marine environment.

4.5.2 OU D Operation, Maintenance, and Monitoring

As part of the OU D property transfer agreement between the Navy and the City, the City was to bear the responsibility for ICs and maintaining the remedy at the site. The deed restrictions were to ensure that the ICs were transferred with the property. A Memorandum of Agreement (MOA) was established in May 2013 between the City of Bremerton and the Navy regarding the management and operations of OU D, including remedy inspections. This MOA established responsibility for remedy inspections to the City of Bremerton. OU D IC inspection reports completed by the City of Bremerton are included in the BNC terrestrial annual remedy inspection reports.

4.6 OU NSC

The primary RAOs and remedial action components established in the ROD for OU NSC are listed in Table 4-1.

4.6.1 OU NSC Remedy Implementation

Completion of paving, cleaning of stormwater piping and catch basins, and repair of stormwater piping and catch basins as necessary were documented in the remedial action closeout report for OU NSC (Navy, 1999a) for work performed between June 1997 and March 1999. Storm drains and catch basins were cleaned with a high-pressure water hose and vacuum truck, inspected via video camera, and repaired as necessary. Paving enhancement included paving previously unpaved areas and replacing pavement in the former Defense Reutilization Management Office (DRMO) yard and Fleet and Industrial Supply Center (FISC) parking lot.

Institutional control requirements for BNC (including OU NSC) were addressed by completion of the final IC work plan (Navy, 2006b). The IC work plan was updated in 2008, 2009, 2014, and 2015 (Navy, 2008a, 2009c, 2014c, and 2015c). The IC plan was combined with the O&M plan into a single, updated plan in 2016 (Navy, 2016b). The ICs include access control, groundwater restrictions, excavation management, and land use restrictions. Prior to the completion of the IC work plan, existing access control measures included security measures for BNC that were in place at the time that the ROD was signed. In addition, administrative control of acceptable groundwater and land use has been maintained by Navy planning divisions (i.e., the Navy planning divisions control groundwater and land use through review of development plans). Additional discussion of ICs at BNC is provided in Section 4.7.

The O&M and IC plan (Navy, 2016b) includes requirements for annual inspection of select storm drain system components within OU NSC in accordance with ROD requirements.

Excavation management controls have been included as part of each IC work plans, including the current O&M and IC work plan (Navy, 2016b). The IC work plan references and includes a MOA for excavation management (Navy, 2007b), which provides guidelines for BNC personnel and contractors regarding excavation management.

Development and implementation of LTM was satisfied by the publication of the final monitoring plan for OU NSC in October 2000 (Navy, 2000c) and annual monitoring events that began in 1998.

The requirement for a five-year review of the OU NSC remedial action and monitoring program is addressed by this five-year review report.

4.6.2 OU NSC Operation, Maintenance, and Monitoring

4.6.2.1 Inspection and Maintenance of Pavement and Storm Drains

Annual inspections of the storm drain system and pavement cap at OU NSC have been conducted since the ROD was executed, in accordance with ROD requirements. From the time the ROD was signed to the publication of the BNC-wide 2006 O&M plan (Navy, 2006a), these activities were guided by the OU NSC monitoring plan. The most recent inspection and monitoring have been based on the 2016 O&M and IC plan (Navy, 2016b). During this five-year review period, annual inspections were conducted. The inspections included the pavement cap and vegetated covers, and wet and dry season inspections of catch basins.

4.6.2.2 Groundwater Monitoring

LTM during this five-year review period consisted of groundwater sampling conducted annually (2012 through 2016) at two to five monitoring well locations (including background well 346). A summary of the groundwater monitoring performed in OU NSC during this five-year review period is presented in Table 4-5. Sampling was conducted in accordance with the

comprehensive LTM plans covering all terrestrial OUs (Navy, 2011b, 2012i, 2013g, 2014g, and 2016f).

Under the current groundwater monitoring plan (Navy, 2016f), five wells (including background well 346) are monitored for arsenic, copper, lead, and nickel. Wells 310R, 392R, and background well 346 are monitored for diesel-range hydrocarbons and residual range hydrocarbons either annually (wells 392R and 346) or every 5 years (well 310R) (Navy, 2016f).

An additional monitoring well (902) was installed at OU NSC in 2011 near the northern boundary of OU NSC to support vapor intrusion and contaminant source and extent studies associated with the Child Development Center facility (Navy, 2012b). Figure 4-5 shows the location of this well. Monitoring well 902 was initially sampled in 2012 and 2013 and analyzed for VOCs and total mercury in accordance with the 2011 LTM plan (Navy, 2011b). Samples from this well were not intended to support the LTM program, but rather separate studies. Monitoring for mercury was conducted in response to a recommendation from the second five-year review (Navy, 2007c) to evaluate the groundwater to surface water transport pathway for mercury. The data were included in the appendices of the 2012 and 2013 monitoring reports, but not tabulated with the LTM data in the body of the reports. Following the initial sampling, the sampling and data evaluation for this well was moved into the "non-LTM" sampling program (see additional discussion in Section 4.3.4).

4.7 Institutional Controls Implementation

The Navy prepared an IC work plan (Navy, 2006b) to describe procedures for implementing the IC RAOs for OUs A, B Terrestrial, D, and NSC at the BNC. The IC work plan was updated as an independent document in 2008, 2009, 2014, and 2015 (Navy, 2008a, 2009c, 2014c, and 2015c). The IC plan was combined with the O&M plan into a single, updated plan in 2016 (Navy, 2016b) and is described in detail in Section 4.7.

The Navy is responsible for implementing, monitoring[2], reporting on, and enforcing the ICs at the terrestrial OUs. The IC Plan and Navy real property procedures ensure that, in the event of a future transfer of a portion of the property, land use restrictions would be documented and appropriate deed restrictions would be developed.

Inspection and maintenance of the ICs as detailed in the IC and O&M plan (Navy, 2016b) ensures that the RAO of limiting human exposure to site soils and groundwater is maintained. The ICs will be maintained until contaminant levels allow for unlimited use and unrestricted exposure. Observations are documented on checklists and via photographs, as necessary (Navy, 2016b).

The Navy maintains a central database of properties restricted by ICs. The database includes relevant information on the property, types of ICs established, any land use monitoring and

[2] The City of Bremerton is responsible, per the MOA, for performing monitoring of the ICs at OU D.

management responsibilities, and the location of real estate records. This database is queried when making land use and planning decisions.

The objective of the ICs is to protect human health, the environment, and the integrity of an engineering remedy by limiting the activities that may occur at a particular contaminated site. The ICs for BNC are detailed in the documents listed in Table 4-6 (Navy, 2016b).

The objectives of the ICs implemented at BNC are the following:

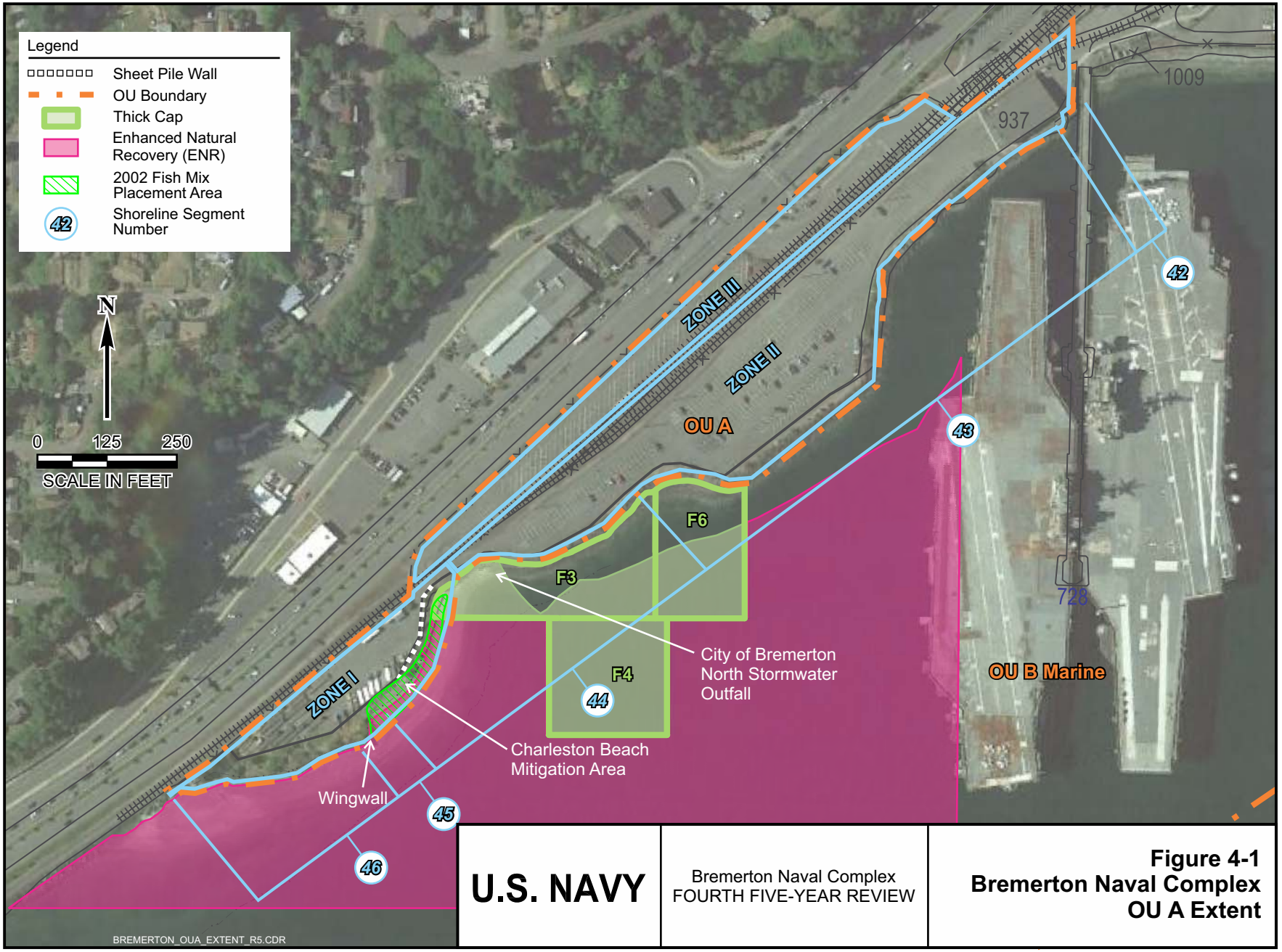
- Ensure that access to BNC is controlled.
- Ensure that the sole use of groundwater is for monitoring purposes.
- Ensure that excavations are managed appropriately given the contaminants left in place.
- Ensure land use restrictions are maintained and controlled including real estate transactions/property transfers, land use changes, and new construction.
- Ensure that land use remains compatible with cleanup decisions.

The soil management plan requirement in the OU A ROD is equivalent to the excavation management plan requirement established under the OU NSC ROD (see Section 4.2). Excavation management controls have been included as part of each IC work plan, including the current O&M and IC work plan (Navy, 2016b). The IC work plan references and includes as an MOA for excavation management (Navy, 2007b), which provides guidelines for BNC personnel and contractors regarding excavation management.

There is currently no IC plan covering OU B Marine, and this five-year review recommends that an OU B Marine IC plan be developed. The current status of the OU B Marine ICs is as follows:

1. Site 1 is within the floating security boom with prominent signage controls that read, “U.S. Navy Restricted Area Use of Force Authorized”.
2. Site 1 ICs are included in and inspected/maintained as part of the O&M and IC Plan for terrestrial operable units.
3. The CAD cell is within an access controlled area monitored by the Navy.
4. NOAA and the Coast Guard indicated that they would not make updates to navigation charts regarding the presence of the CAD cell, as this area is controlled by the Navy (Navy, 2007c).
5. CAD cell cap ICs have been implemented periodically in conjunction with LTM work but are not fully covered by the O&M and IC Plan (Navy, 2016b) for terrestrial OUs.
6. ICs are not required for the thick and thin cap areas by either the terrestrial or OU B Marine RODs.

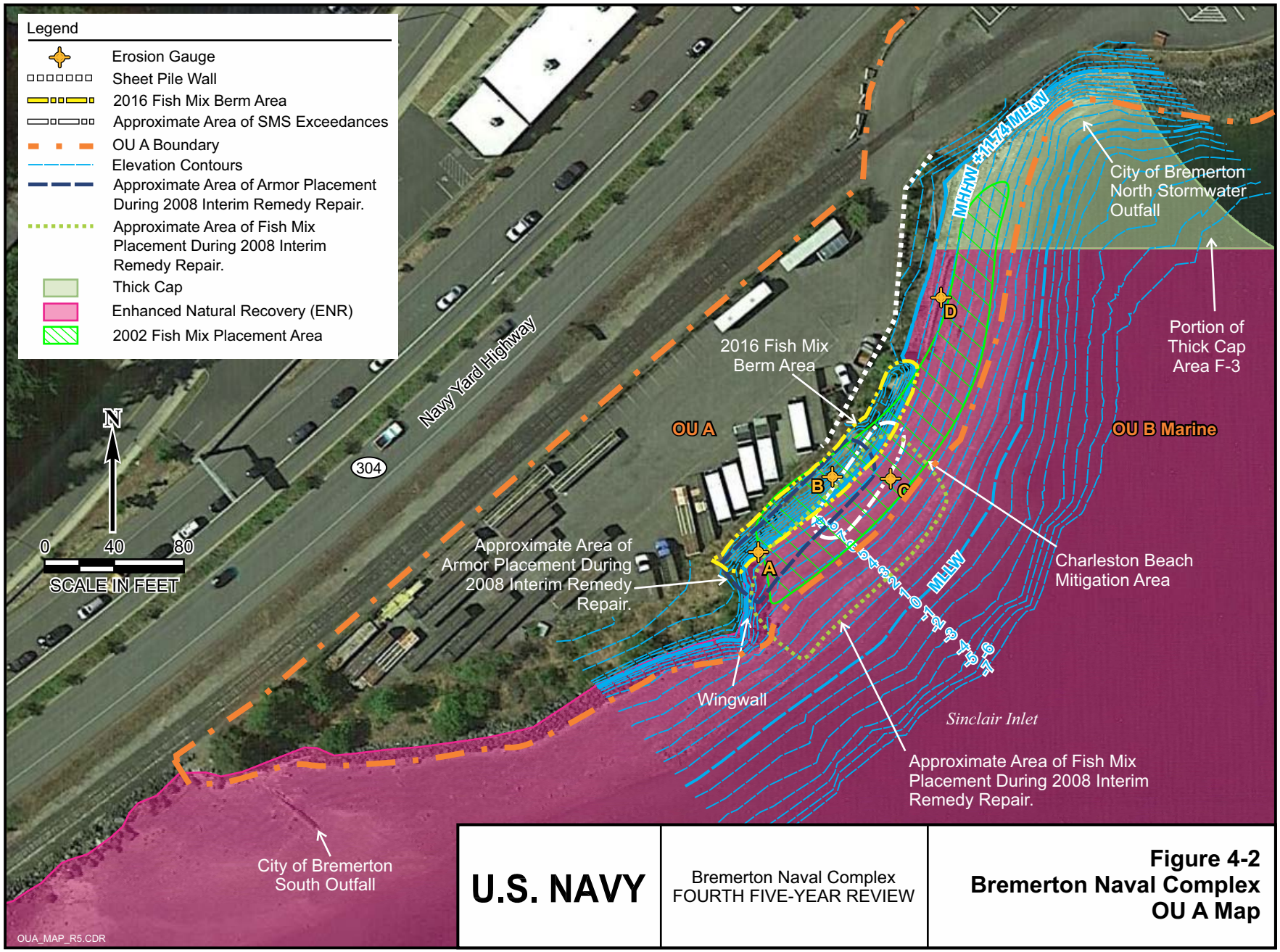
ICs were required in the CAP for OU C, but no inspection frequency was specified. Inspections at OU C have been performed as part of five-year reviews, but it would be an improvement to include OU C in annual IC inspections.



U.S. NAVY

Bremerton Naval Complex
FOURTH FIVE-YEAR REVIEW

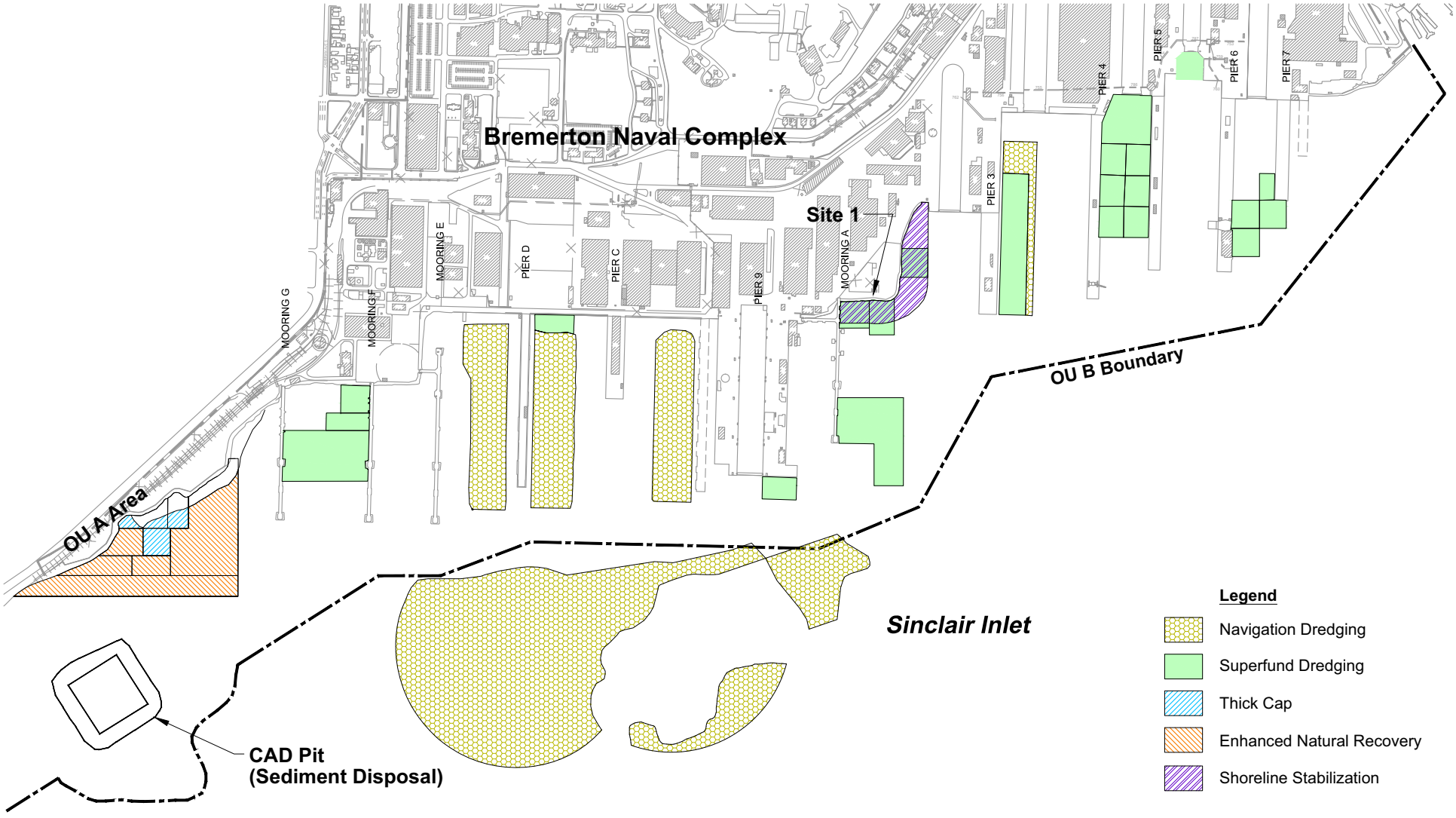
Figure 4-1
Bremerton Naval Complex
OU A Extent



U.S. NAVY

Bremerton Naval Complex
FOURTH FIVE-YEAR REVIEW

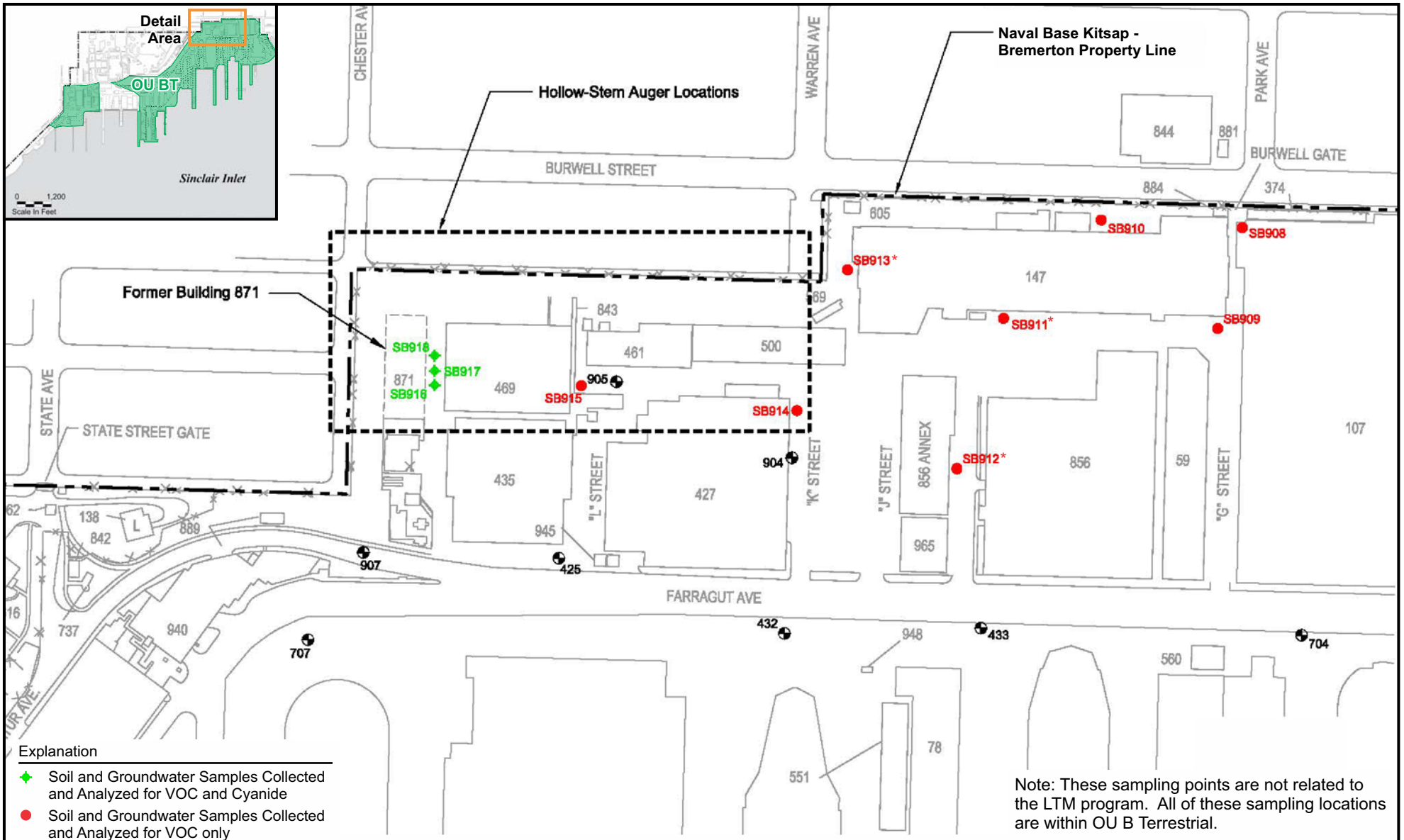
Figure 4-2
Bremerton Naval Complex
OU A Map



U.S. NAVY

Bremerton Naval Complex
FOURTH FIVE-YEAR REVIEW

Figure 4-3
Remedial Action at
Marine OU B (2000-2001)



Explanation

- Soil and Groundwater Samples Collected and Analyzed for VOC and Cyanide
- Soil and Groundwater Samples Collected and Analyzed for VOC only
- Groundwater Samples Collected and Analyzed for VOC only
- * No Groundwater Samples Collected at These Locations.

(SOURCE: U.S. NAVY, 2013)

BREMERTON_LOCATIONS.CDR

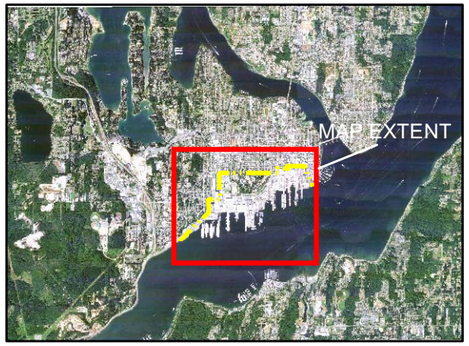
0 100 200
SCALE IN FEET

Note: These sampling points are not related to the LTM program. All of these sampling locations are within OU B Terrestrial.

U.S. NAVY

Bremerton Naval Complex
FOURTH FIVE-YEAR REVIEW

Figure 4-4
TCE Northern Plume Area Soil and Groundwater Sampling Locations



MW905
MW904
MW907
425
346
707
432
433
704
MW903
LTMP-4
406R
LTMP-5
GMWT-10
GMWT-14
GMWT-19
GMWT-7
GMWT-18
GMWT-9
GMWT-15
GMWT-23
GMWT-22
MW902
GMWT-26
GMWT-24
428/428R
PMP-1
GMWT-25
386
310R
MW900
MW-811A
MW811
MW809
718
392R
380
410R
412
709
MW810
LTMP-3
MW901
392
713
715R
LTMP-1
LTMP-2
241
266
206
203
204

SINCLAIR INLET

LEGEND

- LTM WELLS SAMPLED DURING THE LAST FIVE YEAR REVIEW PERIOD
- MONITORING WELL
- NAVY PROPERTY LINE
- NAVY RAILROAD PROPERTY LINE
- OU A
- OU B MARINE
- OU B TERRESTRIAL
- OU C
- OU D
- OU NSC

N

0 500 1,000 2,000
Feet

1 inch = 800 feet

(SOURCE: SEALASKA, 2016)

BREMERTON_OUS_N_WELLS03.CDR

U.S. NAVY	Bremerton Naval Complex FOURTH FIVE-YEAR REVIEW	**Figure 4-5** **Locations of Monitoring Wells**

Table 4-1. Summary of Remedial Actions at BNC

OU	Reasonably Anticipated Land Use	Media	COC	Remedial Action Objectives	Remedy Components	Ongoing Operation, Maintenance and Monitoring
OU A	Industrial	• Soil	• Metals • TPH • PAHs • PCBs	• Prevent people from coming in contact with soil containing lead, arsenic, PCBs, and PAHs above acceptable levels • Reduce the physical hazards associated with the existing riprap, such as exposed scrap metal, construction debris, and fill materials • Limit the erosion of heavy metal and organic constituents in fill materials into Sinclair Inlet marine waters through the existing riprap • Reduce the transport of chemicals to groundwater or the marine environment • Enhance terrestrial and marine habitat	• Upgrading the pavement cap over approximately 3.7 acres • Placing erosion protection (additional riprap or stabilized cobble/gravel layer) along approximately 1,400 linear feet of the existing shoreline. If placement of erosion protection causes there to be a net loss of productive capacity of fish and shellfish habitat, mitigation measures will be incorporated into the project. Appropriate mitigation measures will be determined after close consultation with interested parties and in accordance with ***the substantive requirements*** of the Hydraulic Code, Chapter 220-110 WAC, prior to the placement of erosion protection • Implementing institutional controls, which include fencing (such as already exists), warning signs, an extended prohibition on fish and shellfish harvesting at Charleston Beach, and land use restrictions on residential use. Residential restrictions and controls and requirements for the inspection and maintenance of the pavement cap and erosion protection will be implemented with a Bremerton Naval Complex-wide soil management plan • Creating a monitoring program that examines and reports on all elements of the remediation • Conducting regular inspection and maintenance of the pavement cap and erosion protection, particularly after storms • Implementing marine and terrestrial habitat enhancements	• Inspection and maintenance of pavement and erosion protection • Evaluation of IC effectiveness
		• Groundwater	• Metals • PAHs • Pesticides • TPH • PCBs	• Reduce the transport of chemicals to groundwater or the marine environment	• Conducting a groundwater monitoring sampling and analysis program • Conducting a periodic review of the data no less frequently than every 5 years. At the five-year review, all data will be evaluated by the Navy, Ecology, and the EPA to assess the protectiveness associated with reduction of risks to the human health and ecological receptors in the marine environment, as well as the need for any further action • Conducting regular inspection and maintenance of the pavement cap and erosion protection, particularly after storms	• Groundwater monitoring • Evaluation of IC effectiveness
OU B Marine	Industrial Suquamish Tribe's Usual and Accustomed Fishing Area[1]	Marine Sediment Marine Tissue	• PCBs • Mercury • PAHs • Pesticides • Metals	• Reduce the concentration of PCBs in sediment to below the minimum cleanup level (MCUL; defined in Section 9.3) in the biologically active zone (0- to 10-cm depth) within OU B Marine, as a measure expected to reduce PCB concentrations in fish tissue • Control shoreline erosion of contaminated fill material at Site 1 • Selectively remove sediment with high concentrations of mercury co-located with PCBs	• Dredging of sediment • Confined Aquatic Disposal • Enhanced Natural Recovery • In Situ Capping • Habitat Restoration • Shoreline Stabilization at Site 1 • Monitoring • Maintenance • Institutional Controls • Natural Recovery	• Marine sediment sampling • Hydrographic survey • Sub bottom profiling survey • Tissue sampling • CAD Pit sampling • Evaluation of IC effectiveness
OU B Terrestrial	Industrial	Soil	• Metals-arsenic • TCE • PAHs • PCBs • Pesticides	Continue to limit human exposure to site soils and groundwater	• Stormwater system restoration • Paving • Shoreline stabilization • Institutional Controls • Groundwater monitoring • Remedy maintenance	• Inspection and maintenance • Long term monitoring • Evaluation of IC effectiveness

Table 4-1. (Continued) Summary of Remedial Actions

OU	Reasonably Anticipated Land Use	Media	COC	Remedial Action Objectives	Remedy Components	Ongoing Operation, Maintenance and Monitoring
OU B Terrestrial (Con't)				Reduce the potential for chemical transport and control the threat of recontamination of the adjacent marine environment from: • Accumulation of sediment or debris in the stormwater system • Infiltration of soil and groundwater into the stormwater system • Infiltration of surface water into site soil • Erosion of shoreline soil		
		Groundwater	Metals- arsenic Total PCBs	Continue to limit human exposure to site soils and groundwater Reduce the potential for chemical transport and control the threat of recontamination of the adjacent marine environment from: • Infiltration of soil and groundwater into the stormwater system • Infiltration of surface water into site soil	• Paving • Groundwater monitoring • Remedy maintenance	• Long-term groundwater monitoring • Evaluation of IC effectiveness
OU C	Industrial	Groundwater	Bunker C Fuel Oil	The objective of the CAP is to prevent migration of free and dissolved phase petroleum hydrocarbon contamination from affecting Dry Dock 6 and Sinclair Inlet to protect human health and the environment	• Prohibit activities at OU C that interfere with monitoring activities • Prohibit activities at OU C that may result in the release of petroleum hydrocarbon contamination, which is contained on site as part of the cleanup action • Notify Ecology of the Navy's intent to convey any interest in the site • Notify Ecology of any proposal to use the site in a manner inconsistent with the land use restrictions	• Long-term groundwater monitoring • Evaluation of IC effectiveness
OU D	Industrial	Soil	VOCs-Tetrachloroethene cPAHs (total) Pesticides – 4,4 DDT, Dieldrin, Endrin Metals – Arsenic, cadmium, copper, mercury, zinc	Reduce the potential for chemical transport to the adjacent marine environment from: • Accumulation of sediment or debris in the stormwater system • Infiltration of soil and groundwater into the stormwater system • Infiltration of surface water into the soil Continue to limit exposure to site soils and groundwater	• Site-wide capping • Stormwater system contaminated sediment removal • Institutional controls • Groundwater monitoring	• Evaluation of IC effectiveness
		Groundwater	Metals- arsenic, cadmium, copper, mercury, zinc Pesticides –4,4 DDT, Dieldrin, Endrin	Reduce the potential for chemical transport to the adjacent marine environment from the following: • Infiltration of soil and groundwater into the stormwater system Continue to limit exposure to site soils and groundwater	• Site-wide capping, • Groundwater monitoring	• Long-term groundwater monitoring • Evaluation of IC effectiveness
OU NSC	Industrial	Soil	Metals- lead Total TPH Individual PAHs Total PCBs	Reduce human exposure to the COCs and reduce or control the contamination of groundwater	• Measures to enhance existing site paving • Accumulation of soil, fill and miscellaneous debris that clog many of the stormdrain lines at OU NSC will be removed from the lines and disposed of appropriately • Institutional Controls - Specific ICs will be implemented at OU NSC. Navy will develop an excavation management plan with which all future construction projects will be required to comply	• Inspection and maintenance of pavement and storm drains • Evaluation of IC effectiveness

Table 4-1. (Continued) Summary of Remedial Actions

OU	Reasonably Anticipated Land Use	Media	COC	Remedial Action Objectives	Remedy Components	Ongoing Operation, Maintenance and Monitoring
OU NSC (Con't)					• Monitoring- The Navy will develop and implement a plan for regular environmental monitoring at OU NSC, subject to review and approval by Ecology and the EPA • Review- The results of the remedial action and environmental monitoring program will be reviewed with Ecology and the EPA at least every 5 years	
		Groundwater	Metals-Arsenic, Copper, lead, Nickel Pesticides-Alpha-BHC, alpha-chlordane, 4,4-DDT, gamma-Chlordane Total PCBs Total TPH	Reduce the potential for arsenic, copper, nickel, lead, pesticides, PCBs, and TPH to reach the groundwater, to the extent feasible, using technologies that are implementable and effective for the site	• Measures to enhance existing site paving • Monitoring- The Navy will develop and implement a plan for regular environmental monitoring at OU NSC, subject to review and approval by Ecology and the EPA • EPA Review- The results of the remedial action and environmental monitoring program will be reviewed with Ecology and the EPA at least every 5 years	• Groundwater monitoring • Evaluation of IC effectiveness
		Surface water	Metals- arsenic, copper, lead, nickel, zinc	Reduce the potential for COCs to be introduced into water flowing through the storm drains and thus discharged to Sinclair Inlet	• Accumulation of soil, fill and miscellaneous debris that clog many of the stormdrain lines at OU NSC will be removed from the lines and disposed of appropriately • Monitoring- The Navy will develop and implement a plan for regular environmental monitoring at OU NSC, subject to review and approval by Ecology and the EPA • EPA Review- The results of the remedial action and environmental monitoring program will be reviewed with Ecology and the EPA at least every 5 years	• Inspection and maintenance of pavement and storm drains • Evaluation of IC effectiveness
		Storm drain sediment	PAHs, PCBs Metals- arsenic, lead, cadmium, copper, zinc	Reduce the potential for COCs in storm drain sediment to be discharged to Sinclair Inlet	• Accumulation of soil, fill and miscellaneous debris that clog many of the stormdrain lines at OU NSC will be removed from the lines and disposed of appropriately • Monitoring- The Navy will develop and implement a plan for regular environmental monitoring at OU NSC, subject to review and approval by Ecology and the EPA • EPA Review- The results of the remedial action and environmental monitoring program will be reviewed with Ecology and the EPA at least every 5 years	• Inspection and maintenance of pavement and storm drains • Evaluation of IC effectiveness

Note:
[1] Sinclair Inlet is an exclusive portion of the Suquamish Tribe's adjudicated Usual and Accustomed fishing area that is reserved under the 1855 Treaty of Point Elliott. The Tribe's treaty reserved fishing rights are firmly established as a matter of federal law and are co-located with the Navy's facilities in Sinclair Inlet. The Tribe harvests several species of finfish within Sinclair Inlet and intends to harvest shellfish that is safe to consume in the future. The Navy and Tribe work on a government-to-government basis to respectfully and fairly address each party's federal interests without interference.
The table reflects the exact wording in the ROD for each OU.
Data Sources: Navy, 1996; Navy, 1997; Navy, 2000; Navy, 2004a; Navy, 2005; Navy, 2007e; Navy, 2016b.

Table 4-2. Monitoring during this Five-Year Review Period for Operable Unit A

Chemical	Sampling Events				
	Fall 2012	Fall 2013	Fall 2014	Fall 2015	2016
Well Location 203					
Total Metals- Arsenic	✓	✓	✓	X	✓
Total Metals - Copper	✓	✓	✓	X	✓
Well Location 204					
Total Metals – Arsenic	✓	X	✓	X	✓
Total Metals - Copper	✓	X	✓	X	✓
Total Metals - Nickel	✓	X	✓	X	✓
Total Metals - Zinc	✓	X	✓	X	✓
Well Location 206					
Total Metals -Arsenic	✓	✓	✓	✓	✓
Total Metals - Copper	✓	✓	✓	✓	✓
Well Location 241					
Total Metals – Arsenic	✓	X	✓	X	✓
Total Metals - Copper	✓	X	✓	X	✓
Total Metals - Zinc	✓	X	✓	X	✓
Total Metals - Nickel	✓	X	✓	X	✓
Well Location 346					
Total Metals – Arsenic	✓	✓	✓	✓	✓
Total Metals - Copper	✓	✓	✓	✓	✓
Total Metals - Nickel	✓	✓	✓	✓	✓
Total Metals - Zinc	✓	✓	✓	✓	✓
Total Metals - Lead	✓	✓	✓	✓	✓

Notes:
✓ - analyte included in monitoring round
X - analyte not included in monitoring round
Data sources: Navy, 2011b; Navy, 2012i; Navy, 2013g; Navy, 2014g; Navy, 2016f.

Table 4-3. Monitoring during this Five-Year Review Period for Operable Unit B Terrestrial

Chemical	2012	2013	2014	2015	2016
Well Location 406R					
TPH-D	✓	✓	✓	X	✓
Free Product Thickness Measurement	✓	✓	✓	✓	✓
Well Location 410R					
Total Metals- Nickel	✓	✓	✓	✓	✓
Total Metals -Zinc	✓	✓	✓	✓	✓
Total Metals -Mercury	✓	✓	✓	✓	✓
TCE	✓	✓	✓	X	✓
Pesticides[a]	X	X	X	✓	X
Well Location 432					
TCE	✓	✓	✓	X	✓
Pesticides[a]	X	X	X	✓	X
Well Location 428R					
TPH-D	✓	X	✓	X	✓
TPH-O	X	X	X	X	✓
Free Product Monitoring	✓	✓	✓	✓	✓
Well Location 811a					
TPH-D	X	X	✓	X	✓
TPH-O	X	X	✓	X	✓
Well Location 433					
Pesticides[a]	X	X	X	✓	X
Well Location 704					
TCE	✓	✓	X	X	X
Pesticides[a]	X	X	X	✓	X
Well Location 707					
TCE	X	X	✓	X	✓
Pesticides[a]	X	X	X	✓	X
Well Location LTMP-1					
Total Metals - Copper	✓	✓	✓	✓	✓
Total Metals - Nickel	✓	✓	✓	✓	✓
Total Metals - Zinc	✓	✓	✓	✓	✓
Total Metals- Mercury	✓	✓	✓	✓	✓
Pesticides[a]	X	X	X	✓	X
Well Location LTMP-2					
Pesticides[a]	X	X	X	✓	X
Well Location LTMP-3					
Total Metals - Arsenic	✓	✓	✓	✓	✓
Total Metals -Copper	✓	✓	✓	✓	✓
Total Metals -Nickel	✓	✓	✓	✓	✓
Total Metals -Zinc	✓	✓	✓	✓	✓
Total Metals -Mercury	✓	✓	✓	✓	✓
Pesticides[a]	X	X	X	✓	X
Well Location LTMP-4					
Total Metals- Arsenic	✓	✓	✓	X	X
Total Metals- Copper	✓	✓	✓	X	X
Total Metals - Nickel	✓	✓	✓	X	X
Pesticides[a]	X	X	X	✓	X

Table 4-3 (Continued). Monitoring during this Five-Year Review Period for Operable Unit B Terrestrial

Chemical	2012	2013	2014	2015	2016
Well Location LTMP-5					
Total Metals- Hg	✓	✓	✓	✓	✓
Pesticides[a]	✓	✓	X	✓	X
Well Location 346					
Total Metals- Arsenic	✓	✓	✓	✓	✓
Total Metals-Copper	✓	✓	✓	✓	✓
Total Metals-Lead	✓	✓	✓	✓	✓
Total Metals- Nickel	✓	✓	✓	✓	✓
Total Metals-Zinc	✓	✓	✓	✓	✓
Total Metals-Mercury	✓	✓	✓	✓	✓
TCE	X	✓	✓	X	✓
Pesticides[a]	✓	✓	X	✓	X
TPH-D	✓	✓	✓	X	✓
TPH-O	✓	✓	✓	X	✓
TPH-G	X	X	✓	X	X
Sinclair Inlet					
Total Metals- Cadmium	✓	✓	X	X	X
Pesticides[a]	✓	✓	X	X	X

Notes:
✓ - analyte included in monitoring round
X - analyte not included in monitoring round
[a]Includes 4,4'-DDE, 4,4'-DDT, aldrin, dieldrin, and heptachlor epoxide
Date sources: Navy, 2011b; Navy, 2012i; Navy, 2013g; Navy, 2014g; Navy, 2016f.

Table 4-4. Non-LTM Monitoring during Fourth Five-Year Review Period

Year	Purpose	OU B Terrestrial	Purpose	OU NSC
2012	**1,3**	**VOCs** - Wells 410R, 432, 704, 809, 810, 811, 904, 905, 907	**1,3**	**VOCs** - well 902.
	2	**Low-level Mercury** - Wells 900, 901, 346 and Sinclair Inlet[a].	**2**	**Low-level mercury** -well 902, 346, Sinclair Inlet.
	4	**Pesticides**- Wells 903, 346 and Sinclair Inlet[a].	**5**	**TSS** -wells 392R, 346 and Sinclair Inlet.
	4	**Metals (Dissolved cadmium)** - Wells 903, 346 and Sinclair Inlet[a].		
	5	**TSS**- Wells 346, 432, 810, 903, 905, 406R, 410R, 428R, LTMP-1, LTMP-3, LTMP-4, LTMP-5, and Sinclair Inlet[a]		
2013	**1,3**	**VOCs** - Wells 410R, 432, 704, 809, 810, 811, 904, 905, 907, 425, 346	**1,3**	**VOCs** - well 902 and 346
	2	**Low-level mercury** - wells 900, 901, 903, 346 and Sinclair Inlet [a]	**2**	**Low-level mercury** - well 902, 346 and Sinclair Inlet.
	4	**Pesticides**- Wells 903, 346 and Sinclair Inlet[a].	**5**	**TSS** - wells 392R, 346 and Sinclair Inlet.
	4	**Metals (Dissolved cadmium)** - Wells 903, 346 and Sinclair Inlet[a].		
	5	**TSS**- Wells 346, 432, 810, 903, 905, 406R, 410R, LTMP-1, LTMP-3, LTMP-4, LTMP-5, and Sinclair Inlet[a]		
	3	**TPH-gasoline (-G), TPH-diesel (-D) and TPH-residual (-R)** - well 811, product from well 811, and product from an underground tank observed near the well was sampled.		
2014	**2**	**Low-level Mercury** - wells 900, 901, 346 and Sinclair Inlet[a]	**1,3**	**VOCs** - well 902
			2	**Low-level mercury**-well 902, 346, Sinclair Inlet.

Purpose codes explanation:
The non-LTM program was performed in support of groundwater investigations to assess:
1 Vapor intrusion
2 Mercury presence, concentration, and extent
3 VOC presence, concentration, and extent
4 Protectiveness of the OU D remedy and potential infiltration of contaminants into OU B Terrestrial
5 Support USGS investigations
[a]Sinclair Inlet is not part of OU B Terrestrial.
Data sources: Navy, 2012h; Navy, 2013b; Navy, 2013c; Navy, 2014h.

Table 4-5. Monitoring during this Five-Year Review Period for Operable Unit NSC

Chemical	2012	2013	2014	2015	2016
Well Location 310R					
Total Metals -Arsenic	✓	✓	✓	X	✓
Total Metals -Copper	✓	✓	✓	X	✓
Total Metals - Lead	✓	✓	✓	X	X
Total Metals - Nickel	✓	X	✓	X	✓
Well Location 380					
Total Metals - Arsenic	✓	X	✓	X	✓
Total Metals -Copper	✓	X	✓	X	✓
Total Metals - Nickel	✓	✓	✓	X	✓
Well Location 386					
Total Metals -Arsenic	✓	✓	✓	X	✓
Total Metals -Copper	✓	X	X	✓	✓
Well Location 392R					
Total Metals -Arsenic	✓	X	✓	X	✓
Total Metals - Copper	✓	X	✓	X	✓
TPH-D	✓	X	✓	X	✓
TPH-O	✓	X	✓	X	✓
Free Product Thickness Measurement	✓	✓	✓	✓	✓
Well Location 346					
Total Metals - Arsenic	✓	✓	✓	X	✓
Total Metals - Copper	✓	✓	✓	✓	✓
Total Metals - Lead	✓	✓	✓	X	X
Total Metals - Nickel	✓	✓	✓	X	✓

Notes:
✓ - analyte included in monitoring round
X - analyte not included in monitoring round
Data sources: Navy, 2011b; Navy, 2012i; Navy, 2013g; Navy, 2014g; Navy, 2016f.

Table 4-6. BNC Institutional Controls

Operable Unit	Institutional Control Requirement Document	Institutional Control Implementation Documents (see list in Notes)	Institutional Controls					
			Access Control	Harvest Restriction	Dredging and Construction Restrictions (CAD Pit	Groundwater Restriction	Excavation Management	Land Use Restrictions
OU A	OU A ROD (Navy et al., 1997)	a, b, c, d, e	✓	✓	X	✓	✓	✓
OU B Marine	OU B Marine ROD (Navy et al., 2000)	a, b, c (see additional notes in sec 4.2 and 4.7)	✓	X	✓	X	✓*	✓
OU B Terrestrial	OU B Terrestrial ROD (Navy et al., 2004)	a, b, c, d, e	✓	X	X	✓	✓	✓
OU C	OU C Cleanup Action Plan (Navy, 2007e)	b, c, d, e	X	X	X	X	X	✓
OU D	OU D ROD (Navy et al., 2005)	f	X	X	X	✓	✓	✓
OU NSC	OU NSC ROD (Navy et al., 1996)	a, b, c, d, e	✓	X	X	✓	✓	✓

Institutional Control Implementation Documents:

a. O&M and IC Plan (Navy, 2008a; 2016b). Only Site 1 in OU B Marine is covered by the current plan.
b. Naval Base Kitsap Shipyard Anti-Terrorism/Force Protection Plan - NAVBASEKITSAPINST 5530.6 CH-5 (Navy, 2008c)
c. Puget Sound Naval Shipyard Physical Security Plan – PSNS&IMFINST P5530.1B, (Navy, 2015l)
d. Memorandum of Agreement for Excavation Management at Naval Base Kitsap Bremerton (Navy, 2007a)
e. Land Use Controls at Puget Sound Naval Shipyard and Intermediate Maintenance Facility (PSNS & IMF) Bremerton Site and Naval Base Kitsap - PSNS&IMFINST 5090.50/NAVBASEKITSAPINST 5090.14 (Navy, 2007b)
f. Memorandum of Agreement between Navy and City of Bremerton (Navy, 2013i)

✓ - institutional control required for Operable Unit

X - institutional control not required for Operable Unit

*The excavation management is applicable only to the Site 1 portion of OU B Marine.

Data sources: Navy, 2006b; Navy, 2008a; Navy, 2009c; Navy, 2014c; Navy, 2015c; Navy, 2016b.

5.0 PROGRESS SINCE LAST FIVE-YEAR REVIEW

Since the third five-year review in October 2012, the Navy has completed or made significant progress on all but two of the actions recommended by that review. The status of each of the recommendations was documented in the addendum to the third five-year review in June 2016 (Navy, 2016a), which was required because protectiveness for three OUs was deferred in the third five-year review, pending additional data collection.

The recommended actions from the third five-year review and notes regarding their completion or progress are summarized in Table 5-1.

Table 5-1. Summary of Progress Since Last Five-Year Review

Item No.	Recommendation/ Follow-Up Action	Completion Date	Notes Regarding Completion	Reference
General				
1	Develop and implement a reliable BNC-wide program for executing repair work for pavement and storm drains in a timely manner after maintenance requirements are identified. Clearly document completed repairs and catch basin cleaning.	Ongoing	Pavement repairs at BNC are implemented routinely, both in conjunction with MILCON projects and as stand-alone projects. As with all projects at BNC, paving projects are prioritized based on how critical a project is in supporting the mission of the war fighters and what the impacts are to facility operations. The 2016 Annual Remedy Inspection Report has documented less than 3% poor pavement overall (within paved areas of OU A, OU B Terrestrial, and OU NSC). Additionally, paving projects have been completed since the time of the inspection and currently there are two projects with large paving components in progress in areas where poor pavement was identified during the 2016 annual inspection. Pavement condition statistics will continue to be updated in the Annual Remedy Inspection Report. Catch basins identified as requiring maintenance are reported to the NBK – Bremerton Public Works Department for follow-up. NBK – Bremerton Public Works Department cleans accessible stormwater system catch basins at least annually.	Navy, 2017a
2	Revise the IC plan to include a provision for assessing the potential for vapor intrusion resulting from future remodeling in the TCE northern plume area.	March 2014	Beginning with the March 2014 revision of the IC plan, the Navy has included a provision for assessing the potential for vapor intrusion resulting from future remodeling in the TCE northern plume area.	Navy, 2016b
3	Update the IC plan to ensure that new discoveries are promptly reported to EPA. Improve the administrative processes for implementing the plan.	March 2016	In the kick-off meeting for the Fourth Five-Year Review, the stakeholders and the Navy agreed that the IC Plan was not the appropriate location for emergency notification procedures and that notifications should be via shipyard procedures and instructions. Subsequent to this meeting, the Navy Terrestrial and Marine RPMs	Navy, 2016j; Navy, 2016k

Table 5-1 (Continued). Summary of Progress Since Last Five-Year Review

Item No.	Recommendation/ Follow-Up Action	Completion Date	Notes Regarding Completion	Reference
3 (Con't)			determined that NAVBASEKITSAPINST 5401.1B issued March 28, 2016 includes Navy internal and external notification requirements for significant environmental issues.	
OU A				
4	Complete the 90 percent design of the remedy repair. Sample and analyze intertidal sediment as part of OU B Marine monitoring. Depending on the results of the sampling, consider the need for upland sampling or design modifications.	October 2015	The Navy completed the 100% design of a remedy repair. The Navy sampled and analyzed intertidal sediment as part of OU B Marine monitoring. The intertidal surface sediment results presented in the 2014 Phase II Marine Monitoring Report indicate that there is no apparent impact to surface sediment quality.	Navy, 2015a; Navy 2016c
OU B Terrestrial				
5	Complete the analysis of ongoing transport of metals COCs from the terrestrial to marine environment, as well as potential remedies.	February 2017	Mercury (COC for OU B marine) was evaluated in the Supplemental Mercury Investigation Report.	Navy, 2017c; USGS unpublished reports
OU B Marine				
6a	Collect additional data to reflect current conditions in Sinclair Inlet and reduce uncertainties associated with the data that were used for the human health risk evaluation technical memorandum.	February 2017	The 2014 OU B Marine Phase 2 Long-term Monitoring Report was finalized in 2016; the Supplemental Mercury Investigation Report was finalized in early 2017.	Navy, 2015b Navy, 2016c; Navy, 2016g; Navy, 2017c

Table 5-1 (Continued). Summary of Progress Since Last Five-Year Review

Item No.	Recommendation/ Follow-Up Action	Completion Date	Notes Regarding Completion	Reference
6b	Perform a focused feasibility study to document and collate studies related to mercury in sediment, and identify and evaluate potential approaches for reducing human health risks from mercury in Sinclair Inlet. The study will include an evaluation of source control (contaminant transport from the uplands to the marine waters and sediment).	Pending	The focused feasibility study is expected to kick off in February 2018 based on the current OU B Marine schedule.	
6c	If data support, develop a ROD amendment or ESD to address mercury as a contaminant of concern, select cleanup levels and select the preferred alternative of the focused feasibility study.	Pending	Navy is planning to develop a ROD amendment or new ROD or ESD to address mercury as a marine COC, select cleanup levels and select the preferred alternative from the OU B Marine focused feasibility study.	
7	The Navy will make a detailed comparison between historical records regarding the CAD pit sediment cover placement and recent reports of possible thinning of the cover material.	January 2016	The Navy completed a comparison between historical records regarding the CAD pit sediment cover placement and reports of possible thinning of the cover material.	Navy, 2016d
8	Establish a process for evaluating the data generated from recent in-water construction projects relative to the protectiveness of the OU B Marine remedy. Consider the potential application of this process to other future data generated from outside of the OU B Marine long-term monitoring program.	Ongoing	The Navy included an initial evaluation of the data generated from recent in-water construction projects in the 2012 Marine Monitoring Report. This work has been superseded, as the Decision Framework Goals and Objectives document (Navy, 2017d) established a goal of determining how pre- and post-construction data sets, and other relevant data sets will or will not be integrated into the Decision Framework.	Navy, 2016d: Navy, 2017d
OU D				
9	Transition to EPA and Ecology the lead regarding engagement with the City of Bremerton and initiate a meaningful	May 2013	EPA led engagement with the City of Bremerton and initiated a meaningful dialog that allows additional assessment and effective IC inspections. The City of Bremerton now does annual IC inspections	Navy, 2015e; Navy, 2016e

Table 5-1 (Continued). Summary of Progress Since Last Five-Year Review

Item No.	Recommendation/ Follow-Up Action	Completion Date	Notes Regarding Completion	Reference
9 (Con't)	dialog that allows additional assessment and effective IC inspections.		in accordance with memorandum of agreement with Navy. Navy incorporates this inspection into the Annual Remedy Inspection Report for the BNC Terrestrial OUs.	
10	Finalize the existing remedy evaluation report prepared by the Navy without City input.	May 2013	The City of Bremerton did not provide comments on the Draft OU D Remedy Evaluation Report. Therefore, the Navy issued the report as final.	Navy, 2010a

6.0 FIVE-YEAR REVIEW PROCESS

6.1 Five-Year Review Team

The Navy is the lead agency for this five-year review. Project managers and other staff from the Navy, EPA, Ecology, and other stakeholder groups who were offered the opportunity to participate in the review process consisted of:

- Pamela Sargent, NAVFAC NW
- Yorick Wahaus, NAVFAC NW
- Bryan Ransom, NAVFAC NW
- Jai Jeffrey, NAVFAC NW
- Mark Wicklein, NAVFAC NW
- Rory Lee, NBK- Bremerton
- Carlotta Cellucci, NAVFAC NW
- Susan Moore, CH2MHill
- Karen Keely, EPA
- Chris Eckley, EPA
- John Evered, Ecology
- Mahbub Alam, Ecology
- Brittany Gordon, Washington Department of Fish and Wildlife
- Erika Shaffer, Washington State Department of Natural Resources
- Denice Taylor, Suquamish Tribe
- Tom Cressman, City of Bremerton
- Bonnie Arthur, EPA

Both the EPA and Ecology are cosignatories of the RODs for BNC, and Ecology approved the CAP for OU C. All stakeholders had the opportunity to provide input to this report and interview responses from those individuals who chose to participate are included in Appendix C.

6.2 Community Notification and Involvement

There are specific requirements pursuant to CERCLA Section 117(a), as amended, for certain reports to be released to the public and for the public to be notified of proposed cleanup plans and remedial actions. Community involvement activities are performed in accordance with the community relations plan for BNC (Navy, 2008b). The specific community notification and involvement activities performed over the last five-year review period are described below.

The Navy published a public notice of the five-year review process in November 2016 in the *Kitsap Daily News* and the *Kitsap Sun*. This notice also provided information as to when, where, and how the public could receive information and how to provide comments on the protectiveness of the remedy. There has been no public response resulting from the notice.

Because of a lack of community interest, there has been no Restoration Advisory Board meeting since the last five-year review, nor were any community members interviewed during this five-year review (see Section 6.6). The draft final five-year review report will be made available electronically at the NAVFAC NW public website: https://www.navfac.navy.mil/navfac_worldwide/atlantic/fecs/northwest/about_us/northwest_documents.html. A second public notice will be published to announce the availability of the final report. The final report will also be made available electronically at the NAVFAC NW public website.

6.3 Document Review

Documents reviewed during this five-year review were primarily those that established the remedies and those describing the monitoring of the selected remedies during the time period January 2012 through October 2016. Earlier documents were reviewed as needed to establish a complete summary of the site history. The primary documents that were reviewed are listed in Table 6-1.

6.4 Data Review

This section summarizes trends in chemical data collected through the various monitoring programs at BNC (as described in Section 4) from January 2012 through October 2016. Site inspection data are presented separately in Section 6.5. The implications of the data regarding the functionality and protectiveness of the remedies are discussed in Section 7.

6.4.1 Groundwater Data Review

For OUs A, B Terrestrial, C, D, and NSC, groundwater monitoring is included in the current comprehensive long-term groundwater monitoring program for BNC. Data generated by this program are reported in data summary reports produced following each sampling event and/or in annual trend analysis reports.

A statistical trend analysis agreed by the stakeholders has been performed for the detected COCs still being monitored for the period covering fall 2012 through fall 2016. The trend analysis uses the nonparametric Mann-Kendall test and an assessment of the coefficient of variation. The Mann-Kendall statistical test is used to determine whether an increasing or decreasing trend over time exists in a data set. The coefficient of variation assessment examines the stability of the measured values over time for wells that do not exhibit an increasing or decreasing trend. If no trend exists at the 80 percent confidence interval and the coefficient of variation is less than or equal to 1, the concentrations are considered stable. However, if the coefficient of variation is greater than 1, the concentrations are not considered stable, but rather variable over time.

The long-term and recent data trends are described in the sections that follow.

6.4.1.1 OU A Groundwater Monitoring Data

The RGs specified in the ROD for groundwater at OU A were set at concentrations protective of beneficial uses of surface water which included federal and state ambient water quality criteria for human health based on fish and shellfish ingestion and on the protection of biota. In addition, RGs were selected as practical quantitation limits (PQLs) and ambient groundwater concentrations (Navy et al., 1997) in those circumstances where it would have been technically impractical to achieve the surface water quality criteria.

Figure 6-1 provides the RGs for established COCs at OU A. Ambient values were established for inorganic elements based on statistical analysis of upgradient wells. The ambient values provided for inorganic elements are based on ambient background levels for total inorganics in groundwater (BNC-only), as presented in Appendix T of the final RI report for OU B dated March 2002 (Navy, 2002c). Note that the data reported for well 346 are associated with a background monitoring location and do not represent conditions at OU A.

Figure 6-1 shows the locations of the OU A LTM monitoring wells. The August 2012 through October 2016 data for OU A are presented in Figure 6-1. The results of the rolling trend analysis for OU A (Navy, 2017b) showed that, for most detected COCs, the concentration trend over the last 10 years (2006 through 2016) either exhibits no trend or an increasing trend, but in all cases, concentrations do not substantially differ from concentrations reported since monitoring began in 2002. For all COCs but lead, concentrations at most monitoring wells remain above the RGs. Current and long-term trends in COC data for the metals still being monitored at OU A are discussed in the sections below by COC.

Total Arsenic

Arsenic concentrations in groundwater continue to be above the RG of 0.5 micrograms per liter (µg/L) in all four monitoring wells. For wells 204 and 206, arsenic concentrations have remained relatively unchanged since monitoring began in 2002 and have been consistently below the ambient concentration of 5 µg/L. For wells 203 and 241, arsenic concentrations continue to be above the ambient concentration; however, recent concentrations measured in these two wells are similar to those concentrations detected at the time the ROD was executed.

Total Copper

Copper concentrations in groundwater have remained consistently above the RG of 2.5 µg/L and the ambient concentration of 2.2 µg/L at monitoring wells 204 and 241. For well 203, copper concentrations had been below the RG since 2009, but copper was detected above the RG in the September 2016 monitoring event (2.73 µg/L). Copper analysis was discontinued at well 206 after the February 2007 monitoring event because copper concentrations were consistently below the RG for eight consecutive monitoring events. The trend analyses conducted for the three wells indicated increasing copper concentrations wells 204 and 241 and no discernable trend at

well 203. Even though recent concentrations appear to be increasing, concentrations measured in these wells are similar to those concentrations detected at the time the ROD was executed.

Total Nickel

Nickel concentrations in groundwater have been consistently below the RG, except at wells 204 and 241, where the concentrations have been consistently above the RG. The current nickel concentrations in these wells are slightly higher than at the time of the ROD. The recent data imply no discernible trend in nickel concentrations at wells 241 and 206 and a decreasing trend at well 204. Nickel analysis was discontinued in well 203 subsequent to the August 2008 monitoring event. Sampling has been conducted under the requirements of the comprehensive LTM plans covering all terrestrial OUs (Navy, 2011b, 2012i, 2013g, 2014g, and 2016f). Recommendations for adjusting monitoring frequencies for COCs were made through application of the decision criteria included in the OU A ROD (Navy et al., 2004a).

Total Zinc

Zinc concentrations in groundwater have been consistently above the RG (76.6 µg/L) at well 204 and more often than not in well 241. Although current zinc concentrations in wells 204 and 241 are slightly higher than at the time of the ROD, the trend analyses indicate no discernible trend in these wells. Zinc analysis was discontinued in wells 203 and 206 subsequent to the August 2008 and February 2007 monitoring events, respectively. As mentioned above, recommendations for adjusting monitoring frequencies for COCs were made through application of the decision criteria included in the OU A ROD (Navy et al., 2004a).

6.4.1.2 OU B Terrestrial Groundwater Monitoring Data

The OU B Terrestrial LTM program was initiated in summer 2004. Data from January 2012 through September 2016 were reviewed for this five-year review period.

Figures 6-2 and 6-3 show the locations of the OU B Terrestrial monitoring wells, the RGs for COCs, and the LTM results from this five-year review period. PMP results are shown on Figure 6-4. Because of the presence of the drydocks and their associated dewatering systems, evaluation of groundwater monitoring data and data trends is more complex at OU B Terrestrial than for the other terrestrial OUs. The original LTM plan for OU B Terrestrial (Navy, 2004b) established a method for estimating the extent of attenuation between the drydock compliance monitoring wells (410/410R, 432, 433, 704, 707, and LTMP-4) and the groundwater discharge points to Sinclair Inlet. The attenuation is assumed to be the result of natural seawater intrusion and seawater intrusion induced by the drydock dewatering systems. The basis for the estimate is the difference in salinity measured in the groundwater sample at a compliance monitoring well from that measured in surface water at the shoreline. The estimation method assumes that constituent concentrations in groundwater will be reduced by the ratio of groundwater salinity to that of Sinclair Inlet surface water salinity. This methodology is not applied to target analyte

concentrations in groundwater samples collected from shoreline wells LTMP-1, LTMP-2, LTMP-3, and LTMP-5, because these wells are located immediately adjacent to the shoreline.

The results of the trend analysis for OU B Terrestrial (Navy, 2017b) showed that, for most detected COCs at most monitoring locations, the concentration trend over the last 10 sampling events has been stable or decreasing. Several of the monitoring wells exhibit COC concentrations that consistently exceed the compliance criteria. At these monitoring wells, however, most COC concentrations are not significantly different from those at the time the ROD was executed, when it was "concluded through analyses of primary fate and transport mechanisms that site groundwater is sufficiently protective of the marine environment" (Navy et al., 2004a).

Current and long-term trends in COC data for metals, pesticides, TCE, and petroleum compounds still being monitored at OU B Terrestrial are provided in the sections below by COC. Petroleum compounds in groundwater, monitored under the PMP, include TPH-D and total petroleum hydrocarbons, oil range (TPH-O). The petroleum compound data generated during this five-year review period are summarized below.

Dissolved Arsenic

Arsenic was not detected above the ambient level of 5 µg/L in the OU B Terrestrial monitoring well LTMP-3 and LTMP-4 during this five-year review period (Figure 6-2). Concentrations of arsenic in LTMP-3 and LTMP-4 have remained relatively the same since the ROD was signed. Dissolved arsenic analysis has been discontinued in wells 704, 707, LTMP-1, LTMP-2, LTMP-5, 410R, 432 and 433.

Dissolved Copper

Copper is consistently detected at dissolved concentrations substantially above the compliance criterion of 3.1 µg/L in wells LTMP-1 and LTMP-3 (measured concentrations up to 150 µg/L [Figure 6-2]) during this five-year review period. Copper concentrations at LTMP-1 and LTMP-3 are increasing and stable, respectively, and are not notably different than concentrations detected historically in these wells. Copper concentrations at well LTMP-1 have been an exception to the rule with recent COC concentrations falling within the historical range of concentrations. The concentrations were higher in 2013 and 2014, dropped in 2016 but remained higher than the historical maximum. Dissolved copper analysis has been discontinued in all of the OU B Terrestrial wells, except for LTMP-1 and LTMP-3.

Total Mercury

Starting in fall 2008, the Navy elected to provide low-level mercury results using EPA Method 1631 for the 10 OU B Terrestrial wells in order to report results at or below the mercury groundwater compliance criterion of 0.025 ug/L. Prior mercury analysis was performed using

routine sampling and laboratory methods, where EPA SW-846 Method 7470 provided a reporting limit of 0.20 ug/L. The low-level sampling and analysis methodologies continue to provide low-level mercury results. Regulatory approval of this change was documented through regulatory review approval of the sampling and analysis plan covering the 2008 sampling event (Navy, 2008d). During this five-year review period, total mercury was consistently detected above the compliance criterion (0.025 µg/L) in wells LTMP-1 (up to 0.409 µg/L) and LTMP-3 (up to 3.33 µg/L) (Figure 6-2). Total mercury was detected once above the compliance criterion in well LTMP-5 in February 2014 (0.0304 µg/L). Based on the results of the trend analysis, mercury concentrations were indicated to be increasing in LTMP-1, whereas decreasing and no discernible trends were noted for 410R, LTMP-3, and LTMP-5.

Dissolved Nickel

Dissolved nickel is consistently detected above the compliance criterion of 8.2 µg/L in wells LTMP-1 and LTMP-3 (Figure 6-2). The highest dissolved nickel concentration measured in these wells during this five-year review period was 25.7 µg/L in well LTMP-1. Dissolved nickel was not detected above the compliance criterion in well 410R and LTMP-4 during this five-year review period. Dissolved nickel concentrations are currently stable in well LTMP-1 and decreasing in wells LTMP-3 and 410R. Dissolved nickel analysis was discontinued in wells LTMP-2, LTMP-5, 432, 433, 707 and 704 subsequent to the October 2006 monitoring event.

Dissolved Zinc

Dissolved zinc is consistently detected above the compliance criterion of 81 µg/L in wells LTMP-1 and LTMP-3 (Figure 6-2). Dissolved zinc concentrations appear to be stable at LTMP-3 and exhibit an increasing trend at LTMP-1. Dissolved zinc analysis was discontinued in each of the OU B Terrestrial wells subsequent to the October 2006 monitoring event with the exception of wells LTMP-1 410R and LTMP-3. Zinc analysis was discontinued at well 410R after October 2012.

4,4′-DDE

4,4′-DDE is being sampled every five years at the OU B Terrestrial wells and was sampled during fall 2015 using the most up to date analytical methods with the lowest achievable PQL. 4,4′-DDE was not detected (Figure 6-3) during this five-year review period.

4,4′-DDT

4,4′-DDT is being sampled every five years at the OU B Terrestrial wells and was sampled during fall 2015 (Figure 6-3) using the most up to date analytical methods with the lowest achievable PQL. 4,4′-DDT was detected at a concentration above the compliance criterion in well LTMP-3 during the event. 4,4′-DDT has been consistently detected over time in LTMP-3

above the compliance criteria, but the concentration detected in 2015 is lower than in previous sampling events.

Aldrin

Aldrin was not detected in any of the OU B Terrestrial wells during this five-year review period (Figure 6-3). Aldrin is currently being sampled every five years and was sampled during fall 2015 during this five-year review period using the most up to date analytical methods with the lowest achievable PQL. As shown on Figure 6-3, the compliance criterion for aldrin is less than the analytical quantitation limit. The risk-based compliance criterion is technically impossible to achieve with currently-available analytical methods.

Dieldrin

Dieldrin was not detected in any of the OU B Terrestrial wells during this five-year review period. Dieldrin is currently being sampled every five years and was sampled during fall 2015 during this five-year review period (Figure 6-3) using the most up to date analytical methods with the lowest achievable PQL. As shown on Figure 6-3, the compliance criterion for dieldrin is less than the analytical quantitation limit. The risk-based compliance criterion is technically impossible to achieve with currently-available analytical methods.

Endrin

Endrin was not detected in any of the OU B Terrestrial wells during this five-year review period (Figure 6-3). Endrin is currently being sampled every five years and was sampled during fall 2015 during this five-year review period using the most up to date analytical methods with the lowest achievable PQL.

Heptachlor Epoxide

Heptachlor epoxide was not detected in any of the OU B Terrestrial wells during this five-year review period. Heptachlor epoxide is currently being sampled every five years and was sampled during fall 2015 during this five-year review period using the most up to date analytical methods with the lowest achievable PQL. As shown on Figure 6-3, the compliance criterion for heptachlor epoxide is less than the analytical quantitation limit. The risk-based compliance criterion is technically impossible to achieve with currently-available analytical methods.

Petroleum Compounds

During this five-year review period, annual free-product monitoring was conducted at wells 428R and 406R in OU B Terrestrial. Free product was not detected in wells 428R during the five-year review period. Free product was intermittently detected in well 406 at 0.01 feet

thickness during this five-year review period. Figure 6-4 shows the locations at BNC monitored for petroleum compounds.

Petroleum compounds at all wells monitored during the fall 2016 sampling event have been consistently either not detected or detected at concentrations below the compliance criteria (Figure 6-4). Petroleum analysis has been discontinued in wells 382, 412, 425, 704, 709, 713, 715/715R, 718, PMP-1, LTMP-1, LTMP-2, LTMP-3, and LTMP-5. Note that some of the petroleum monitoring locations shown on Figure 6-4 are not in OU B Terrestrial, but rather are within OU NSC.

Trichloroethene

TCE has been consistently detected in wells 410R, 432, and 707 (Figure 6-2). The recent trend analysis showed TCE concentrations exhibited a decreasing trend at wells 707 and 432 and stable at 410R. The wells where TCE is detected are located at the heads of drydocks, so the attenuation estimation is applicable. When the estimation is performed for the recent TCE concentration data (Navy, 2017b), estimated TCE concentrations discharging to Sinclair Inlet are below the ROD compliance criterion of 55.6 µg/L and the current regulatory cleanup level (MTCA Method B surface water cleanup level) of 12.8 µg/L (see Figure 6-2). A review of current applicable or relevant and appropriate requirements (ARARs) is included in Section 7.2.1. Estimated TCE concentrations in groundwater discharging to Sinclair Inlet, based on recent data, are around 1.21 µg/L (Navy, 2017b), much less than the ROD compliance criterion of 55.6 µg/L.

Data from OU B Terrestrial Non-LTM Investigations

As discussed in Section 4.3.4, the Navy conducted a plume characterization in the TCE northern plume area in 2013 (Figure 4-4) (Navy, 2013b). This area is located within OU B Terrestrial. The objective of this work was to improve the level and quality of data to fully characterize the northern VOC plume on Navy property at BNC. These additional characterization data were intended to be used in the event that a future land use change was planned, though no land use change was planned at the time or is currently planned. In addition to the plume characterization, the additional work also addressed a finding by contractors closing underground storage tanks during demolition of Building 871, which indicated the potential for cyanide in soil associated with a removed pipeline. The Navy conducted cyanide sampling in soil and groundwater. VOCs and cyanide were not reported in soil at concentrations above their respective MTCA Method B soil cleanup level or EPA residential or industrial regional screening levels (RSLs). The results of the soil and groundwater samples collected during this investigation are described in more detail in the paragraphs below. However, the three soil borings completed near former Building 871 were positioned up to 70 feet from the location of the former cyanide tanks because of access limitations. Because of site sampling location

limitations, the report recommended that future projects in the former Building 871 area consider potential cyanide presence. The data from this investigation is summarized in Appendix A.

The soil samples collected during January and February 2013 for the purpose of characterizing the TCE northern plume area did not contain any target compounds (1,1-dichloroethene [DCE], 1,2-dichloroethane [DCA], cis-1,2-DCE, carbon tetrachloride, chloroform, PCE, TCE, vinyl chloride and total cyanide) at concentrations greater than the MTCA Method B soil cleanup level or the EPA residential RSL (Appendix A).

TCE was detected in 15 of the 19 groundwater samples collected during January and February 2013 at concentrations ranging from 1.1 to 97 µg/L (Appendix A). Groundwater samples from three locations, MW-425 (97 µg/L), MW-432 (31 µg/L), and SB914 (9.6 µg/L), contained TCE concentrations greater than the maximum contaminant level (MCL) of 5 µg/L and 12 detections were greater than the most stringent TCE calculated residential vapor intrusion groundwater screening level of 0.9 µg/L (MTCA Method B calculated groundwater screening level [CGSL] for residential vapor intrusion).

PCE was detected in three of the 19 groundwater samples collected during January and February 2013 at concentrations ranging from 21 to 42 µg/L (Appendix A). The detections from locations MW-905 (36 µg/L), SB-909 (21 µg/L), and SB915 (42 µg/L) contained PCE concentrations greater than the MCL of 5 µg/L. These three detections were also greater than the most stringent PCE calculated residential vapor intrusion groundwater screening level of 12.5 µg/L (EPA residential CGSL for vapor intrusion).

Chloroform was detected in three of the 17 groundwater samples collected during January and February 2013 at concentrations ranging from 0.73 to 2 µg/L (Appendix A). The detections from locations MW-425 (2 µg/L), MW-704 (1.5 µg/L), and MW-907 (0.73 µg/L) contained chloroform concentrations greater the most stringent calculated residential vapor intrusion groundwater screening level of 0.7 µg/L (MTCA Method B and EPA residential CGSL for vapor intrusion).

The target analytes 1,1-DCE, 1,2-DCA, cis-1,2-DCE, carbon tetrachloride, vinyl chloride, and total cyanide were not measured in groundwater at concentrations greater than their respective CGSLs for vapor intrusion (Appendix A).

As the vapor intrusion follow-up report (Navy, 2012c) concluded, these groundwater concentrations do not pose an unacceptable risk based on the current building use and occupation. However, this conclusion could change if the building use or occupation changes.

Groundwater samples were collected from well MW-425 during 1995 and 2013. The TCE concentration remained consistent with a 1995 concentration of 96 µg/L with a 2013

concentration of 97 µg/L. However, the TCE concentration decreased in MW-707 groundwater samples from 11 to 1.7 µg/L.

6.4.1.3 OU C Groundwater Monitoring Data

During this five-year review period, the trigger level for TPH-diesel-range petroleum (0.5 mg/L) was exceeded once in groundwater samples collected from well GMWT-9 (Figure 6-5) on July 16, 2014 (Figure 6-5). The trigger level for TPH-oil-range petroleum (0.5 mg/L) was not exceeded in the groundwater sample collected from GMWT-9 during this five-year review period. All other results for all wells were below the trigger levels.

The 2016 Mann-Kendall statistical analysis for OU C concluded the following:

- **Well GMWT-9** – The well was sampled in 2012, 2013, 2014, 2015 and 2016. Statistical trend analysis was not performed on TPH-O because the data set contained greater than 20% non-detect data. The most recent trend analysis showed TPH-D with no trends and stable.

- **Well GMWT-23** – The well was sampled in 2015 and 2016 during this five-year review period. Statistical trend analysis was not performed on TPH-D and TPH-O because both data sets contained greater than 20% non-detect data.

In general, the extent and thickness of the floating petroleum product plume remained relatively consistent throughout this five-year period (Table 6-2). The product extent and thickness data do not indicate movement of the floating product plume towards Sinclair Inlet. Although the product thickness at individual wells has varied over time, the overall thickness and areal extent of the floating petroleum product plume have remained relatively stable.

6.4.1.4 OU D Groundwater Monitoring Data

OU B Terrestrial well LTMP-5 continued to serve as the conditional point of compliance well for groundwater for OU D, in accordance with the third five-year review (Navy, 2012a). The Navy monitors groundwater from OU D for endrin and dissolved cadmium. The location of well LTMP-5 is shown on Figure 6-3. The data summarized in Section 6.4.1.2 for monitoring well LTMP-5 are relevant to OU D. Well LTMP-5 was sampled for endrin during 2012, 2013, and 2015. Endrin was not detected at LTMP-5 during all the sampling events. Endrin has not been detected during any sampling event since inception of the LTM program. Dissolved cadmium, sampled at well LTMP-5 during 2012 and 2013, was below the compliance criterion during both sampling events.

6.4.1.5 OU NSC Groundwater Monitoring Data

Groundwater RAOs were developed for OU NSC for those COCs identified by comparing laboratory results to chemical-specific regulations and as a result of a baseline risk assessment (Navy et al., 1996). The regulations addressed in the RI report (Navy, 1995a) include MTCA cleanup levels that focus on water quality standards and human health exposure via direct contact or ingestion of groundwater or marine life. Figure 6-6 provides ROD RGs established for groundwater COCs at OU NSC. Ambient values were established for inorganic elements based on statistical analysis of upgradient wells. The ambient values provided for inorganic elements are based on ambient background levels for total inorganics in groundwater (BNC only), as presented in Appendix T of the final RI report for OU B dated March 2002 (Navy, 2002c).

The monitoring wells included in the OU NSC LTM are shown on Figure 6-6. The August 2012 through October 2016 data for OU NSC are also presented in Figure 6-6.

Petroleum compounds in groundwater, monitored under the PMP, include TPH-G, TPH-D, TPH as diesel and heavy oil (TPH-O), and benzene, toluene, ethylbenzene, and xylenes (BTEX). The petroleum compound data generated at OU NSC during this five-year review period are also summarized in Figure 6-4. Note that the data reported for well 346 are associated with a background monitoring location and does not represent conditions associated with historical activities at OU NSC.

Current and long-term trends in COC data for the metals still being monitored at OU NSC are provided in the sections below by COC.

Total Arsenic

Overall, arsenic concentrations have been consistently below the ambient level of 5 µg/L in all wells, and below the RG of 0.5 µg/L in wells 380 and 392R during this five-year review period. Although arsenic concentrations in wells 310R and 386 continue to exceed the RG, the trend analysis for these wells showed decreasing trends. Concentrations observed during this five-year review reporting period are within the range of concentrations observed prior to 2012.

Total Copper

Copper concentrations in groundwater have been below the RG of 2.5 µg/L in well 392R since February 2007. Up to two instances of exceedances were noted at wells 380, 310R and 386 over the last five years. Current copper concentrations are within the range of concentrations observed historically in wells 380 and 386, although an increasing concentration trend was implied for well 380 and a decreasing concentration trend for well 386. For well 310R, copper concentrations detected in 2014 and 2016 are higher than at the time of the ROD and trend analysis indicates an increasing concentration trend.

Total Lead

Lead concentrations in groundwater have been consistently below the RG of 5.8 µg/L since the time the ROD was executed, except for a single sample at well 392 in February 2003 (6.48 µg/L). Lead analysis was discontinued in all OU NSC wells subsequent to the October 2009 monitoring event with the exception of well 310R.

Total Nickel

Nickel concentrations in groundwater at OU NSC were consistently below the RG of 7.9 µg/L in well 386 and 392R between 2002 and 2007; therefore, nickel analysis was discontinued in these wells after February 2007. During this five-year review period, nickel concentrations exceeded the RG at well 380 during September 2012 (13.6 µg/L) and September 2016 (22.8 µg/L). Historical (prior to this five-year review period) exceedances of the nickel RG at well 380 have also been recorded. Nickel concentrations exceeded the RG at well 310R during September 2014 (7.94 µg/L) and September 2016 (9.64 µg/L). For both well 380 and 310R, trend analysis indicates nickel concentrations are stable with no trend.

Petroleum Compounds

During this five-year review period, TPH-D and TPH-O were frequently detected at concentrations above the compliance criteria at well 392/392R (Figure 6-4). Figure 6-4 shows the locations at BNC monitored for petroleum compounds. During this five-year review period, annual free-product monitoring was conducted at wells 392/392R in OU NSC. Free product was intermittently detected at well 392, at thicknesses recorded near 0.01 foot. Based on the precision of field instruments used to detect free product, a measurement of 0.01 foot of free product is commonly recorded as a "trace" of free product. Measurable free product is commonly or recorded at values greater than 0.01 foot.

6.4.2 Non-LTM Data Summary

As discussed in Section 4.3.4, groundwater monitoring was performed during this five-year review period outside of the LTM program (thus referred to as "non-LTM" data). The non-LTM groundwater monitoring was initiated in 2009 to assess:

- Vapor intrusion
- Mercury presence, concentration, and extent
- VOC presence, concentration, and extent
- Remedy protectiveness of OU D and potential migration of offsite contaminants into OU B Terrestrial

Non-LTM Groundwater Monitoring

Groundwater monitoring well locations included in the non-LTM program are depicted on Figure 6-7. As shown on this figure, some wells are currently sampled in support of the LTM program, but analyzed for additional COIs in support of non-LTM monitoring. Well 346, located near the northern BNC property line, was established as a background well to monitor background groundwater conditions. Samples obtained from well 346 are analyzed for a range of constituents to provide a reference for the evaluation of both LTM and non-LTM groundwater samples. Data tables from the non-LTM data reports are reproduced in Appendix A, and the data are presented in the subsections below.

The OU B Terrestrial and OU NSC non-LTM data summary is presented in Tables 6-3 and 6-4, respectively.

Results from Well 811

The 2013/2014 data discussion below includes a summary of the discovery of free-phase petroleum in well 811. This well was installed in 2010 as part of a vapor intrusion investigation, as summarized in the third five-year review. As reported in the Well Abandonment/Replacement Storm Drain Line Repair Report (Navy, 2015k), the well was drilled into a stormwater management line running from a catch basin to a manhole that ties into the industrial wastewater treatment system at BNC. The Navy provided notification of the diesel release to the Washington Department of Ecology's NW Regional Office on March 21, 2014. The release notification was assigned Ticket Number 647634 by Ecology. Following this investigation and conclusion, well 811 was replaced with well 811a in August 2014, and the pipeline penetrated by the well was repaired. Well 811INJ was also installed at the time of replacement of well 811, in the event that treatment of groundwater in the area was required. During excavation to repair the pipeline, it was found that the diesel fuel release was contained within a very small area proximal to the storm drain line breach. Soil containing TPH-D at concentrations greater than the MTCA Method A soil cleanup level was successfully removed during the excavation. Soil samples were collected from the final limits of the excavation as shown on Figure 6-8 and groundwater samples were collected from Well 811a (Figure 6-8) in 2014. The soil samples demonstrated that soil remaining in place did not contain petroleum constituents at concentrations above the MTCA Method A soil cleanup level for unrestricted use. The groundwater samples demonstrated that groundwater was not impacted at concentrations above the MTCA Method A groundwater cleanup levels.

6.4.2.1 Assessment of Non-LTM Data

The non-LTM data collection met the goals of the program, which was terminated in winter/spring 2014.

Groundwater data from the area of the TCE northern plume area provides a time-dependent data set for future assessment of vapor intrusion risks if building or land use in the area changes, as recommended by the 2013 sampling report (Navy, 2013b). The VOC concentrations in the time-dependent groundwater data were similar to those measured during the initial investigation and do not result in changes to the interpretation regarding VOC presence, concentration, or extent. Non-LTM sampling to assess mercury concentrations in groundwater showed a consistent exceedance of the mercury compliance criterion at one well: 901. Concentrations of mercury at well 901 are consistently one to two orders of magnitude lower that nearby shoreline LTM monitoring well LTMP-3. LTMP-3 is therefore a more conservative monitoring location for documenting mercury concentrations in groundwater in this area, and no change to the LTM program regarding mercury is warranted based on the non-LTM sample results.
The concentrations of endrin and cadmium in groundwater samples from well 903 did not exceed the compliance criteria during any of the non-LTM monitoring events, and were not indicative of any groundwater transport of these COCs from OU D to OU B Terrestrial.

6.4.3 OU B Marine Monitoring Data

The results of monitoring for OU B Marine within this five-year review period are presented in three marine monitoring reports (Navy, 2016c, 2016d, and 2016g). The results of this monitoring are summarized below.

6.4.3.1 Marine Sediment Sampling

Figure -6-9 shows the 500-foot square grid used to guide the marine sediment sampling within OU B Marine, and Figure 6-10 shows the 1,500-foot grid used to guide sampling in the remainder of Sinclair Inlet. Together these grids are the basis for characterizing marine sediment throughout Sinclair Inlet. Table 6-5 summarizes the results of the sampling using the 500-foot grid in 2012 and 2014, while Table 6-6 summarizes the results of sampling using the 1,500-foot grid. Table 6-7 presents the AWA concentrations of total PCBs and mercury for the 500-foot and 1,500-foot grid samples, as well as the combined inlet-wide area-weighted concentrations.

The 2014 AWA geomean concentration of total PCBs for the 500-foot grid was 1.6 mg/kgOC, compared to 6.7 mg/kg in 2003. The 2014 AWA arithmetic mean mercury concentration for the 500-foot grid was 0.66 mg/kg, compared to 1.0 mg/kg in 2003.

The 2014 AWA geomean PCB concentration for the 1,500-foot grid was 0.73 mg/kgOC, compared to 2.6 mg/kg in 2003. The 2014 arithmetic mean mercury concentration for the 1,500-foot grid was 0.42 mg/kg, compared to 0.50 mg/kg in 2003.The 2014 AWA geomean PCB concentration for the combined 500-foot and 1,500-foot grid was 0.85 mg/kgOC, compared to 3.2 mg/kg in 2003. The 2014 arithmetic mean mercury concentration for the combined grid was 0.47 mg/kg, compared to 0.60 mg/kg in 2003.

The OU B Marine ROD (Navy et al., 2000) stated that active remediation and natural recovery were predicted to result in the attainment of the MCUL of 3 mg/kgOC within 10 years. The 2014 sampling event represents conditions at 10 years, as active remediation was completed in March 2004. The 2014 AWA geomean PCB concentration in OU B Marine is below the MCUL of 3 mg/kgOC and the 2014 AWA geomean PCB concentration for Sinclair Inlet is below the cleanup goal of 1.2 mg/kgOC.

6.4.3.2 Hydrographic Survey

In 2012, bathymetric surveys were conducted at the CAD pit and along the OU A shoreline. The bathymetry was measured using precision multi-beam hydrographic survey techniques, in accordance with the U.S. Army Corps of Engineers Hydrographic Surveying Manual (USACE, 1994. Figure 4-3 shows the locations of the CAD pit and OU A shoreline cap area.

6.4.3.2.1 CAD Pit

The bathymetric survey revealed slight change in elevation at the CAD pit and an overall change of up to a total of 8 feet since construction was completed. This is believed to be primarily the result of anticipated consolidation and settling of the CAD pit contents and cap material, although there is a possibility some material has also been lost due to erosion. The rate of change in the CAD pit cover elevation appears to have been greatly reduced in the last two rounds of monitoring compared to the initial rounds. The current CAD pit cover elevation approximately matches the original pre-excavation elevation.

6.4.3.2.2 Cap/ENR Area Offshore of OU A

The cap and ENR remedial measures involved placement of clean sediment from the CAD pit excavation, along with surficial layers of imported gravel and quarry spalls in adjacent intertidal areas. Both the newly-placed sediment material and underlying sediment are sandy silt, and some gradual consolidation was expected to occur in the cap area following construction. Previous surveys found a decrease in elevation of portions of the nearshore cap of up to 4 feet. The 2010 and 2012 survey results show that an additional decrease in seafloor elevation of 1 to 2 feet has occurred in some portions of the nearshore cap.

Differences in elevations in the thick cap areas (and in the ENR area) may be due to consolidation, vertical accuracy of the individual surveys, equipment differences, differing vertical datums, horizontal accuracy of surveys, or use of different survey controls points. Survey results need to be revalidated to identify the reason or reasons for the differences in elevation to determine if protectiveness has been affected in the thick cap areas.

In the ENR area, the post-construction survey and the four subsequent surveys with a few minor exceptions track within 2 feet of each other. Inter-survey differences of this magnitude are considered to be within the range of expected variability. Loss of surface material in the ENR area could interfere with the goal of clean placed material gradually mixing with the native sediment. However, only a few locations are 2 feet lower than in the postconstruction survey.

Most of these locations are closely adjacent to the area planned for full capping and were actually covered with 4 to 8 feet of clean cover sediment. Changes in the seafloor elevation in such locations may be at least partially a result of consolidation of the surface cover.

6.4.3.3 CAD Pit Coring

A vibracore was used to collect through-cap cores at four locations at the CAD pit in 2012. Discrete samples from the cores were analyzed for PCBs, mercury, total organic carbon, percent moisture, and grain size in 2012. The CAD pit cap is made up of a 1-foot thick layer of imported sand material (primary sand cap) topped with a nominal 4-foot thick layer of clean sediment consisting of central Sinclair Inlet turning basin sediment and clean sediment from the CAD pit excavation. Field observations and grain size analyses suggest that all of the samples analyzed from the four cores were composed primarily of marine sediment. However, the core log for location C-2 records the presence of sand at a depth of 2.5 feet as well as in the 3.0 to 4.0 foot horizon. The measured PCB and mercury concentrations in the core samples appear to be comparable to or lower than those measured in the samples from the four 500-foot grid cells that overlap the CAD pit. The 2012 results do not appear to suggest any upward movement or release of contaminants is occurring.

6.4.3.4 Sub-Bottom Profiling Survey

A sub-bottom survey was conducted at the CAD pit in 2012. The sub-bottom data were acquired concurrently with the hydrographic data in 2012. The 2012 results of the sub-bottom profiling at the CAD pit suggest that the cap materials continue to form a contiguous cover over the pit, with a combined sand and sediment thickness ranging in most of the pit area from approximately 3 to 8 feet. However, there are small areas at the south edge of the pit and along the perimeter, respectively, where the thickness is as much as 10 feet and as little as 1 foot. This is generally consistent with reporting following completion of construction that the sediment placed atop the sand layer had an average thickness of 5.5 feet and ranged from 0.5 to 10 feet in thickness (Navy, 2002b). As noted below, sand was observed in 2012 at a depth of 2.5 feet in one of the cores collected at the CAD pit. For comparison, the 2010 sub-bottom profiling reported the presence of sand at a depth of slightly less than 2 feet. Sand was observed at depths ranging from 3-4 feet in two of the CAD pit cores in 2005, 2007, and 2010. Apparent thinning of the CAD pit cap material in some areas suggests the likelihood of ongoing mixing of sediment and sand as well as potential loss of cover sediment. There are a number of possible factors that could contribute to the apparent thinning of portions of the upper sediment cap layer. The fine-grained sediment typical of much of Sinclair Inlet may be continuing to consolidate, although this would have more of an effect on the overall depth of material in the pit than on the thickness of the uppermost sediment cover layer.

A sub-bottom profiling survey was conducted in 2014 using a series of northeast-to-southwest and northwest-to-southeast transects with approximately 50-foot spacing across the CAD pit.

Sub-bottom profiling technology creates cross-sectional acoustic images which are then interpreted at discrete points to assess the thickness of the cap material.

The results of the sub-bottom profiling in 2014 at the CAD pit suggest that the cap materials continue to form a contiguous cover over the pit, with a combined sand and sediment thickness ranging in most of the pit area from approximately 2 to 8 feet. However, there is a small area at the southwest corner of the pit where the cap thickness exceeds 10 feet and there are also limited areas along the outer perimeter of the pit where the cap is less than one foot thick. This is generally consistent with reporting following completion of construction that the sediment placed atop the sand layer had an average thickness of 5.5 feet and ranged from 0.5 to 10 feet in thickness.

6.4.3.5 Beach Sediment Sampling at Charleston Beach

The 2015 results from sampling and analysis of subtidal and intertidal sediments at Charleston Beach showed detections of mercury, arsenic, cadmium, chromium, copper, lead, silver and zinc. The maximum concentrations of these metals were below the sediment cleanup objective (SCO) established in the sediment management standards (SMS). However, sample CB-6 exceeded the natural background values shown in Table 6-8 for cadmium, copper, lead, and silver, and samples CB-1 and CB-3 also exceeded natural background for lead. Mercury was detected in all six samples, at concentrations ranging from 0.037 to 0.18 mg/kg. PCBs were not detected in any of the samples (Table 6-8), at reporting limits below the SCO. Figure 6-11 shows the sediment sampling locations at Charleston Beach.

These surface sediment results indicate that there is no apparent impact to surface sediment quality.

6.4.3.6 Sediment Sampling Associated with Military Construction Projects

As described in Section 4.2.3, pre- and post-construction marine sediment sampling has been a requirement for construction permits associated with construction projects that include in-water work within OU B Marine. In some cases, when the construction has involved removal of piers, the sampling has also included one-time collection of underpier samples to characterize portions of OU B Marine that are not normally accessible for sampling.

The 2012 OUB marine monitoring report (Navy, 2016d) presented an approach for assessing whether the construction project data would alter the AWA value calculated based on the OU B LTM data. Subsequent to the 2012 report, the Decision Framework Goals and Objectives document (Navy, 2017d) was finalized. This document states, “Until the Decision Framework is updated, only data collected for the LTM program (grids) will be used to calculate area-weighted averages. Other data may be evaluated for use as weight of evidence to further understand site conditions, such as identifying contaminant sources or evaluating areas not previously characterized.” Because the approach is still under discussion, the past construction project data,

and the construction project data from this five-year review period, are not discussed in detail in this report. The Pier 6 data are not included in this five-year review because the report has not yet been finalized. The data from the saltwater main break are included in Appendix A. All non-LTM data will be evaluated under the Decision Framework.

6.4.3.7 Tissue Sampling

English sole were sampled and analyzed as part of the 2012 and 2015 monitoring rounds (Table 6-9). English sole were collected in 2015 as part of the PSEMP. As documented in the 2015 marine monitoring report (Navy, 2016c), the average PCB concentration for 2015 sampling round is 0.030 mg/kg, wet weight. For comparison, the average English sole PCB concentrations in prior similar sampling included in the 2003, 2007, 2010, and 2012 LTM rounds were 0.106, 0.033, 0.033, and 0.068 mg/kg, wet weight. All average English sole PCB concentrations, including the most recent, exceed the cleanup goal of 0.023 mg/kg.

The 2015 average mercury concentration in English sole was 0.037 mg/kg, wet weight. The average English sole mercury concentrations in the 2003, 2007, 2010, and 2012 LTM rounds were 0.044, 0.025, 0.056, and 0.048 mg/kg, wet weight. No cleanup goal has been established for mercury in English sole tissue.

6.4.3.8 Other OU B Marine Sampling and Investigation Data

The 2013 sediment and marine tissue monitoring report (Navy, 2015b) presented the data generated from the 2013 sampling event in both graphical and tabular form. Basic statistics were provided for the data, broken out by medium, species, and sampling area. The data tables generated from this effort are provided in Appendix A. These data were evaluated as part of the Supplemental Mercury Investigation Report (SMIR; Navy, 2017c).

Data collected in association with the saltwater main break and Pier 6 fender pile replacement will be evaluated as part of the forthcoming Decision Framework. The Decision Framework goals document (Navy, 2017d) established a goal of determining how pre- and post-construction data sets, and other relevant data sets would or would not be integrated into the Decision Framework. Data collected in association with the saltwater main break are included in Appendix A. Data from the Pier 6 fender pile replacement are not yet available.

6.4.3.9 OU B Marine Monitoring Status and Ongoing Efforts

The 2014 sediment monitoring results (Table 6-8) demonstrate that PCB levels in sediment in OU B Marine have met the MCUL, and PCB levels throughout Sinclair Inlet have achieved the cleanup goal established in the ROD for the site. The Navy and stakeholders have agreed that a confirmatory round of monitoring will be conducted in 2018 to validate the 2014 LTM results and additional monitoring efforts will be evaluated as part of the implementation of the Decision Framework.

The Navy and the OU B Marine stakeholder team are working to address mercury–related human health risks associated with subsistence-level consumption of Sinclair Inlet marine species. In early 2017, this team completed the Decision Framework goals document (Navy, 2017d) and SMIR (Navy, 2017c). Currently, this team is completing tasks that will enable a focused feasibility study for mercury to be completed. The focused feasibility study may include development of site-specific cleanup goals for mercury in sediment and/or tissue to address human health risks from the consumption of mercury in Sinclair Inlet seafood.

6.5 Results of Site Inspections

Site inspections from 2012 through 2016 were conducted based on the O&M plan and IC work plan for BNC, and a site-wide inspection was performed as part of this five-year review (see Appendix B). During this five-year review period, the O&M plan was updated as an independent document in 2014 and 2015 (Navy, 2014c, 2015c). The IC work plan was also updated as an independent document in 2014 and 2015 (Navy, 2014b, 2015d). These two plans were consolidated into a single, updated plan in 2016 (Navy, 2016b). However, ICs for OU B Marine were not included in the latest IC plan.

This section describes the inspections carried out between 2012 and 2016 under the O&M and IC plans, as well as the site-wide inspection performed in 2016 as part of this five-year review. The O&M inspection results are presented by OU in Sections 6.5.1 through 6.5.4 and Tables 6-10 through 6-13, covering OU A, OU B Terrestrial, OU D, and OU NSC, respectively. Annual inspections are not required for OU C, however OU C was inspected as part of this five-year review (Table 6-14).

The annual O&M inspection reports summarize the results of the inspections of pavement and vegetative cover, catch basins, and shoreline stabilization and protection. The total area of marginal and poor pavement, and the length of cracks or deteriorated sealant, are summarized in Table 6-15 and compared to conditions in 2011 at the time of the third five-year review.

Annual IC inspections were conducted for the entire BNC complex throughout this five-year review period. The IC inspection results for BNC are presented on a site-wide basis in Section 6.5.5.

Review of the annual inspection reports in combination with the observations made during the five-year review site inspection indicate that the O&M and inspection of pavement and vegetative covers, shorelines, and ICs is effective overall, with the following improvement warranted.

- Shoreline inspection noted two areas of interest (Segment 4 in OU B Terrestrial and Segments 45 and 46 in OU A, as shown in Figure 6-12). In Segment 4, shoreline armoring has deteriorated and anthropogenic debris consistent with historical fill in the

area is present along the shoreline, indicating the need for a repair to prevent erosion of fill materials. Inspections at Segment 45 indicated that interim repair is eroding as evidenced by the gauge measurements. Frequent interim erosion control projects are necessary to prevent areas identified as having SMS exceedances from being exposed. The inspection for Segment 46 indicated a section devoid of armor rock; however, no signs of erosion were present. In addition, small gaps in the armor rock were noted near a treed area along with some concrete pieces, which appeared to be have been placed as armoring versus construction debris having eroded out of the shoreline.

- All shoreline segments except 41A and 41B were also inspected by Waterfront Facilities Inspection Program during this five-year review period (segments 8 through 40 in 2015 and segments 1 through 7 and 42 through 46 in 2016). Inspections indicate that the shoreline continues to be protected from erosion. (These segments will continue to be periodically inspected, prioritized for maintenance and maintained under this program). The armor rock shoreline segments (Figure 6-12) are currently stable.

6.5.1 OU A Inspection Results

Annual inspections were conducted at OU A throughout this five-year review period. Five primary activities were the subject of the annual inspections at OU A: pavement and vegetative cover, shoreline armoring and Charleston Beach erosion gauges, access controls, and catch basins. IC inspections, which also include the access controls, fencing, and signage, are discussed in Table 6-10.

6.5.2 OU B Terrestrial Inspection Results

Annual inspections were conducted at OU B Terrestrial throughout this five-year review period. Five primary activities were the subject of the annual inspections at OU B Terrestrial: pavement and vegetative cover, shoreline, catch basins, and fencing and signage. Shoreline inspections for OU B Terrestrial included inspection of Site 1, which is part of OU B Marine. IC inspections, which also include fencing and signage, are described in Table 6-11.

6.5.3 OU D Inspection Results

OU D was established to support the conveyance of land to the City of Bremerton for creation of a new city park in conjunction with ongoing development near the ferry terminal. OU D was evaluated for recreational use and transferred to the City of Bremerton by quit claim deeds (Navy, 2016b). The IC obligations for OU D are set forth in the provisions of these deeds. The shoreline adjacent to OU D to the high tide line is part of OU B Terrestrial and was not transferred to the City of Bremerton. It is included in the shoreline inspection for OU B Terrestrial in accordance with the IC work plan. A memorandum of agreement was established in May 2013 between the City of Bremerton and the Navy regarding the management and operations of OU D, including remedy inspections. This memorandum of agreement transfers responsibility for remedy inspections to the City of Bremerton. As the memorandum of

agreement was being negotiated, neither the Navy nor the City performed an annual inspection of the remedy in 2012. As a result of the timing of the memorandum of agreement signature the Navy conducted the annual OU D inspection in 2013. As required, the MOA was reviewed by both the City and the Navy during this five-year review period and both parties concluded that no changes were warranted (Cressman, 2016).

The five-year review site inspection found the grass, pavers, fountain, and planter areas of the park to be in place, with no exposed subsurface materials and no evidence of new plantings or excavations. The two catch basins within the park were observed to have accumulated solids present, but well below 60 percent of the sump depth.

The City of Bremerton performed the OU D inspections in 2014, 2015, and 2016, and provided a completed inspection form to the Navy, as required by the MOA and summarized in Table 6-12.

6.5.4 OU NSC Inspection Results

Annual inspections were conducted at OU NSC throughout this five-year review period. Three primary activities were subject to the annual inspections at OU NSC: pavement and vegetative cover, catch basins, and fencing and signage. IC inspections, which also include fencing and signage inspections, are described in Table 6-13.

6.5.5 Site-Wide Institutional Controls Inspection Results

Annual IC inspections were conducted at all OUs throughout this five-year review period. These IC inspections included a review of access control (i.e., signage and security), groundwater use, excavation management, and property transfer and were conducted based on the IC work plans prepared in 2009, 2014, 2015, and 2016 (Navy, 2009c, 2014c, 2015c, 2016b). The inspections at OU B Marine consisted of inspection of the floating boom security signage, and evaluation of periodic monitoring results with regard to the integrity of the CAD pit.

The inspections for each year during this review period concluded that access to BNC has been adequately controlled to prevent exposures to contaminants remaining in place, and that the prohibition of groundwater use remains intact. No property transfers occurred during this five-year review period, and none are currently planned at BNC.

Annual inspections of signs occur at more than 90 different locations around BNC. These locations include one or multiple signs on fences, shorelines, piers, and floating booms. Inspections since 2012 typically identified relatively few (compared to the total) missing or illegible signs, or changes to infrastructure (such as removing Pier 8) that resulted in a change to the needed signage. Results of the annual inspection noted three faded signs and one missing sign.

IC inspections in 2012 did not identify any active excavations during the inspection. The 2013 IC inspection did identify an active excavation which was found to be in compliance with the MOA for excavation management at BNC (Navy, 2007a) and the base instruction (Navy, 2007b). The 2015 IC inspection identified an excavation that was not in compliance with the MOA or base instruction. An unattended excavation was identified between Buildings 880 and 983, and west of Dry Dock 5, with soil from the excavation stockpiled nearby. The stockpile was not underlain with plastic and the plastic cover had been displaced by recent storms. The NAVFAC Northwest Remedial Project Manager immediately contacted the Navy Stormwater Manager for Code 106, who in turn worked with NAVFAC Northwest Public Works to resolve the excavation. Two excavation management inspections were conducted between 2016 and 2017 to determine if BNC excavation procedures are adhered to and BMP for erosion control are being followed. Inspections noted one location within OU B Terrestrial that had a small soil stockpile with the cover tarp partially removed, exposing about 25% of the stockpile. The NAVFAC Northwest Public Works Department was notified to resolve the issue.

Observations during the five-year review site inspection were consistent with the findings of the 2015 IC inspection. Access to BNC was controlled by fencing and manned security gates, and signage was prominent throughout the facility. No evidence of prohibited groundwater use was observed, and there was no evidence of property transfer within the last five years.

Excavations were observed in two locations during the five-year review SI. In the area of construction associated with the Machine Shop, Building 431, substantial soil from a footing excavation was observed on the pavement surface, with poor construction stormwater best management practices. Near the east end of OU B Terrestrial, an open and unattended excavation and adjacent soil stockpile was observed. The excavation appeared to have been open and unattended for some time. Code 106 (Base Environmental) was notified and followed up with the responsible contractor.

6.6 Results of Interviews

As part of the five-year review, interviews were conducted with persons familiar with the CERCLA actions at BNC. Interview candidates were identified from a variety of organizations and groups, including the Navy, EPA, Ecology, Suquamish Tribe, Washington State Department of Fish and Wildlife (WDFW), Washington State Department of Natural Resources (DNR), and City of Bremerton. A set of interview questions and instructions were transmitted to interview candidates by e-mail. Not all of those invited to participate chose to do so. No members of the public chose to participate.

The complete interview responses are included in Appendix C. Highlights of the interviews are summarized below. Subsequent to publication of the draft final version of the five-year review, the Navy received additional input from the stakeholders, including the Suquamish Tribe, Ecology, and EPA. That additional input is included in Appendix C.

6.6.1 Navy Personnel

Seven Navy staff and one Navy contractor completed the interview form. The respondents were in general agreement that remedy performance has been adequate, but some respondents indicated that improvements could be made. In particular, some Navy respondents indicated that improvements were warranted in the following areas:

- Stormwater system cleaning and repair needs to be tracked and reported annually.
- Storm drain system repairs are overdue.
- Additional improvements are warranted for the system of pavement maintenance, and vegetated cover maintenance is lacking.
- Inspections of the pavement and storm drain system should be more frequent.
- Mercury source control needs to be addressed.
- Performance of the OU A soft bank portion of the remedy is poor, and progress towards a permanent repair has been slow.
- IC requirements need to be more robustly incorporated into the excavation management plan.
- IC requirements need to be clearly communicated to the Shipyard workforce.
- The documentation and follow-through on incidents/activities that could impact the remedies could be improved.

Some progress towards a protectiveness statement for OU B Marine has been made, however little progress has been made towards a protectiveness statement for OU B Terrestrial, as mercury source control investigation is still underway.

The pending work to complete the "decision framework" document for OU B Marine was noted, with the anticipation that this document will address how to handle data generated from military construction work. Also noted was the pending completion of the SMIR, which will provide a path forward for addressing mercury in Sinclair Inlet.

None of the Navy respondents reported any pending land use or ownership changes, or any use of groundwater other than monitoring. No community concerns were reported by any Navy respondent, however, one Navy respondent listed the concerns of the stakeholder group (which are captured below in the summary of stakeholder responses).

The respondents felt that the frequency of LTM was adequate to meet the goals of the RODs (and CAP for OU C). One Navy respondent felt that the value of any additional sampling of OU B Marine for PCBs was questionable.

One Navy respondent questioned whether sediment sampling should continue to be required for in-water construction projects, since those data are not part of the CERCLA action and do not seem to be used for any purpose.

One Navy respondent listed eight specific suggestions to improve remedy effectiveness. These suggestions can be found in the interview responses in Appendix C.

6.6.2 Agency Personnel

6.6.2.1 Environmental Protection Agency

Two individuals from EPA responded to the interview questionnaire, but only one respondent indicated sufficient knowledge to respond to most of the questions. EPA's responses were focused on OU B Marine only.

The EPA respondent expressed concern regarding the slow progress on the SMIR, the final remedy repair for OU A, and the protectiveness statement for OU B Marine. The EPA respondent was further concerned about the level of engagement between the Navy and the Suquamish Tribe regarding the remedy repair at OU A.

The EPA respondent stated that the IC component of the remedies, in particular, must be reviewed in accordance with EPA guidance. The ICs for OU B Marine were cited as a particular concern, especially with regard to clarifying whether environmental covenants need to be in place to protect the CAD pit, other capped areas within Sinclair Inlet, and the capped area outside of Navy property on state-owned aquatic lands.

The EPA respondent stated that the five-year review must include a schedule for all outstanding work, and that the schedule must be adhered to.

6.6.2.2 Washington State Department of Ecology

Two individuals from Ecology responded to the interview questionnaire – one focused on the terrestrial OUs and one focused on OU B Marine. With regard to the terrestrial OUs, the respondent stated that the remedies have been performing as designed, but that certain areas need attention. The terrestrial respondent noted the need to implement the permanent remedy repair at OU A. The terrestrial respondent also felt that quantitative measurements of IC performance needed to be added, including measurement of all terrestrial COCs in stormwater and accumulated solids. The terrestrial respondent asserted that the "asphalt cap is deteriorating throughout the site," the "groundwater monitoring frequency at OU C is not occurring as stated in the CAP," and "the PMP is still in the works." These points do not appear to be supported by

the evidence available during this five-year review. However, the additional point that the excavation management plan needs to be improved does appear to be supported. The terrestrial respondent stated that some analytes removed from the groundwater monitoring program should be reinstated based on the availability of improved analytical techniques that can achieve lower reporting limits. The respondent also advocated for analyzing PCBs using a congener analysis method.

The OU B Marine respondent stated Ecology's position that, "the remedy designed to lower PCB concentrations in sediment and marine tissue has met the intent of the corrective action plan that was agreed to at the time of signing of the ROD; however, it is yet to be determined if long-term protectiveness has been achieved." The respondent stated that an additional confirmatory round of sampling should be conducted to verify remedy effectiveness. This confirmatory sampling event should incorporate analysis for PCB congeners, rather than PCB Aroclors, to achieve lower reporting limits and thereby allow assessment of risk to lower target values. The respondent cited the cleanup level development process under the 2013 revision of the SMS as part of the rationale for requesting congener analysis.

The respondent also expressed concern regarding the results of sediment samples collected in response to the seawater main break. The PCB concentrations in this area of sampling, especially at depth, call into question the source and extent of PCBs in this area of sediment. An additional round of sampling could be used, in part, to assess this area.

The respondent indicated that ICs and O&M had been implemented in accordance with the ROD.

The marine respondent reported two events that required a response from Ecology, consisting of the seawater main break and the proposed in-water hull cleaning of the ex-Independence.

The marine respondent also expressed concern that the approach being taken regarding mercury in Sinclair Inlet was not going to address higher trophic level risk, and would be limited to the current OU B Marine boundary. It was the opinion of this respondent that the boundary of the investigation should be expanded to include all areas of Sinclair Inlet exhibiting elevated mercury, in accordance with the definition of "site" under CERCLA.

6.6.3 Natural Resource Trustee Personnel

6.6.3.1 Suquamish Tribe

The Suquamish Tribe respondent stated the belief that the remedies have been generally implemented as intended by the RODs, but that some remedy components have not achieved long-term protectiveness. Particular concerns were:

- Long overdue remedy repair for the OU A shoreline at Charleston Beach.

- Continued release of mercury from the upland areas to the marine environment.
- Accumulation of mercury in marine sediment and aquatic organisms, which continues to present an unacceptable health risk via consumption of seafood.
- Potential impacts of PSNS construction projects and operations on in-place remedies.
- Lack of communication and coordination between different Navy commands regarding implementation of ICs, land use controls and O&M procedures designed to protect the remedies. (This includes spill and release events such as the 2015 salt water main break.)

The respondent reported that the remedial actions have had limited benefit to tribal members because harvest restrictions remain in place and shoreline armoring is detrimental to the habitat of treaty-protected resources.

The respondent felt that, in general, the LTM programs were designed to meet the goals of the RODs and are continuing to be reviewed. The respondent noted the ongoing discussions regarding how to verify natural recovery in OU B Marine.

The respondent articulated the following expectations of the Tribe:

- The Navy will respond to all comments and engage in meaningful dialogue with the Tribe regarding the design and implementation of the final remedy repair for OU A/Charleston Beach.
- The Navy will implement a remedial action to control sources of mercury from the terrestrial OUs and to reduce legacy sources of mercury in the marine environment.

The respondent also expressed that the Tribe:

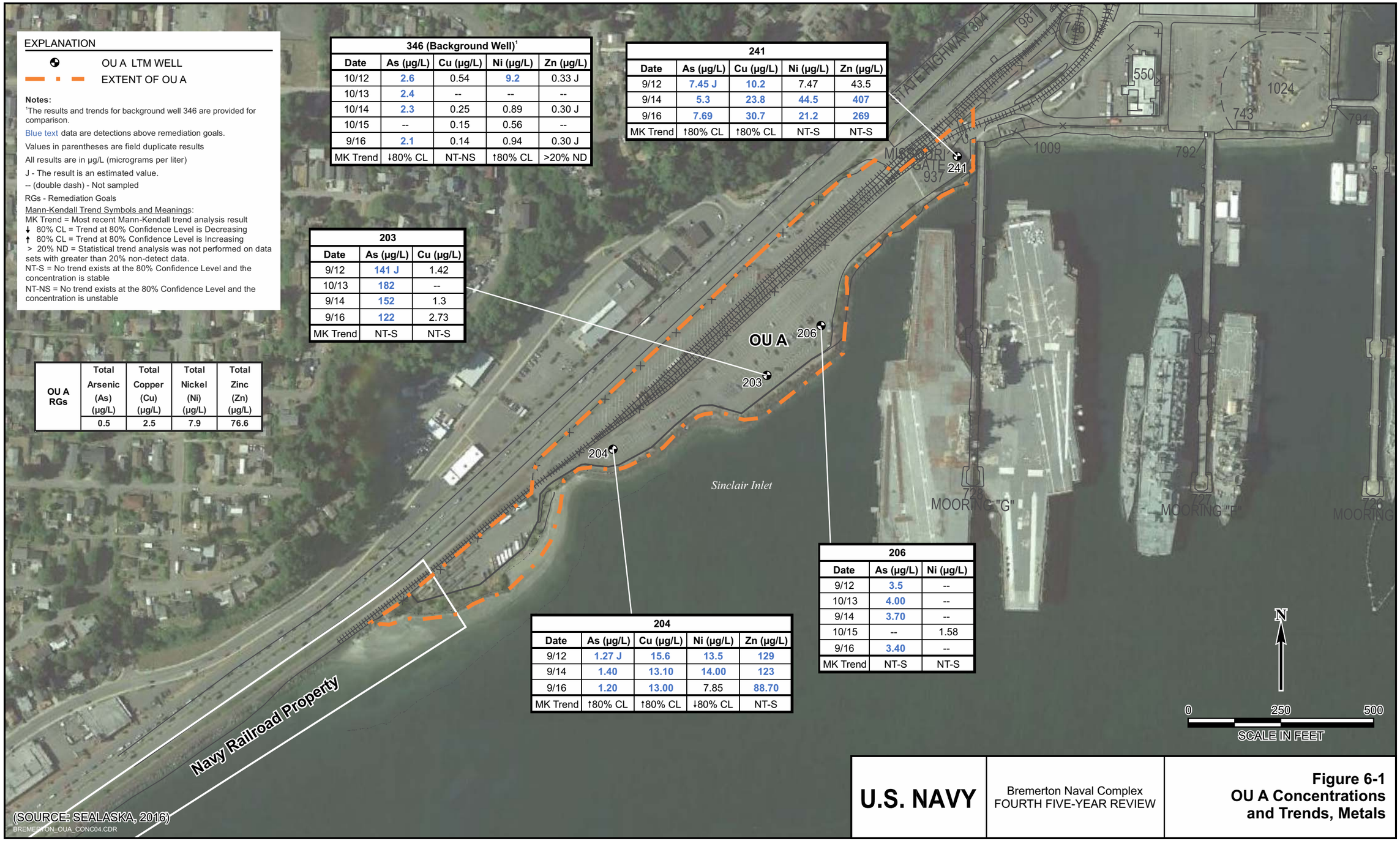
- Supports optimization of LTM for the terrestrial OUs and recommends that monitoring of the terrestrial and marine environments be addressed from a more holistic perspective to ensure long-term protectiveness of human health and the environment.
- Encourages the Navy to develop more effective communication and coordination strategies for ongoing and routine O&M activities, as well as spill/release notification and response.

6.6.3.2 Washington State Department of Fish and Wildlife

The WDFW respondent indicated that WDFW had not had sufficient involvement in the RODs or CAP to provide feedback.

6.6.3.3 City of Bremerton

The City of Bremerton representative returned the interview questionnaire, but had no comments.



EXPLANATION

OU A LTM WELL

EXTENT OF OU A

Notes:

[1]The results and trends for background well 346 are provided for comparison.

Blue text data are detections above remediation goals.

Values in parentheses are field duplicate results

All results are in µg/L (micrograms per liter)

J - The result is an estimated value.

-- (double dash) - Not sampled

RGs - Remediation Goals

Mann-Kendall Trend Symbols and Meanings:

MK Trend = Most recent Mann-Kendall trend analysis result

↓ 80% CL = Trend at 80% Confidence Level is Decreasing

↑ 80% CL = Trend at 80% Confidence Level is Increasing

> 20% ND = Statistical trend analysis was not performed on data sets with greater than 20% non-detect data.

NT-S = No trend exists at the 80% Confidence Level and the concentration is stable

NT-NS = No trend exists at the 80% Confidence Level and the concentration is unstable

346 (Background Well)[1]				
Date	As (µg/L)	Cu (µg/L)	Ni (µg/L)	Zn (µg/L)
10/12	2.6	0.54	9.2	0.33 J
10/13	2.4	--	--	--
10/14	2.3	0.25	0.89	0.30 J
10/15	--	0.15	0.56	--
9/16	2.1	0.14	0.94	0.30 J
MK Trend	↓80% CL	NT-NS	↑80% CL	>20% ND

241				
Date	As (µg/L)	Cu (µg/L)	Ni (µg/L)	Zn (µg/L)
9/12	7.45 J	10.2	7.47	43.5
9/14	5.3	23.8	44.5	407
9/16	7.69	30.7	21.2	269
MK Trend	↑80% CL	↑80% CL	NT-S	NT-S

203		
Date	As (µg/L)	Cu (µg/L)
9/12	141 J	1.42
10/13	182	--
9/14	152	1.3
9/16	122	2.73
MK Trend	NT-S	NT-S

OU A RGs	Total Arsenic (As) (µg/L)	Total Copper (Cu) (µg/L)	Total Nickel (Ni) (µg/L)	Total Zinc (Zn) (µg/L)
	0.5	2.5	7.9	76.6

206		
Date	As (µg/L)	Ni (µg/L)
9/12	3.5	--
10/13	4.00	--
9/14	3.70	--
10/15	--	1.58
9/16	3.40	--
MK Trend	NT-S	NT-S

204				
Date	As (µg/L)	Cu (µg/L)	Ni (µg/L)	Zn (µg/L)
9/12	1.27 J	15.6	13.5	129
9/14	1.40	13.10	14.00	123
9/16	1.20	13.00	7.85	88.70
MK Trend	↑80% CL	↑80% CL	↓80% CL	NT-S

(SOURCE: SEALASKA, 2016)

BREMERTON_OUA_CONC04.CDR

U.S. NAVY

Bremerton Naval Complex
FOURTH FIVE-YEAR REVIEW

Figure 6-1
OU A Concentrations and Trends, Metals

Legend

- OU B T Well Sampled
- BNC Property Line
- OU B T Boundary
- OU A Boundary

Notes:

[1]The results and trends for background well 346 are provided for comparison

Blue text data are detections above remediation goals.

Values in parentheses are field duplicate results.

All results are in µg/L (micrograms per liter)

J - The result is an estimated value.

-- (double dash) - Not Sampled

RGs - Remediation Goals

U - Analyte not detected at indicated quantitation limit.

UJ - The analyte is not detected at the specified, estimated quantitation limit.

Mann-Kendall Trend Symbols and Meanings:
MK Trend = Most recent Mann-Kendall trend analysis result
↓ 80% CL = Trend at 80% Confidence Level is Decreasing
↑ 80% CL = Trend at 80% Confidence Level is Increasing
> 20% ND = Statistical trend analysis was not performed on data sets with greater than 20% non-detect data.
NT-S = No trend exists at the 80% Confidence Level and the concentration is stable.
NT-NS = No trend exists at the 80% Confidence Level and the concentration is unstable.
ID = Insufficient Data

346 (Background Well)[1]

Date	As (µg/L)	Cu (µg/L)	Ni (µg/L)	Zn (µg/L)	Hg (µg/L)	TCE (µg/L)
3/12	--	--	--	--	--	--
4/12	--	--	--	--	0.00113 UJ	--
10/12	2.5	0.09 J	0.83	0.28 J	--	--
10/12	--	--	--	--	0.00039	--
1/13	--	--	--	--	0.00040 U	--
10/13	2.36	0.08 J	0.47	0.50 U	--	0.50 U
2/14	--	--	--	--	0.00040 U	--
10/14	2.3	0.19	0.68	0.50 U	0.00041 U	0.50 U
2/15	--	--	--	--	0.00040 U	--
9/16	2.1	0.61	0.78	0.30 J	0.00040 U	0.50 U
MK Trend	↓80% CL	NT-NS	NT-S	>20% ND	>20% ND	>20% ND

707

Date	TCE (µg/L)
10/14	2.3
9/16	2.8
MK Trend	↓80% CL

432

Date	TCE (µg/L)
10/12	36
10/13	27/(27)
9/14	29
9/16	29/(29)
MK Trend	↓80% CL

LTMP-5

Date	Hg (µg/L)
1/12	--
3/12	--
4/12	0.017
9/12	--
10/12	0.00753/ (0.00739)
1/13	0.0147
10/13	0.00819
2/14	0.0304
10/14	0.00808
2/15	0.0112
9/16	0.0168
MK Trend	↓80% CL

LTMP-1

Date	As (µg/L)	Cu (µg/L)	Ni (µg/L)	Zn (µg/L)	Hg (µg/L)
4/12	--	--	--	--	0.106/ (0.101)
10/12	--	77.1	19.7	642	--
10/12	--	--	--	--	0.125
1/13	--	--	--	--	0.0757
9/13	--	150	25.7	973	--
10/13	--	--	--	--	0.172
2/14	--	--	--	--	0.0931/ (0.092)
10/14	--	144/(142)	14.4/(10.6)	1,070/ (960)	0.25
2/15	--	--	--	--	0.294
9/16	--	99.5	8.04	1,270	0.409
MK Trend	ID	↑80% CL	NT-S	↑80% CL	↑80% CL

LTMP-3

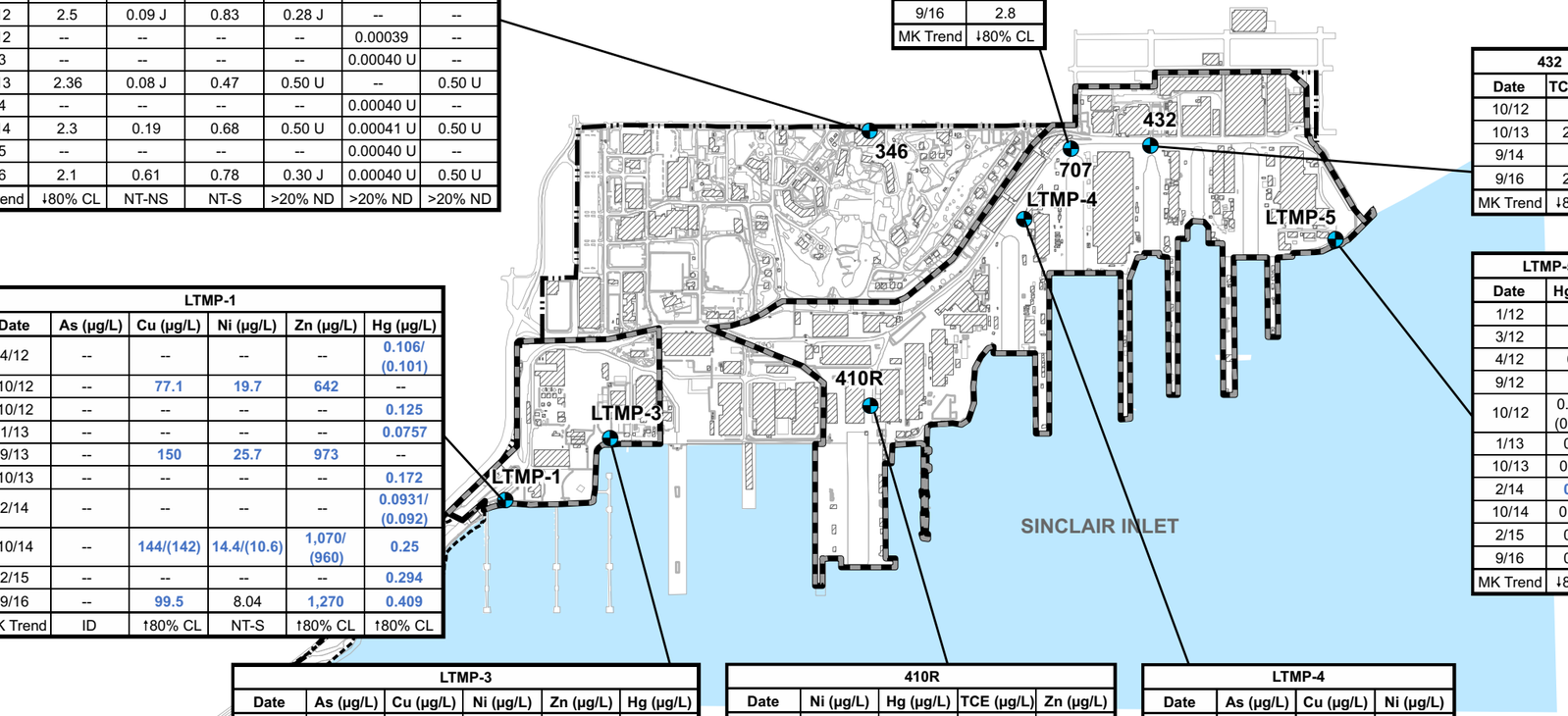
Date	As (µg/L)	Cu (µg/L)	Ni (µg/L)	Zn (µg/L)	Hg (µg/L)
4/12	--	--	--	--	1.54
10/12	4.6/(4.75)	74.4/(72.6)	7.02/(6.52)	181/(172)	--
10/12	--	--	--	--	1.43
1/13	--	--	--	--	1.56
9/13	4.35/(4.24)	76.9/(80)	8.01/(7.96)	203/(221)	--
10/13	--	--	--	--	2.22/(1.98)
2/14	--	--	--	--	1.56
10/14	4.1	108	13.5	298	3.33/(3.24)
2/15	--	--	--	--	1.42
9/16	4.33 J/ (3.62 J)	81/(80.3)	7.46/(6.93)	217/(217)	1.9/(1.85)
MK Trend	NT-S	NT-S	↓80% CL	NT-S	NT-S

410R

Date	Ni (µg/L)	Hg (µg/L)	TCE (µg/L)	Zn (µg/L)
4/12	--	0.0372	--	--
10/12	7.69	--	15	--
10/12	--	0.00956	--	1.15
1/13	--	0.0157	--	--
10/13	7.43	0.0102	15	--
2/14	--	0.0534	--	--
10/14	6.85	0.0141	0.50 U	--
2/15	--	0.0876	--	--
9/16	5.09	0.0254	13	--
MK Trend	↓80% CL	NT-S	NT-S	ID

LTMP-4

Date	As (µg/L)	Cu (µg/L)	Ni (µg/L)
10/12	0.02	0.0048	0.03
10/13	0.0178	0.0029	0.02
9/14	0.022	--	--
MK Trend	ID	ID	ID



OU B T RGs

Dissolved Arsenic (As) (µg/L)	Dissolved Copper (Cu) (µg/L)	Dissolved Nickel (Ni) (µg/L)	Dissolved Zinc (Zn) (µg/L)	Total Mercury (Hg) (µg/L)	TCE (µg/L)
5	3.1	8.2	81	0.025	55.6

0 500 1,000 2,000
SCALE IN FEET

BREMERTON_OUBT_CONC.CDR

(SOURCE: SEALASKA, 2016)

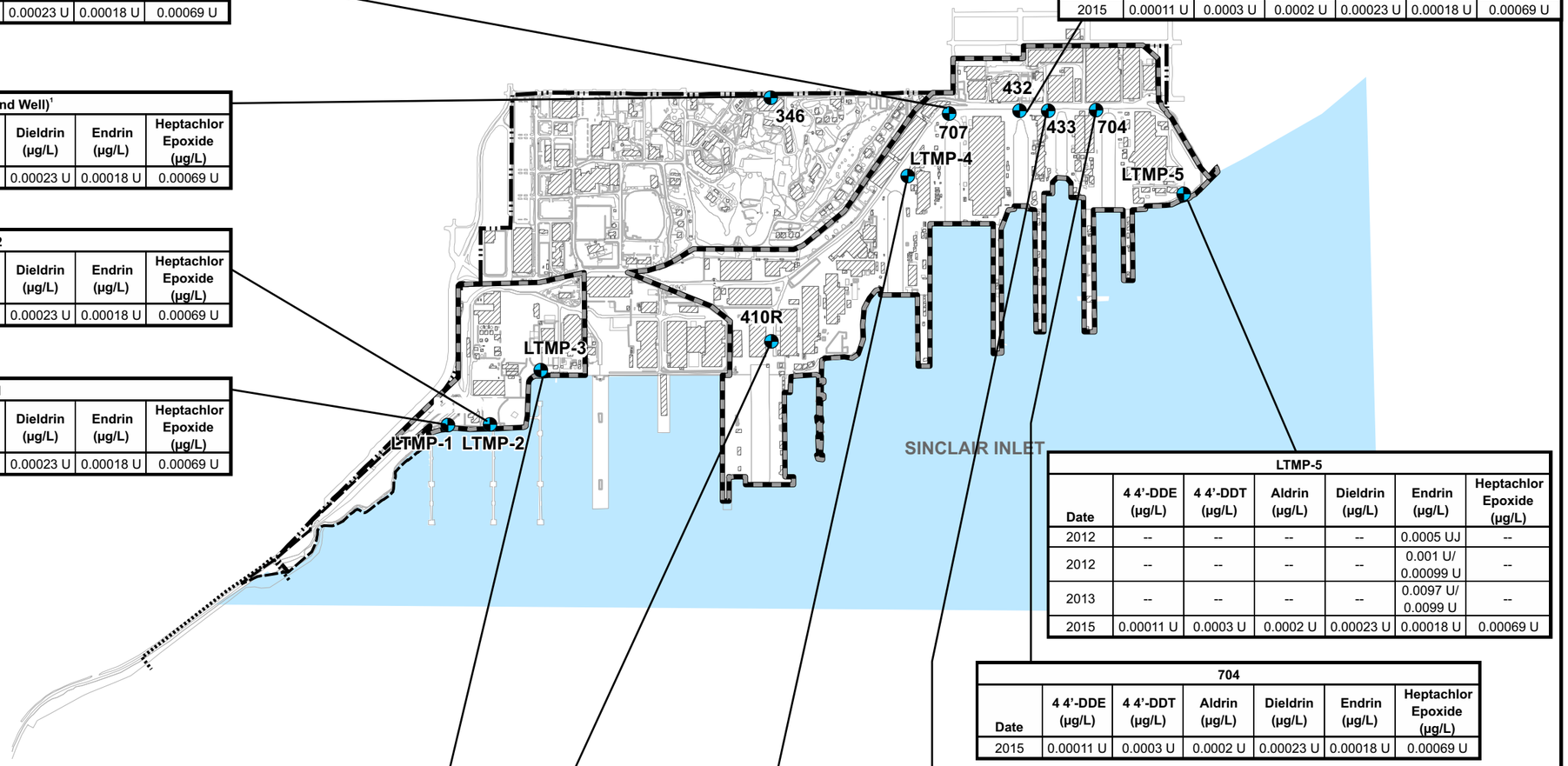
U.S. NAVY

Bremerton Naval Complex
FOURTH FIVE-YEAR REVIEW

Figure 6-2
OU B T Concentrations and Trends - Metals and TCE

Legend

- OU B T Well Sampled
- BNC Property Line
- Navy Railroad Property Line
- OU B T Boundary
- OU A Boundary



707						
Date	4 4'-DDE (µg/L)	4 4'-DDT (µg/L)	Aldrin (µg/L)	Dieldrin (µg/L)	Endrin (µg/L)	Heptachlor Epoxide (µg/L)
2015	0.00011 U	0.0003 U	0.0002 U	0.00023 U	0.00018 U	0.00069 U

346 (Background Well)[1]						
Date	4 4'-DDE (µg/L)	4 4'-DDT (µg/L)	Aldrin (µg/L)	Dieldrin (µg/L)	Endrin (µg/L)	Heptachlor Epoxide (µg/L)
2015	0.00011 U	0.0003 U	0.0002 U	0.00023 U	0.00018 U	0.00069 U

LTMP-2						
Date	4 4'-DDE (µg/L)	4 4'-DDT (µg/L)	Aldrin (µg/L)	Dieldrin (µg/L)	Endrin (µg/L)	Heptachlor Epoxide (µg/L)
2015	0.00011 U	0.0003 U	0.0002 U	0.00023 U	0.00018 U	0.00069 U

LTMP-1						
Date	4 4'-DDE (µg/L)	4 4'-DDT (µg/L)	Aldrin (µg/L)	Dieldrin (µg/L)	Endrin (µg/L)	Heptachlor Epoxide (µg/L)
2015	0.00011 U	0.0003 U	0.0002 U	0.00023 U	0.00018 U	0.00069 U

432						
Date	4 4'-DDE (µg/L)	4 4'-DDT (µg/L)	Aldrin (µg/L)	Dieldrin (µg/L)	Endrin (µg/L)	Heptachlor Epoxide (µg/L)
2015	0.00011 U	0.0003 U	0.0002 U	0.00023 U	0.00018 U	0.00069 U

LTMP-5						
Date	4 4'-DDE (µg/L)	4 4'-DDT (µg/L)	Aldrin (µg/L)	Dieldrin (µg/L)	Endrin (µg/L)	Heptachlor Epoxide (µg/L)
2012	--	--	--	--	0.0005 UJ	--
2012	--	--	--	--	0.001 U/ 0.00099 U	--
2013	--	--	--	--	0.0097 U/ 0.0099 U	--
2015	0.00011 U	0.0003 U	0.0002 U	0.00023 U	0.00018 U	0.00069 U

704						
Date	4 4'-DDE (µg/L)	4 4'-DDT (µg/L)	Aldrin (µg/L)	Dieldrin (µg/L)	Endrin (µg/L)	Heptachlor Epoxide (µg/L)
2015	0.00011 U	0.0003 U	0.0002 U	0.00023 U	0.00018 U	0.00069 U

433						
Date	4 4'-DDE (µg/L)	4 4'-DDT (µg/L)	Aldrin (µg/L)	Dieldrin (µg/L)	Endrin (µg/L)	Heptachlor Epoxide (µg/L)
2015	0.00012 U	0.00031 U	0.00021 U	0.00024 U	0.00019 U	0.00071 U

LTMP-3						
Date	4 4'-DDE (µg/L)	4 4'-DDT (µg/L)	Aldrin (µg/L)	Dieldrin (µg/L)	Endrin (µg/L)	Heptachlor Epoxide (µg/L)
2015	0.00011 U	0.001	0.0002 U	0.00023 U	0.00018 U	0.00069 U

410R						
Date	4 4'-DDE (µg/L)	4 4'-DDT (µg/L)	Aldrin (µg/L)	Dieldrin (µg/L)	Endrin (µg/L)	Heptachlor Epoxide (µg/L)
2015	0.00011 U	0.0003 U	0.0002 U	0.00023 U	0.00018 U	0.00069 U

LTMP-4						
Date	4 4'-DDE (µg/L)	4 4'-DDT (µg/L)	Aldrin (µg/L)	Dieldrin (µg/L)	Endrin (µg/L)	Heptachlor Epoxide (µg/L)
2015	0.00011 U	0.0003 U	0.0002 U	0.00023 U	0.00018 U	0.00069 U

Notes:

[1]The results and trends for background well 346 are provided for comparison

All results are in µg/L (micrograms per liter)

RGs - Remediation Goals

U - Analyte not detected at indicated quantitation limit.

J - The result is an estimated value.

-- (double dash) - Not Sampled

OU B T RGs					
4 4'-DDE (µg/L)	4 4'-DDT (µg/L)	Aldrin (µg/L)	Dieldrin (µg/L)	Endrin (µg/L)	Heptachlor Epoxide (µg/L)
0.000356	0.000356	0.0000816	0.0000867	0.05	0.0000636

0 500 1,000 2,000

SCALE IN FEET

BREMERTON_OUBT_PESTCONC_v2.CDR

(SOURCE: SEALASKA, 2016)

U.S. NAVY

Bremerton Naval Complex
FOURTH FIVE-YEAR REVIEW

Figure 6-3
OU B Terrestrial Concentrations - Pesticides

EXPLANATION

- PMP LTM WELLS SAMPLED
- BNC PROPERTY LINE
- EXTENT OF OU NSC
- NAVY RAILROAD PROPERTY LINE

Notes:

[1]The results and trends for background well 346 are provided for comparison

Blue text data are detections above remediation goals.

Values in parentheses are field duplicate results

All results are in µg/L (micrograms per liter)

TPH-D - Diesel-range total petroleum hydrocarbons.

TPH-O - Oil-range total petroleum hydrocarbons.

J - The result is an estimated value.

L - The chromatographic fingerprint of the sample resembles a petroleum product with a lighter component than the calibration standard.

RGs - Remediation Goals

O - The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.

Y - The chromatographic fingerprint of the sample resembles a petroleum product but the elution pattern does not match the calibration standard.

-- (double dash) - Not Sampled

U - Analyte not detected at specified reporting limit

UJ - Analyte not detected at specified estimated quantitation limit.

Mann-Kendall Trend Symbols and Meanings:
MK Trend = Most recent Mann-Kendall trend analysis result
↓ 80% CL = Trend at 80% Confidence Level is Decreasing
↑ 80% CL = Trend at 80% Confidence Level is Increasing
> 20% ND = Statistical trend analysis was not performed on data sets with greater than 20% non-detect data.
NT-S = No trend exists at the 80% Confidence Level and the concentration is stable
ID = Insufficient Data; No Trend

PMP RGs	
TPH-D (µg/L)	TPH-O (µg/L)
500	500

346 (Background Well)[1]		
Date	TPH-D (µg/L)	TPH-O (µg/L)
3/12	280 U	280 U
10/12	110 U	110 U
10/13	97 U	97 U
10/14	16 J	110 U
10/15	110 U	110 U
9/16	110 U	110 U
MK Trend	>20% ND	>20% ND

811		
Date	TPH-D (µg/L)	TPH-O (µg/L)
10/14	420 Y	370 L
9/16	130 Y	160 UJ
MK Trend	ID	ID

406R		
Date	TPH-D (µg/L)	TPH-O (µg/L)
9/12	110 UJ	--
10/13	14 J	--
9/14	21 J	--
9/16	26 J	--
MK Trend	>20% ND	>20% ND

428R		
Date	TPH-D (µg/L)	TPH-O (µg/L)
10/12	110 U	--
9/14	16 J	--
9/16	15 J	110 U
MK Trend	>20% ND	>20% ND

392R		
Date	TPH-D (µg/L)	TPH-O (µg/L)
3/12	3,400 Y/ (3,000 Y)	2,200 L/ (1,800 L)
9/12	760 YJ	310 LJ
10/13	1,900 Y/ (1,700 Y)	1,200/ (980 L)
9/14	750 Y/(880 Y)	790 L/ (1,000 L)
9/16	1,000 Y/ (990 Y)	900 O/ (960 L)
MK Trend	↑80% CL	↑80% CL

346
406R
428R
811
392R

Naval Base Kitsap - Bremerton

Sinclair Inlet

Navy Railroad Property

N

0 0.2 0.4

SCALE IN MILES

(Sources: SEALASKA, 2016; Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community)

BREMERTON_PMP_CONC03.CDR

U.S. NAVY

Bremerton Naval Complex
FOURTH FIVE-YEAR REVIEW

Figure 6-4
PMP Concentrations and Trends, Petroleum Hydrocarbons

Legend

- OU C LTM Well Sampled
- OU C LTM Well
- Alternate Well
- OU C Boundary

Notes:

[1]The results and trends for background well 346 are provided for comparison

Blue text data are detections above remediation goals.

Values in parentheses are field duplicate results

All results are in µg/L (micrograms per liter)

TPH-D - Diesel-range total petroleum hydrocarbons.

TPH-O - Oil-range total petroleum hydrocarbons.

J - The result is an estimated value.

L - The chromatographic fingerprint of the sample resembles a petroleum product with a lighter component than the calibration standard.

Y - The chromatographic fingerprint of the sample resembles a petroleum product but the elution pattern does not match the calibration standard.

-- (double dash) - Not Sampled

RGs - Remediation Goals

U - Analyte not detected at specified reporting limit

UJ - Analyte not detected at specified estimated quantitation limit.

Mann-Kendall Trend Symbols and Meanings:
MK Trend = Most recent Mann-Kendall trend analysis result
↓ 80% CL = Trend at 80% Confidence Level is Decreasing
↑ 80% CL = Trend at 80% Confidence Level is Increasing
> 20% ND = Statistical trend analysis was not performed on data sets with greater than 20% non-detect data.
NT-S = No trend exists at the 80% Confidence Level and the concentration is stable
ID = Insufficient Data; No Trend

346 (Background Well)[1]		
Date	TPH-D (µg/L)	TPH-O (µg/L)
3/12	280 U	280 U
10/12	110 U	110 U
10/13	97 U	97 U
10/14	16 J	110 U
10/15	110 U	110 U
9/16	110 U	110 U
MK Trend	>20% ND	>20% ND

GMWT-9		
Date	TPH-D (µg/L)	TPH-O (µg/L)
1/12	380/ 380 Y	230 UJ/ 240 UJ
3/12	380 Y	170 J
10/12	85 J	110 U
10/13	190 Y	120 UJ
1/14	200 Y/ (210 Y)	120 L/ (140 L)
4/14	100 J/ (220 Y)	67 J/ (490 O)
7/14	430 Y/ (570 Y)	92 J/ (150 L)
9/14	210 Y	150 L
10/15	250 Y	200 UJ
9/16	260 Y	170 UJ
MK Trend	NT-S	>20% ND

GMWT-23		
Date	TPH-D (µg/L)	TPH-O (µg/L)
10/15	110 U/ (110 U)	180 UJ/ (170 UJ)
9/16	51 J	140 UJ
MK Trend	>20% ND	>20% ND

GMWT-22		
Date	TPH-D (µg/L)	TPH-O (µg/L)
9/14	41 J	77 J
MK Trend	ID	ID

OU C RGs	
TPH-D (µg/L)	TPH-O (µg/L)
500	500

0 100 200 400
SCALE IN FEET

BREMERTON_OUC_CONC03.CDR

(SOURCE: SEALASKA, 2016)

U.S. NAVY

Bremerton Naval Complex
FOURTH FIVE-YEAR REVIEW

Figure 6-5
OU C Concentrations and Trends - Petroleum Hydrocarbons

Legend

- OU NSC LTM Well Sampled
- OU NSC Boundary

Notes:

[1]The results and trends for background well 346 are provided for comparison

Blue text data are detections above remediation goals.

Values in parentheses are field duplicate results

All results are in µg/L (micrograms per liter)

J - The result is an estimated value.

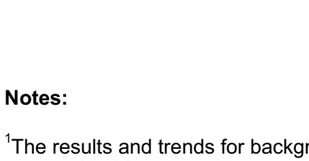
-- (double dash) - Not Sampled

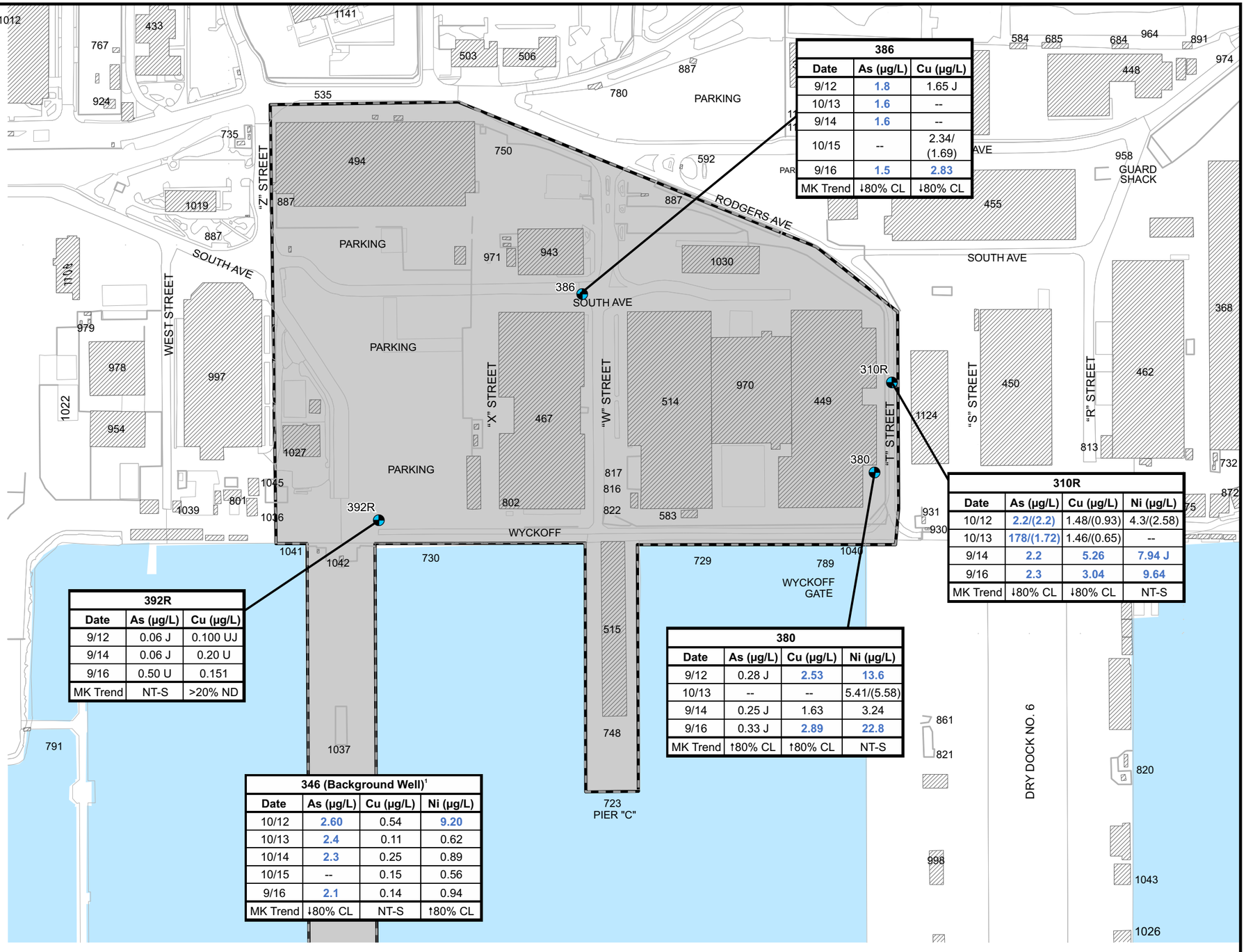
RGs - Remediation Goals

U - Analyte not detected at indicated quantitation limit.

UJ - The analyte is not detected at the specified, estimated quantitation limit.

Mann-Kendall Trend Symbols and Meanings:
MK Trend = Most recent Mann-Kendall trend analysis result
↓ 80% CL = Trend at 80% Confidence Level is Decreasing
↑ 80% CL = Trend at 80% Confidence Level is Increasing
> 20% ND = Statistical trend analysis was not performed on data sets with greater than 20% non-detect data.
NT-S = No trend exists at the 80% Confidence Level and the concentration is stable
NT-NS = No trend exists at the 80% Confidence Level and the concentration is unstable.





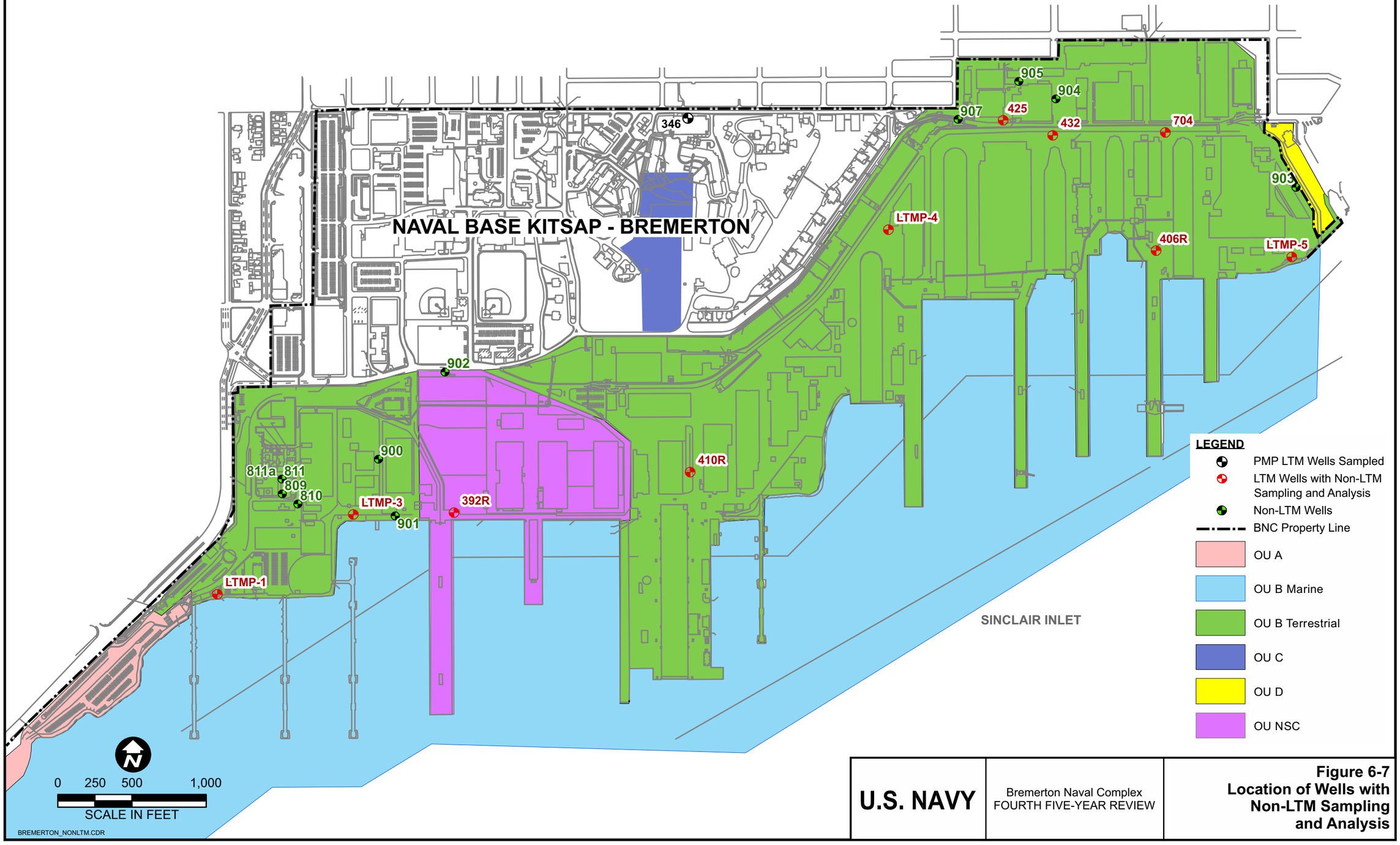
OU NSC RGs	Total Arsenic (As) (µg/L)	Total Copper (Cu) (µg/L)	Total Nickel (Ni) (µg/L)
	0.5	2.5	7.9

(SOURCE: SEALASKA, 2016)

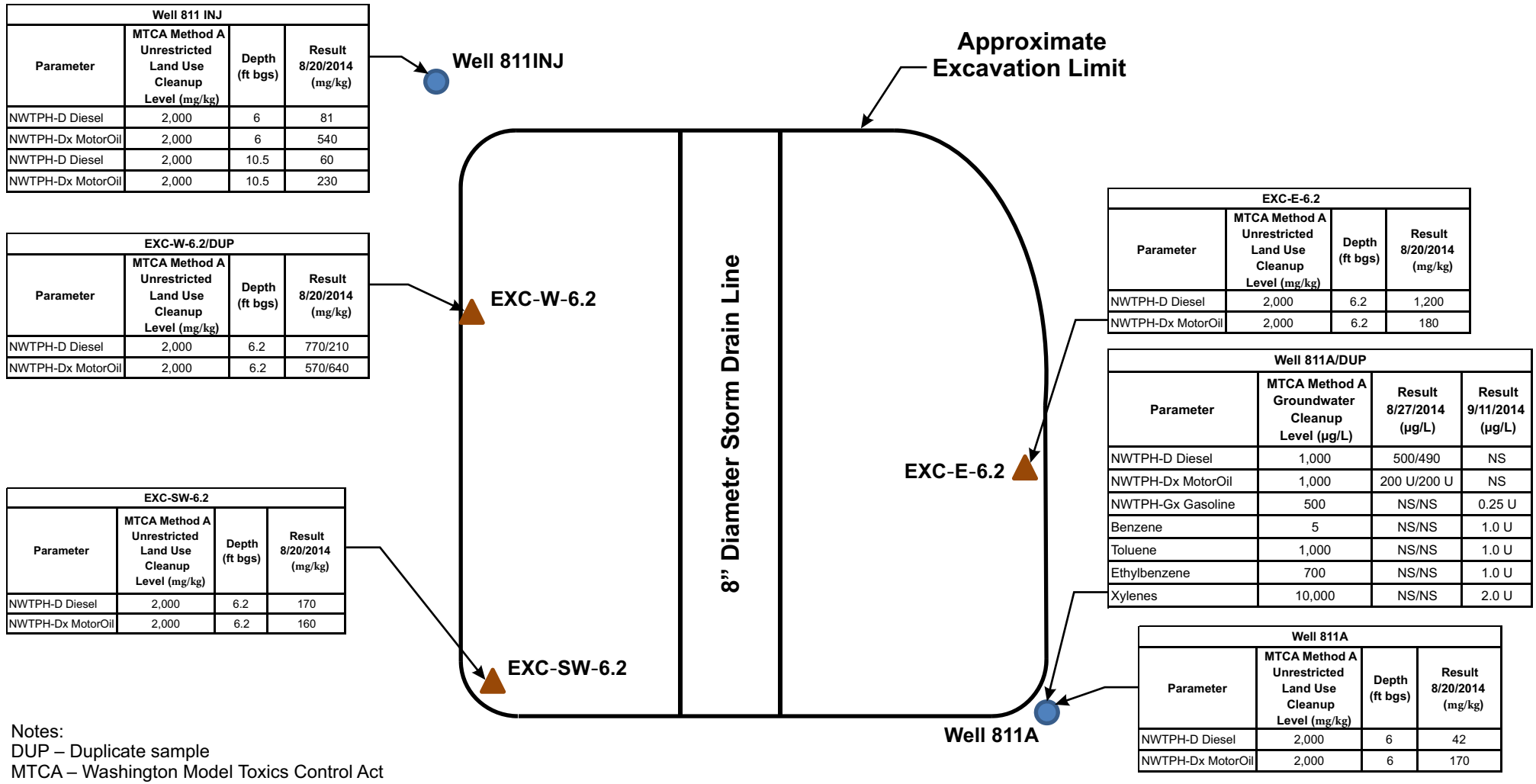
U.S. NAVY

Bremerton Naval Complex
FOURTH FIVE-YEAR REVIEW

Figure 6-6
OU NSC Concentrations and Trends - Metals



U.S. NAVY	Bremerton Naval Complex FOURTH FIVE-YEAR REVIEW	**Figure 6-7** **Location of Wells with Non-LTM Sampling and Analysis**



Well 811 INJ			
Parameter	MTCA Method A Unrestricted Land Use Cleanup Level (mg/kg)	Depth (ft bgs)	Result 8/20/2014 (mg/kg)
NWTPH-D Diesel	2,000	6	81
NWTPH-Dx MotorOil	2,000	6	540
NWTPH-D Diesel	2,000	10.5	60
NWTPH-Dx MotorOil	2,000	10.5	230

EXC-W-6.2/DUP			
Parameter	MTCA Method A Unrestricted Land Use Cleanup Level (mg/kg)	Depth (ft bgs)	Result 8/20/2014 (mg/kg)
NWTPH-D Diesel	2,000	6.2	770/210
NWTPH-Dx MotorOil	2,000	6.2	570/640

EXC-SW-6.2			
Parameter	MTCA Method A Unrestricted Land Use Cleanup Level (mg/kg)	Depth (ft bgs)	Result 8/20/2014 (mg/kg)
NWTPH-D Diesel	2,000	6.2	170
NWTPH-Dx MotorOil	2,000	6.2	160

EXC-E-6.2			
Parameter	MTCA Method A Unrestricted Land Use Cleanup Level (mg/kg)	Depth (ft bgs)	Result 8/20/2014 (mg/kg)
NWTPH-D Diesel	2,000	6.2	1,200
NWTPH-Dx MotorOil	2,000	6.2	180

Well 811A/DUP			
Parameter	MTCA Method A Groundwater Cleanup Level (µg/L)	Result 8/27/2014 (µg/L)	Result 9/11/2014 (µg/L)
NWTPH-D Diesel	1,000	500/490	NS
NWTPH-Dx MotorOil	1,000	200 U/200 U	NS
NWTPH-Gx Gasoline	500	NS/NS	0.25 U
Benzene	5	NS/NS	1.0 U
Toluene	1,000	NS/NS	1.0 U
Ethylbenzene	700	NS/NS	1.0 U
Xylenes	10,000	NS/NS	2.0 U

Well 811A			
Parameter	MTCA Method A Unrestricted Land Use Cleanup Level (mg/kg)	Depth (ft bgs)	Result 8/20/2014 (mg/kg)
NWTPH-D Diesel	2,000	6	42
NWTPH-Dx MotorOil	2,000	6	170

Notes:
DUP – Duplicate sample
MTCA – Washington Model Toxics Control Act
NS – Not sampled for specified analyte
NWTPH-D – Northwest Total Petroleum Hydrocarbons – Diesel
NWTPH-Dx – Northwest Total Petroleum Hydrocarbons – Diesel Extended (Motor Oil)
NWTPH-Gx – Northwest Total Petroleum Hydrocarbons – Gasoline
QA – Quality assurance
U – Analyte not detected above specified reporting limit
µg/L – Micrograms per liter
mg/kg – Milligrams per kilogram

▲ Excavation Soil Sample Location
● Groundwater Monitoring Well Location

N

Scale in Feet
0 1

U.S. NAVY

Bremerton Naval Complex
FOURTH FIVE-YEAR REVIEW

Figure 6-8
Excavation, Groundwater and Soil Samples, and Well Locations

WELL 811 SAMPLING_R1.CDR

Legend

- Site 1 Shoreline Stabilization
- CERCLA Dredging Area
- Navigation Dredging Area
- Thin-Layer Cap (Enhanced Natural Recovery)
- Thick Layer Cap
- Cell Not Sampled Using This Grid
- Sediment Sampling Location Target
- Sampling Cell with Sampling Locations and Cell Number (e.g., 26)

Bremerton Naval Complex

OU B Boundary

CAD Site

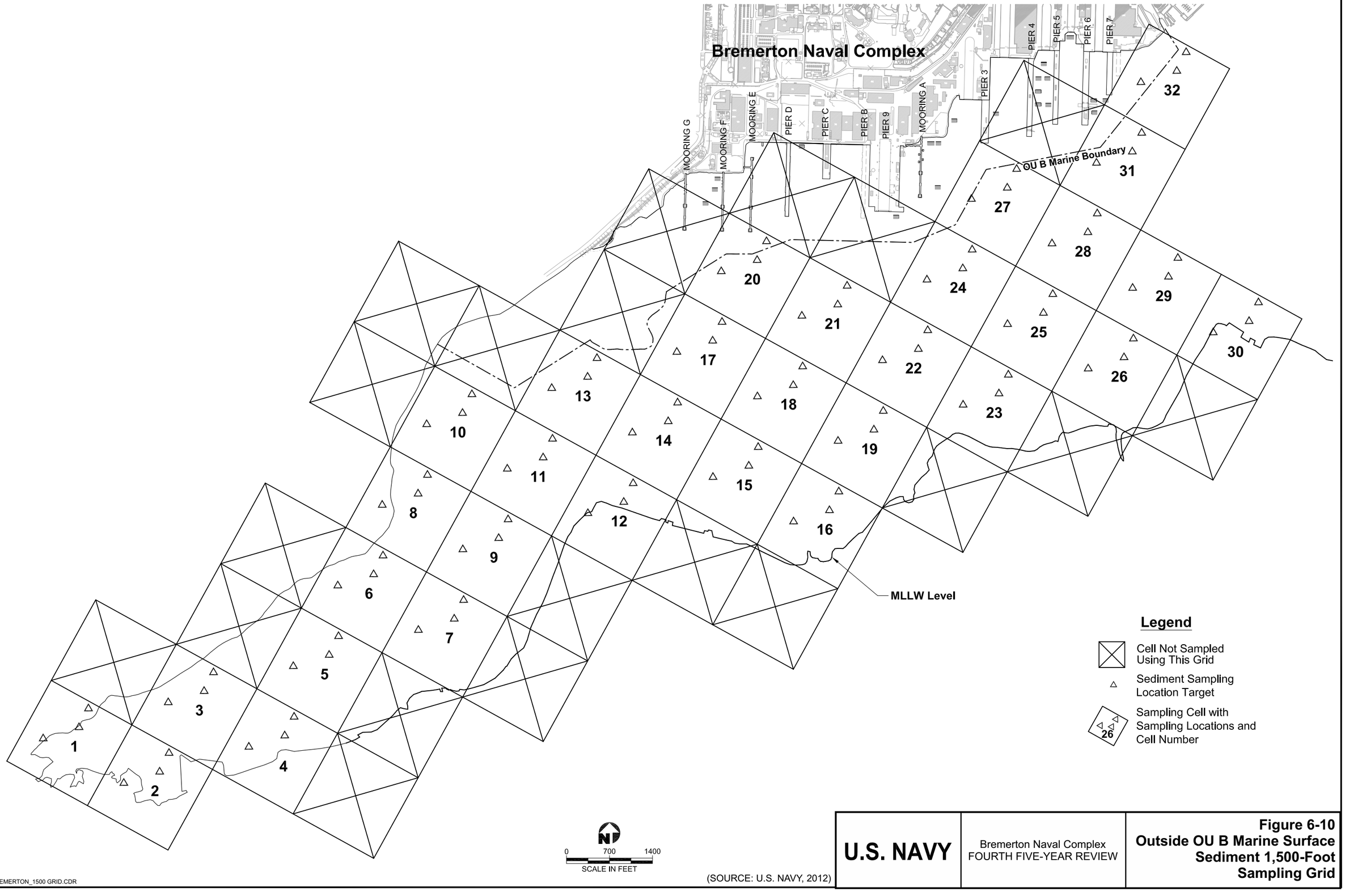
Sinclair Inlet

0 400 800
SCALE IN FEET

(SOURCE: U.S. NAVY, 2012)

BREMERTON_500 GRID.CDR

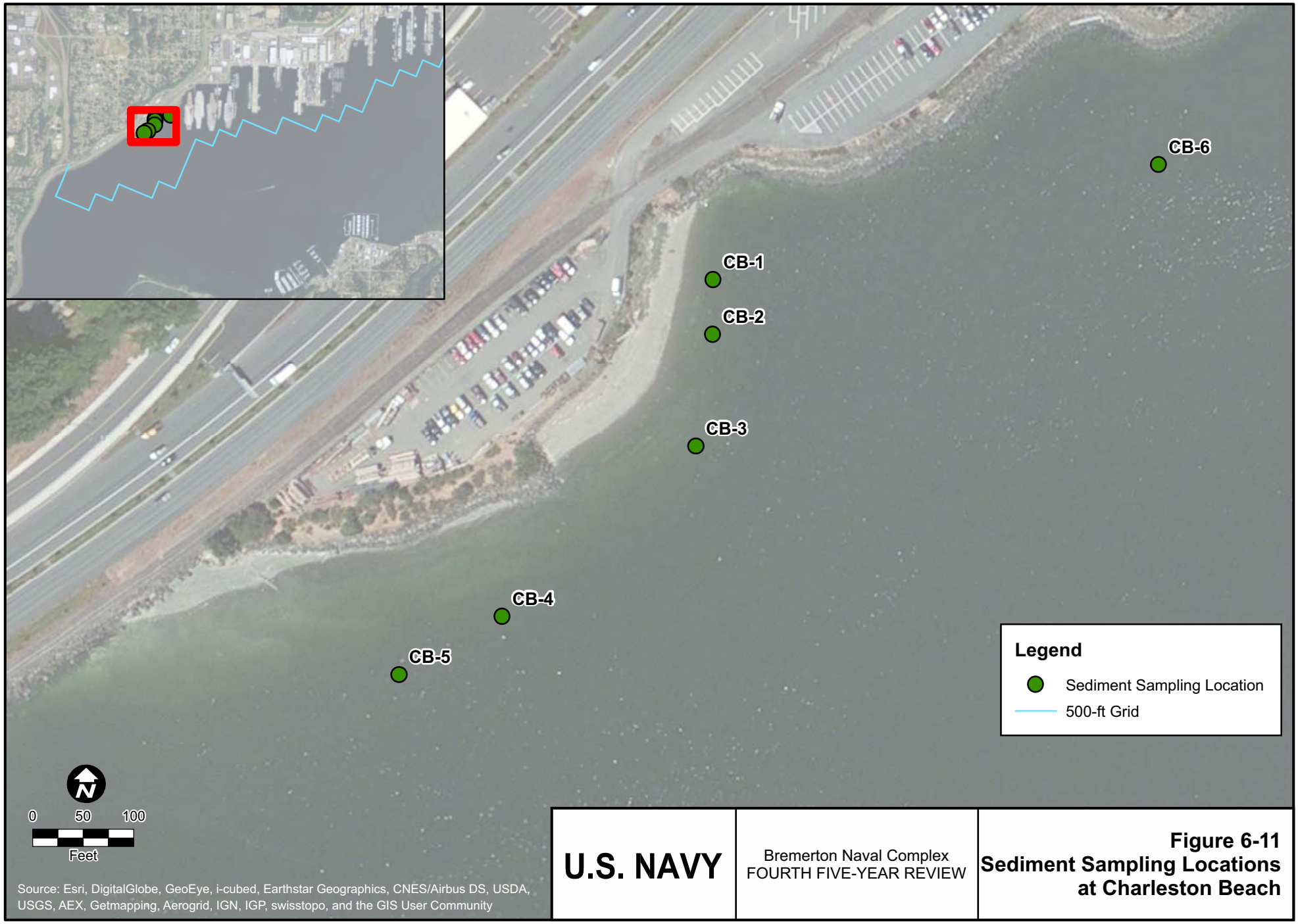
U.S. NAVY	Bremerton Naval Complex FOURTH FIVE-YEAR REVIEW	**Figure 6-9** **OU B Marine Surface Sediment 500-ft Sampling Grid**



(SOURCE: U.S. NAVY, 2012)

BREMERTON_1500 GRID.CDR

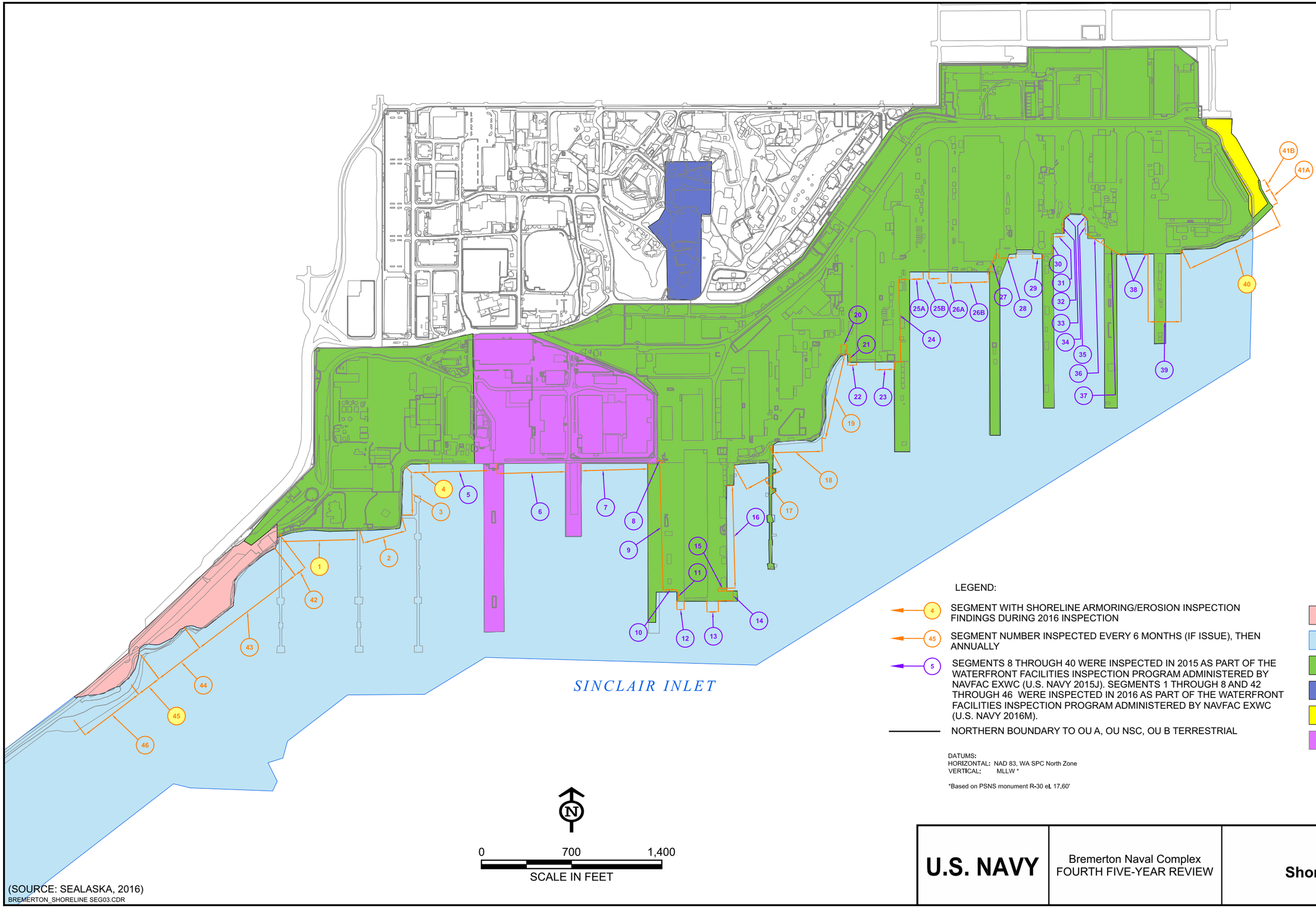
U.S. NAVY	Bremerton Naval Complex FOURTH FIVE-YEAR REVIEW	**Figure 6-10** **Outside OU B Marine Surface Sediment 1,500-Foot Sampling Grid**



U.S. NAVY

Bremerton Naval Complex
FOURTH FIVE-YEAR REVIEW

Figure 6-11
Sediment Sampling Locations at Charleston Beach



(SOURCE: SEALASKA, 2016)

BREMERTON_SHORELINE SEG03.CDR

U.S. NAVY	Bremerton Naval Complex FOURTH FIVE-YEAR REVIEW	**Figure 6-12** **Shoreline Segments**

Table 6-1. Documents Reviewed during this Five-Year Review

Document	References
Final Record of Decision, Operable Unit NSC, Fleet and Industrial Supply Center	Navy, 1996
Final Record of Decision, Operable Unit A, Missouri Beach Parking Lot and Charleston Beach	Navy, 1997
Final Record of Decision, BNC OU B Marine	Navy, 2000
Final Five-Year Review of Record of Decision, Bremerton Naval Complex	Navy, 2002e
Final Record of Decision, Operable Unit B Terrestrial	Navy, 2004a
Explanation of Significant Differences, Bremerton Naval Complex, OU B Marine.	Navy, 2004b
Final Record of Decision, Bremerton Naval Complex, OU D	Navy, 2005
Second Five-Year Review, Bremerton Naval Complex	Navy, 2007c
Final Cleanup Action Plan, Operable Unit C,	Navy, 2007e
Final Long-Term Monitoring Plan for OU A, OU NSC, OU B T, PMP, and OU C	Navy, 2011b
2011 Addendum to Second Five Year Review Report	Navy, 2011c
Final Long-Term Monitoring Summer 2009 to Fall 2010 Trend Analysis Report	Navy, 2011d
Spring 2012 Long-Term Monitoring Data Summary Report for OU BT, OU C and PMP	Navy, 2012e
Summer 2011 Long-Term Monitoring Data Summary Report for OU A, OU NSC, OU BT, and OU C	Navy, 2012f
Fall 2011 Long-Term Monitoring Data Summary Report for OU BT, OU C, and PMP	Navy, 2012g
Annual Non-Long-Term Monitoring Data Summary Technical Memorandum	Navy, 2012h
Final Long-Term Monitoring, Inspection and Improvement Plan for OU A, OU NSC, OU B T, PMP, OU C and OU D	Navy, 2012i
Final 2012 Annual Remedy Inspection, Controls, and Management Report	Navy, 2013a
Winter/Spring 2013 Long Term Monitoring Data Summary Report	Navy 2013d
Summer/Fall 2012 Long-Term Monitoring Data Summary Report for OU A, OU NSC, OU BT, PMP and OU C	Navy, 2013e
Long-Term Monitoring Trend Analysis Report for OU A, OU NSC, OU BT, PMP and OU C, Spring 2011 through Winter 2012	Navy, 2013f
Long-Term Monitoring, Inspection and Improvement Plan for OU A, OU NSC, OU BT, PMP, OU C and OU D	Navy, 2013g
Data Summary Technical Memorandum for Non-Long-Term Monitoring Investigations	Navy, 2013h
Final 2013 Annual Remedy Inspection Report	Navy, 2014a
Final Institutional Control Work Plan	Navy, 2014b
Final Operation and Maintenance Plan	Navy, 2014c
Long-Term Monitoring Trend Analysis Report for OU A, OU NSC, OU BT, PMP and OU C, Spring 2012 through Winter/Spring 2013	Navy, 2014d

Table 6-1 (Continued). Documents Reviewed during this Five-Year Review

Document	References
Summer/Fall 2013 Long-Term Monitoring Data Summary Report for OU A, OU NSC, OU BT, PMP and OU C	Navy, 2014e
Winter/Spring 2014 Long -Term Monitoring Data Summary Report for OU BT and OU C	Navy, 2014f
Long-Term Monitoring, Inspection and Improvement Plan for OU A, OU NSC, OU BT, PMP, OU C and OU D	Navy, 2014g
Data Summary Technical Memorandum for Non-Long -Term Monitoring Investigations	Navy, 2014h
Final 2013 Sinclair Inlet Marine Monitoring Data Report	Navy, 2015b
Final Operation and Maintenance Plan	Navy, 2015c
Final Institutional Control Work Plan.	Navy, 2015d
Final 2014 Annual Remedy Inspection Report	Navy, 2015e
Basis of Design for Operable Unit A, Charleston Beach Long-Term Erosion Control Protection Remedy Design	Navy, 2015g
Fall 2014 Long -Term Monitoring Data Summary Report for OU A, OU NSC, OU BT, PMP and OU C	Navy, 2015h
Long Term Monitoring Trend Analysis Report for OU A, OU NSC, OU BT, PMP OU C and OU D	Navy, 2015i
Long Term Monitoring Trend Analysis Report for OU A, OU NSC, OU BT, PMP OU C and OU D	Navy, 2016l
Numerical Simulation of Groundwater Flow at Puget Sound Naval Shipyard	Jones et al., 2016
Addendum to the Third Five-Year Review Bremerton Naval Complex (Puget Sound Naval Shipyard Complex Superfund Site)	Navy, 2016a
Final Operation and Maintenance and Institutional Control Plan	Navy, 2016b
Final 2014 OU B Marine Phase 2 Long-term Monitoring Report	Navy, 2016c
Final 2012 OU B Marine Long-term Monitoring Report	Navy, 2016d
Final 2015 Annual Remedy Inspection Report	Navy, 2016e
Final Long-Term Monitoring, Inspection, and Improvement Plan for OU A, OU NSC, OU B T, PMP, OU C, and OU D	Navy, 2016f
Final 2014 OU B Marine Phase 1 Long-term Monitoring Report	Navy, 2016g
Fall 2015 Long Term Monitoring Data Summary Report for OU A, OU NSC, OU BT, PMP, OU C and OU D.	Navy, 2016h
Draft 2016 Data Summary and Trend Analysis Report	Navy, 2017b
Supplemental Mercury Investigation Report	Navy, 2017c
Goals and Objectives for Decision Framework Process for PCBs and Mercury in OU B Marine, Bremerton Naval Complex	Navy, 2017d

Table 6-2. OU C Product Thickness Measurements – Spring 2012 through Fall 2016

Well ID	Product Thickness (feet)						
	3/27/2012	10/1/2012 - 10/5/2012	10/7/2013	1/22/2014	10/6/2014	10/29/2015- 11/19/2015	9/14/2016
GMWT-6	NM	NM	NM	NM	NM	NM	NM
GMWT-7	0	0	0	NM	0	0	0
GMWT-9	0	0	0	0	0	0	0
GMWT-10	NM	0	0	NM	0	0	0
GMWT-14	NM	0	0	NM	0	0	0
GMWT-15	NM	0	0	NM	0	0	0
GMWT-18	NM	0.02	0.03	NM	0.01	0	0.04
GMWT-19	NM	0	0	NM	0	0	0.03
GMWT-21	NM	NM	NM	NM	NM	NM	NM
GMWT-22	NM	NM	0	0	0	0	0
GMWT-23	NM	NM	0	0	0	0	0
GMWT-24	NM	NM	0	0	0	0	0
GMWT–25	NM	NM	0	0	0	0	0
GMWT–26	NM	NM	NM	NM	0	0	0

Note:
NM - not measured
Data sources: Navy, 2013f; Navy, 2014d; Navy, 2015i; Navy, 2016l; Navy, 2017b.

Table 6-3. OU B Terrestrial Non-LTM Data Summary

Year	Analyte Class by Sampling Location	Comments
2012	Pesticides (groundwater and surface water)- Wells 903, 346 and Sinclair Inlet*.	There were no detections for Endrin.
	VOCs (groundwater and surface water) - Wells 410R, 432, 704, 809, 810, 811, 904, 905, 907	Several VOC analytes (such as TCE) were detected in all the wells (see Table A-17) below compliance criteria.
	Low-level mercury (groundwater and surface water) - Wells 900, 901, 903, 346 and Sinclair Inlet*.	The total mercury concentrations exceeded the compliance criterion in one well 901 (0.0311 µg/L; see Table A-18).
	Metals (dissolved cadmium) [groundwater and surface water] - Wells 903, 346 and Sinclair Inlet*.	Wells 903 and 346 had UJ qualifiers for dissolved cadmium and were well below compliance criteria. Sinclair Inlet has a detection of 0.073 µg/L well below the compliance criteria of 8.8 µg/L (see Table A-16).
	TSS (groundwater and surface water)- Wells 346, 432, 810, 903, 905, 406R, 410R, 428R, LTMP-1, LTMP-3, LTMP-4, LTMP-5, and Sinclair Inlet*	TSS data was detected at several wells and was collected as an indicator for the general condition of the water (see Table A-16). TSS does not have compliance criteria.
2013	Pesticides (groundwater and surface water)- Wells 903, 346 and Sinclair Inlet.	Endrin was detected at only one sample- Sinclair Inlet and was below compliance criteria (1.6 J ng/L; see Table A-23).
	VOCs (groundwater) - Wells 410R, 432, 704, 809, 810, 811, 904, 905, 907, 425, 346	Several VOC analytes (such as TCE) were detected in all the wells that were below compliance criteria. Only one well- 425 (77 D µg/L) exceeded the compliance criteria for TCE (see Table A-24)
	Low-level mercury (groundwater and surface water)- wells 900, 901, 346 and Sinclair Inlet*	The total mercury concentrations exceeded the compliance criterion for one well 901 (0.109 µg/L and 0.0309 µg/L; see Tables A-18 and A-26).
	Metals (dissolved cadmium) - Wells 903, 346 and Sinclair Inlet*.	Dissolved cadmium was detected one sample below compliance criteria- Sinclair Inlet (0.111 µg/L; see Table A-23)
	TSS (groundwater and surface water)- Wells 346, 432, 810, 903, 905, 406R, 410R, LTMP-1, LTMP-3, LTMP-4, LTMP-5, and Sinclair Inlet*	TSS was detected at multiple wells- 406R, 410R, 432, LTMP-3, LTMP-4, LTMP-5, 903 and Sinclair Inlet (see Table A-23). TSS does not have compliance criteria.
	TPH-gasoline (-G), TPH-diesel (-D) and TPH-residual (-R) - well 811 (groundwater sample), product from well 811, and product from the underground tank was sampled.	TPH-G, TPH-D, TPH-R were detected in well 811. TPH-D, TPH-R were detected in product and tank sample. TPH-G was not detected in both the tank and product sample (see Table A-25). TPH-G, TPH-D and TPH-R were detected above the MTCA Method A Cleanup levels in the product samples. TPH-G and TPH-D were detected above the MTCA Method A Cleanup levels in the groundwater sample from well 811, while TPH-R was detected below the MTCA Method A Cleanup level in this groundwater sample.

Table 6-3 (Continued). OU B Terrestrial Non -LTM Data Summary

Year	Analyte Class by Sampling Location	Comments
2014	Low-level mercury (groundwater and surface water) - wells 900, 901, 346 and Sinclair Inlet*	The total mercury concentrations exceeded the compliance criterion for well 901(0.0641 µg/L; see Table A-26).

*Sinclair Inlet sampled for reference – not part of OU B Terrestrial
Data sources: Navy, 2012h; Navy, 2013b; Navy, 2013c; Navy, 2014h.

Table 6-4. OU NSC Non-LTM Data Summary

Year	Analyte Class by Sampling Location	Comments
2012	VOCs (groundwater) - well 902.	VOC was not detected above laboratory quantitation limits in the well (see Table A-15).
	Low-level mercury (groundwater and surface water) -well 902, 346, Sinclair Inlet*.	There were no detections above laboratory quantitation limits in wells 902, 346. In Sinclair Inlet, mercury (0.00421 µg/L) was detected above the laboratory quantitation limit, but well below the OU NSC cleanup level (see Table A-16).
	TSS (groundwater and surface water) -wells 392R, 346 and Sinclair Inlet*.	TSS were detected 392R (6.5mg/L) and Sinclair Inlet sample (23 mg/L) see Table A-17. TSS does not have compliance criteria.
2013	VOCs (groundwater) - well 902 and 346	All values for well 902 were "U" (not detected at the indicated quantitation limit) or "UJ" (not detected at the indicated, estimated quantitation limit). For well 346, all values were "U" or "UJ" qualified except for Toluene (0.070J µg/L) and 1,2,4-Trimethylbenzene ((0.080J µg/L) which were both estimated values (see Table A-22). No values were above the compliance criteria.
	Low-level mercury (groundwater and surface water) - well 902, 346 and Sinclair Inlet*.	There were no detections above laboratory quantitation limits in wells 902, 346. In Sinclair Inlet, mercury (0.00124 µg/L) was detected above the laboratory quantitation limit, but well below the OU NSC cleanup level (see Table A-16).
	TSS (groundwater and surface water) - wells 392R, 346 and Sinclair Inlet*.	TSS were detected above the laboratory quantitation limit in one sample- the Sinclair Inlet (see Table A-24). TSS does not have compliance criteria.
2014	VOCs (groundwater) - well 902	There were no detections above laboratory quantitation limits with the exception of toluene with a J qualifier (see Table A-22).
	Low-level mercury (groundwater and surface water) -well 902, 346, Sinclair Inlet*.	There were no detections above laboratory quantitation limits in wells 902, 346. In Sinclair Inlet, mercury was detected (0.00868 µg/L) above the laboratory quantitation limit, but below the OU NSC cleanup level (see Table A-23).

*Sinclair Inlet sampled for reference – not part of OU B Terrestrial
Data sources: Navy, 2012h; Navy, 2013b; Navy, 2013c; Navy, 2014h.

Table 6-5. OU B Marine 500-Foot Grid Sediment Sampling

Cell Number	Total Organic Carbon (%)		Total PCBs – bulk (µg/kg)				Total PCBs – normalized (mg/kg OC)				Mercury (mg/kg)		
	2012	2014	2012		2014		2012		2014		2012	2014	Codes
2001	3.8	4.1	320		130		8.4		3.2		1.2	0.70	
2002	2.9	3.5	100		21	J	3.4		0.60	J	0.66	0.64	
2003	2.0	1.6	170		41		8.5		2.6		0.62	0.38	
2004	3.0	3.0	110		24	J	3.7		0.80	J	0.75	0.67	12
2005	2.7	2.8	100		20	J	3.7		0.71	J	0.68	0.76	
2006	2.6	2.7	120		39		4.6		1.4		0.72	0.61	
2007	2.6	2.6	100		30		3.8		1.2		0.87	0.65	
2008	2.5	2.6	150		54	J	6.0		2.1	J	0.89	0.75	
2009	2.6	2.7	89		27	J	3.4		1.0	J	0.61	0.56	
2010	1.2	1.4	52		22		4.3		1.6		0.35	0.29	
2011	2.2	2.4	100		53	J	4.5		2.2	J	0.56	0.57	
2012	2.3	2.4	170	J	58	J	7.4	J	2.4	J	0.65	0.74	
2013	2.7	3.1	120	J	16	J	4.4	J	0.52	J	0.60	0.55	
2014	1.0	0.95	49		21		4.9		2.2		0.71	0.25	
2015	2.1	1.1	50		22	J	2.4		2.0	J	0.42	0.34	
2016	2.4	2.5	89		31		3.7		1.2		0.58	0.49	
2017	2.6	2.8	100		43		3.8		1.5		0.66	0.58	
2018	1.0	2.3	43		20	J	4.3		0.87	J	0.27	0.19	
2019	2.0	2.2	120		49		6.0		2.2		0.69	0.46	
2020	2.6	2.8	110		36		4.2		1.3		0.62	0.58	
2021	1.6	1.6	54		23		3.4		1.4		0.31	0.28	
2022	2.9	3.2	110		24	J	3.8		0.75	J	0.64	0.63	
2023	2.7	2.9	81		37		3.0		1.3		0.63	0.58	
2024	3.6	3.4	130		62		3.6		1.8		0.58	0.53	14
2025	3.4	3.3	240		120		7.1		3.6		0.70	0.61	
2026	3.6	3.5	230	J	100		6.4	J	2.9		0.74	0.62	
2027	2.5	2.6	120		34		4.8		1.3		0.59	0.52	
2028	3.6	3.8	100		70	J	2.8		1.8	J	0.78	0.57	
2029	3.6	3.5	200		72		5.6		2.1		0.73	0.73	12
2030	3.7	3.4	220		26	J	5.9		0.76	J	0.78	0.64	
2031	2.6	2.5	95		16	J	3.7		0.64	J	0.48	0.65	
2032	3.0	2.7	120		40		4.0		1.5		0.69	0.59	
2033	2.6	3.5	240		120	J	9.2		3.4	J	0.86	0.68	
2034	3.0	3.2	290		84	J	9.7		2.6	J	0.89	0.98	
2035	2.9	3.0	200	J	34	J	6.9	J	1.1	J	0.83	0.62	
2036	2.9	2.9	140	J	30	J	4.8	J	1.0	J	0.67	0.64	12
2037	2.6	2.2	130	J	34	J	5.0	J	1.6	J	0.58	0.48	
2038	1.7	1.6	66		18	J	3.9		1.1	J	0.45	0.43	
2039	2.4	3.3	230		68		9.6		2.1		0.97	0.72	
2040	2.9	3.6	210		31	J	7.2		0.86	J	0.87	0.71	
2041	9.8	3.4	140		26	J	3.9		0.76	J	0.52	0.64	
2042	2.7	2.5	180	J	55		6.7	J	2.2		0.75	0.70	
2043	2.0	1.9	150		46	J	7.5		2.4	J	0.59	0.50	14
2044	2.8	2.9	170		22	J	6.1		0.76	J	0.50	0.52	
2045	3.4	3.4	220		64		6.5		1.9		0.85	0.86	
2046	1.7	0.99	49		23	J	2.9		2.3	J	0.17	0.18	
2047	4.7	2.8	910		33	J	31		1.2	J	9.3	0.56	
2048	2.8	3.0	76		15	J	2.7		0.50	J	0.66	0.49	14
2049	3.1	3.2	180		84	J	5.8		2.6	J	0.55	0.69	
2050	2.9	2.9	140	J	28	J	4.8	J	0.97	J	0.59	2.6	
2051	3.0	2.9	93		18	J	3.1		0.62	J	0.53	0.49	
2052	2.8	3.0	300	J	96	J	11	J	3.2	J	0.70	1.1	
2053	3.3	2.6	120		53		3.6		2.0		3.0	0.73	
2054	2.9	3.0	70		21	J	2.4		0.70	J	0.51	0.63	
2055	2.9	2.7	250		100	J	8.6		3.7	J	0.66	0.58	
2056	2.8	2.9	200	J	66	J	7.1	J	2.3	J	1.2	1.0	
2057	3.9	3.0	160		120	J	4.1		4.0	J	0.80	0.64	
2058	2.9	3.1	77		34		2.7		1.1		0.46	0.50	
2059	3.1	3.4	190		55		6.1		1.6		0.96	0.59	
2060	3.3	3.2	380	J	49		12	J	1.5		2.1	0.61	
2061	4.9	3.2	690		43	J	14		1.3	J	0.79	0.57	
2062	2.7	3.2	90		24	J	3.3		0.75	J	0.80	0.49	
2063	3.6	2.7	360		310		10		11		1.8	1.2	
2064	3.2	3.5	170		71		5.3		2.0		0.78	0.76	
2065	2.6	3.0	170	J	74		6.5	J	2.5		0.77	0.64	
2066	2.4	2.7	130		34	J	5.4		1.3	J	0.78	0.51	12,14
2067	3.2	3.0	170		110	J	5.3		3.7	J	2.1	3.4	
2068	2.8	2.3	200		120	J	7.1		5.2	J	0.96	0.75	
2069	1.2	1.2	90		46		7.5		3.8		0.55	0.35	
2070	2.6	2.6	72		14	J	2.8		0.54	J	0.62	0.39	
2071	0.90	0.80	23		17	J	2.6		2.1	J	0.18	0.23	
GeoMean	—	—	130		41		5.1		1.6		—	—	
Arithm. Mean	2.8	2.7	—		—		—		—		0.88	0.66	

J - estimated value;

Table 6-5 (Continued). OU B Marine 500-Foot Grid Sediment Sampling

* - adjusted from 105% reported by laboratory
Codes, 12, and 14 = values shown are averages of primary sample and field duplicate for years 2012, or 2014, respectively
Data source: Navy, 2016d

Table 6-6. OU B Marine 1,500-Foot Grid Sediment Sampling

Cell Number	Total Organic Carbon (%)		Total PCBs – bulk (µg/kg)				Total PCBs – normalized (mg/kg OC)				Mercury (mg/kg)			Codes
	2012	2014	2012		2014		2012		2014		2012	2014		
2301	2.2	2.2	54		22	J	2.5		1.0	J	0.073	0.070		
2302	0.98	0.85	14	J	5.1	J	1.4	J	0.60	J	0.077	0.0689		
2303	1.2	1.4	20	J	6.4	J	1.7	J	0.46	J	0.071	0.069		
2304	1.1	1.0	10		2.1	U	0.91		0.21	U	0.077	0.059		
2305	3.6	3.5	85		31	J	2.4		0.89	J	0.44	0.44		
2306	3.9	3.8	120		37	J	3.1		0.97	J	0.73	0.63		
2307	4.0	4.2	110		54		2.8		1.286		0.62	0.62		14
2308	3.5	3.8	130	J	49	J	4.0	J	1.3	J	0.76	0.72		12
2309	3.8	4.0	110	J	37	J	2.9	J	0.93	J	0.68	0.68		
2310	3.2	3.7	130	J	40		4.1	J	1.1		0.74	0.64		
2311	3.4	3.7	120		31		3.5		0.84		0.77	0.67		
2312	1.1	0.82	24	J	8.4	J	2.2	J	1.0	J	0.18	0.14		
2313	3.0	3.0	110		38		3.7		1.3		0.64	0.59		
2314	3.5	3.7	100		34	J	2.9		0.92	J	0.71	0.68		
2315	3.6	3.8	100	J	38		2.8	J	1.0		0.68	0.60		
2316	4.0	4.0	140		82		3.5		2.1		0.53	0.51		
2317	6.0	3.2	110		30	J	1.8		0.94	J	0.64	0.68		
2318	3.3	3.4	89		27	J	2.7		0.79	J	0.59	0.59		
2319	3.2	3.4	92		30	J	2.9		0.88	J	0.62	0.62		
2320	2.8	3.0	100		29	J	3.6		0.97	J	0.65	0.56		
2321	2.8	3.0	77		25	J	2.8		0.83	J	0.73	0.58		
2322	2.8	3.1	93		18	J	3.3		0.58	J	0.51	0.38		
2323	2.2	2.5	61		8.8	J	2.8		0.35	J	0.33	0.32		
2324	2.9	2.7	72		14	J	2.5		0.52	J	0.64	0.48		
2325	1.6	2.5	32		7.5	J	2.0		0.30	J	0.27	0.41		
2326	0.34	0.28	4.4	U	4.3	U	1.3	U	1.5	U	0.024	0.024	J	12,14
2327	3.7	3.1	76		25	J	2.1		0.81	J	0.48	0.47		
2328	2.8	2.9	59		4.2	U	2.1		0.14483	U	1.6	0.33		
2329	2.0	1.6	46	J	7.0	J	2.3	J	0.44	J	0.31	0.24		
2330	0.70	0.47	3.0	U	2.1	U	0.43	U	0.45	U	0.059	0.052		
2331	2.5	2.3	46		12	J	1.8		0.52	J	2.2	0.41		
2332	1.6	1.5	44		28		2.8		1.9		0.31	0.26		
Geomean	NC	NC	56		17		2.4		0.75		NC	NC		

Notes:
J - estimated value
NC – not calculated
U - analyte not detected

Table 6-6 (Continued). OU B Marine 1,500-Foot Grid Sediment Sampling

Codes 12 and 14 - values shown are averages of primary sample and field duplicate for years, 2012, or 2014, respectively
Data source: Navy, 2016d

Table 6-7. Area-Weighted Average Concentrations for Sediment Sampling in 2012 and 2014

	2012			2014		
	500-ft	1500-ft	Inlet	500-ft	1500-ft	Inlet
Total PCBs (mg/kgOC)						
Geomean	5.1	2.4	2.8	1.6	0.73	0.85
Mercury (mg/kg)						
Arithmetic Mean	0.88	0.55	0.62	0.66	0.42	0.47

Data Source: Navy, 2016g

Table 6-8. 2014-15 Charleston Beach Sediment Sampling

Sample #	Fines (Clay + Silt) (%)	TOC (%)	PCBs (µg/kg)	PCBs (mg/kgOC)	Arsenic (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Silver (mg/kg)	Zinc (mg/kg)
SCO/CSL	**---**	**---**	**---**	**12/65**	**57/93**	**5.1/6.7**	**260/270**	**390/390**	**450/530**	**0.41/0.59**	**6.1/6.1**	**410/960**
Natural Background*	---	---	---	---	11	0.8	62	45	21	0.2	0.24	93
CB-1	8.2	1.7	4.3 U	0.12 U	2.7	0.38	9.1	36	33 J	0.046	0.089	57
CB-2	3.0	0.32	4.3 U	--- **	2.4	0.20	11	25	18 J	0.060	0.060	56
CB-3	2.4	0.25	4.3 U	--- **	2.0	0.14	11	29	25 J	0.047	0.053	60
CB-4	3.0	0.27	4.3 U	--- **	2.5	0.21	13	22	7.9 J	0.037	0.067	42
CB-4 (FD)	3.2	0.25	4.3 U	--- **	2.0	0.25	9.9	22	9.6 J	0.051	0.065	37
CB-5	2.3	0.18	4.3 U	--- **	1.4	0.10	8.4	33	5.9 J	0.037	0.045	36
CB-6***	31	2.7	140 U****	5.2 U	10	1.5	33 J	160 J	260 J	0.18	0.26	280 J

Notes:
* 90/90 upper tolerance limit (UTL) values calculated from "BOLD Plus" data and presented in Ecology's Sediment Cleanup User's Manual II (Ecology 2015). A natural background value of 0.0000002 mg/kg was calculated for bulk PCBs, but this was based on congener analyses and is not directly comparable to the Aroclor values presented here.
** TOC value is outside the range generally accepted for normalizing PCBs
*** Subtidal sample collected from marine research vessel during LTM sediment sampling in September 2014. Others are intertidal samples collected from on-shore in May 2015.
**** Elevated detection limit likely caused by matrix interference. Does not impair data usability but does impact use for regulatory comparisons (see Data Quality Assessment in Appendix B).
U – undetected; J - estimated value
SCO/CSL – Washington State sediment cleanup objective/cleanup screening level (new term replaced former "SQS" in connection with publication of Sediment Cleanup User's Manual II [Ecology 2015])
Data source: 2016c

Table 6-9. Summary of Sinclair Inlet English Sole Sampling, 2012 and 2015

Analyte	2012	2015
Total PCBs	0.068	0.030
Total Mercury	0.048	0.037

Notes:
Arithmetic mean by sample event, mg/kg, wet weight
Data sources: Navy, 2016c; Navy, 2016d; Navy, 2016g

Table 6-10. OU A Inspection Results

Year	Pavement and Vegetative Cover	Shoreline			Catch Basin
		Segment #	**2016 Condition**	**Notes**	
Five-Year Review Summary	• Confirmed the overall findings of the 2016 annual inspection regarding the conditions of pavement and vegetative cover. • Overall conditions were observed to be good, with some deterioration that did not appear to warrant immediate action, but should be on a planning calendar for maintenance. • Plants deaths were noted in the 2012-2016 Annual Remedy Inspection Reports. The vegetated area is within the footprint of the planned remedy repair and therefore the vegetative cover issues will be addressed by that future repair.	42	Generally in good condition with no holes, some rust	Sheet Pile	• No ponding or blockages were observed. • Accumulated solids depths were not measured.
		43	No evidence of erosion such as sloughing or obvious rock movement	Armor Rock	
		44	No evidence of erosion such as sloughing or obvious rock movement	Armor Rock	
		45	Erosion gauges showed approximately 6.5 inches of exposure at Gauge A and 3.75 inches of exposure at Gauge C in November 2016. As of July 2017, these gauges showed 12" of exposure at Gauge A and 1.5" of exposure at Gauge C. Erosion Gauge B continues to be completely covered (as noted for the last eight inspections).	Armor Rock The shoreline along Segment 45 is not sufficiently resistant to erosion and requires ongoing interim erosion control measures to limit erosion to prevent exposure of areas previously identified as having SMS exceedances.	
		46	One section is devoid of large armor rock; however, no signs of erosion were present. In	Armor Rock and Concrete Slabs	

Table 6-10 (Continued). OU A Inspection Results (Continued)

Year	Pavement and Vegetative Cover	Shoreline			Catch Basin
			addition, small gaps in the armor rock were noted near a treed area along with some concrete pieces, which appeared to be have been placed as armoring – versus construction debris having eroded out of the shoreline.		

Note: Shoreline segments were inspected annually from 2012-2016 and those findings are included in the Annual Remedy Inspection Reports
Data Sources: Navy, 2017a; Navy, 2016e; Navy, 2015e; Navy, 2014a; Navy, 2013a

Table 6-11. OU B Terrestrial Inspection Results

<table>
<tr><th>Year</th><th>Pavement and Vegetative Cover</th><th colspan="3">Shoreline</th><th>Catch Basin</th></tr>
<tr><td rowspan="11">Five-Year Review</td><td rowspan="11">• Confirmed the overall findings of the 2016 inspection regarding the conditions of pavement.
• Overall conditions of asphalt pavement were observed to be very good, and qualitatively better than during the previous five-year review.
• The condition of asphaltic sealant used to seal utilidor lids to the utilidors at the site is being reported during annual inspections as pavement cracks. However, the shipyard utilidors are three-sided concrete forms with a concrete lid that sits on a recessed lip. Any water that enters the utilidor does not therefore come into contact with soil. These joints do not need to be mapped during annual inspections.
• Vegetated areas, especially those along the shoreline, observed during the five-year review inspection appeared to be in poor condition compared to past five-year review inspections, with bare soil, poor vegetation</td><td>Segment #</td><td>2016 Condition</td><td>Notes</td><td rowspan="11">• Numerous catch basins with filter fabric installed were observed.
• In many cases, it appeared that the filter fabric had been in place for many years and was not being maintained.
• The inspection team learned that the facility operates six vacuum trucks and conducts regular street sweeping.
• Observations of debris indicated that the street sweeping was not effective in hard to reach areas near buildings and around equipment and stored materials.</td></tr>
<tr><td>1</td><td>Two areas of erosion observed under the edge of Mooring G.</td><td>Armor Rock</td></tr>
<tr><td>2</td><td>No evidence of erosion such as sloughing or obvious rock movement.</td><td>Armor Rock</td></tr>
<tr><td>3</td><td>No deficiencies were observed</td><td>Armor Rock</td></tr>
<tr><td>4</td><td>Area of erosion exposing concrete, bricks, metal, and asphalt debris.</td><td>Limited Armor Rock</td></tr>
<tr><td>17</td><td>No deficiencies were observed</td><td>Armor Rock</td></tr>
<tr><td>18</td><td>Small 2-foot gap in sheet pile wall observed in 2014, remains unchanged</td><td>Sheet Pile</td></tr>
<tr><td>19</td><td>No deficiencies were observed</td><td>Armor Rock</td></tr>
<tr><td>40</td><td>Some evidence of erosion at the western and eastern ends of the segment.</td><td>Armor Rock</td></tr>
<tr><td>41A</td><td>Several large rocks have moved from 2015 to 2016, but the segment remains protected</td><td>Armor Rock and Concrete Slabs</td></tr>
<tr><td>41B</td><td>No deficiencies were observed</td><td>Armor Rock</td></tr>
</table>

Table 6-11 (Continued). OU B Terrestrial Inspection Results

Year	Pavement and Vegetative Cover	Shoreline	Catch Basin
	coverage, and indications that some woody plants had been pruned to the ground.		

Notes: Shoreline segments listed in the table above were inspected annually from 2012-2016 and those findings are included in the Annual Remedy Inspection Reports. Segments 8 through 40 were inspected in 2015 as part of the Waterfront Facilities Inspection Program administered by NAVFAC EXEC. Segments 1 through 5 were inspected in 2016 as part of the Waterfront Facilities Inspection Program administered by NAVFAC EXWC
Data Sources: Navy, 2017a; Navy, 2016e; Navy, 2015e; Navy, 2014a; Navy, 2013a

Table 6-12. OU D Inspection Results

Year	Control of the Property	Future Activities Planned	Activities Performed	Condition of Existing Utilities
Five-Year Review[a]	• No conveyance of interest has, or is anticipated to occur. • No usage of the site has changed in any manner, or is any change in usage anticipated.	• No construction is proposed to occur at OU D (Harborside Fountain Park) within the next 5 years.	• No issues occurred at the site requiring emergency excavation, groundwater use or other work that could have penetrated the cap. • No use of groundwater at the site. • No earthwork, excavation, or drilling occurred at the site. • No work occurred at the site that may have deformed the cap due to excessive loads.	• No issues have been identified on any storm drain lines. • No issues have been identified on any water lines.

[a] – Reported by the City of Bremerton
Data Sources: Navy, 2017a; Navy, 2016e

Table 6-13. OU NSC Inspection Results

Year	Pavement and Vegetative Cover	Shoreline			Catch Basin
		Segment #	**2016 Condition**	**Notes**	
Five-Year Review	• Active paving was observed in the area west of Building 467. • Confirmed the overall findings of the 2016 inspection regarding the conditions of pavement and vegetative cover. • Overall conditions were observed to be good, with some deterioration that did not appear to warrant immediate action.	6	Shoreline segment inspected by EXWC in Fall 2016.	(U.S. Navy, 2016m)	• No ponding or blockages were observed. Accumulated solids depths were not measured.
		7	Shoreline segment inspected by EXWC in Fall 2016.	(U.S. Navy 2016m)	

Note: Shoreline segments were inspected in 2016 as part of the Waterfront Facilities Inspection Program administered by NAVFAC EXWC (Navy, 2016m).
Data Sources: Navy, 2017a; Navy, 2016e; Navy, 2016m; Navy, 2015e; Navy, 2014a; Navy, 2013a

Table 6-14. OU C Inspection Results

Year	Institutional Control Inspection Results
Fourth Five-Year Review	• No evidence of activities that could interfere with monitoring • No evidence of activities that could result in the release of petroleum hydrocarbons • Navy does not intend to convey any real property interest in the site • No Navy proposals to change the OU C land use to a use inconsistent with the land use restrictions

Table 6-15. Comparison of Marginal and Poor Pavement Conditions in 2011 and 2016

Operable Unit	2011		2016	
	Areas (ft^2)	Cracks (ft)	Areas (ft^2)	Cracks (ft)
A	352	2,632	20,308	4,358
NSC	143,243	8,850	49,391	7,579
B-T	312,491	38,785	241,257	43,294
Overall	456,086	50,267	310,956	55,231

Data Sources: Navy, 2017a; Navy, 2012a

7.0 TECHNICAL ASSESSMENT

This section presents the technical assessment of the remedies at BNC, including an assessment of ongoing remedy functionality, the continued validity of ROD assumptions, and any new information that has arisen that could affect the protectiveness of the remedy. This section also summarizes the issues identified during this five-year review process.

This section answers three questions for each operable unit:

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

Based on the answers to the questions discussed in this section, the technical assessment of the remedies is summarized in Table 7-1. This table provides a quick reference to the answers for questions A, B, and C by OU. A discussion of the answers to the three questions (A, B, and C) and the technical assessment summary are presented in Sections 7.1, 7.2 and 7.3, respectively.

Information necessary for Ecology to perform the periodic review for OU C pursuant to WAC 173-340-420 is provided in Appendix D.

7.1 Question A – Is the Remedy Functioning as Intended by the Decision Documents?

This section summarizes the current state of functionality for each OU based on the findings of the five-year review process. Each component of the remedy for each OU is discussed in the sections that follow, generally in the order that the components were described in Section 4.

7.1.1 Functionality of Remedy for OU A

Is the remedy functioning as intended by the ROD? No, the OU A remedy is not currently functioning as intended by the ROD.

7.1.1.1 Remedial Action Performance

The physical construction components of the OU A remedy were implemented prior to the first five-year review (see Section 4.1.3). The shoreline along Segment 45 of the BNC shoreline, Charleston Beach, is not sufficiently resistant to erosion and requires ongoing beach replenishment to limit erosion of constituents in fill material to Sinclair Inlet. Inspections at Segment 45 indicated that interim repair is eroding as evidenced by the gauge measurements.

Frequent interim erosion control projects are necessary to prevent areas identified as having SMS exceedances from being exposed.

Planning for OU A remedy repair has occurred over many years. Stakeholders provided input during this planning, including reviewing and providing comments on the 90 percent design. The Navy produced the 100 percent design including resolution of stakeholder comments with the exception of comments related to mitigation. A contract was awarded to implement the remedy repair in December 2016. A preliminary habitat analysis was performed at this same time to determine if there would be habitat loss associated with the planned remedy repair. The analysis determined habitat loss is anticipated with repair implementation. This was not envisioned during design development. As a result, the Navy is planning a review of the design as the original design did not take into account any habitat loss. Remedy repair implementation plans have ceased until internal and external stakeholders are consulted about these issues. It is not anticipated that permanent remedy repair for OU A Charleston Beach will occur in 2017 due to time related to design review, design re-development (if necessary), contracting for the work, and in-water timing related to the (fish window) work periods. Interim erosion control is planned until the permanent remedy repair is completed.

7.1.1.2 System Operation and Monitoring

Periodic groundwater monitoring has been conducted under plans approved by the regulatory agencies, as intended by the ROD. The groundwater data (Section 6.4.1) indicate that the conditions present at the time of the ROD remain with little change. Monitoring is ongoing as contaminants are being managed in-place.

7.1.1.3 Implementation of Institutional Controls

The inspections of the pavement and erosion protection remedy components conducted during this five-year review period have identified and documented needed repairs, and this inspection process is therefore generally functioning as intended by the ROD. The site paving remains intact, interrupting the exposure pathways.

7.1.2 Functionality of Remedy for OU B Marine

Is the remedy functioning as intended by the ROD? No, the OU B Marine remedy is not functioning as intended by the ROD.

7.1.2.1 Remedial Action Performance

The physical construction components of the OU B Marine remedy were completed by March 2004 (see Section 4.2.1). To validate that these physical components are functioning as intended by the ROD, a review and revalidation of the bathymetric survey data from the post-construction survey through the 2012 survey in the CAD pit, ENR and thick cap areas should be completed. In

addition, mercury source control at BNC must be addressed for the OU B Marine remedy to be considered functional (see additional discussion in Section 7.1.3.1).

In addition to the Charleston Beach erosion issue, anthropogenic debris consistent with landfill material is within the intertidal zone. The anthropogenic materials along the intertidal area at Charleston Beach are not being released to the shoreline due to the shoreline erosion protection system (combination of rip rap, sheet pile and fish mix berm). These materials were present in/on the beach at the time the OU A and OU B Marine RODs were signed and do not constitute a new condition.

7.1.2.2 System Operation and Monitoring

Post-remedy monitoring of OU B Marine during this five-year review period was conducted in 2012 and 2014/2015. Marine sediment and English sole were sampled in both rounds. The most recent monitoring also included bathymetric surveys, sub-bottom profiling, and sediment coring to verify the persistence and condition of the sediment disposal pit and cap/ENR remedy components.

The 2012 and 2014 sub-bottom profiling results were similar and indicated that the CAD pit cover is intact and functioning as planned.

The OU B Marine MCUL of 3 mg/kgOC and the Sinclair Inlet cleanup goal of 1.2 mg/kgOC were both met based on the 2014 sampling round. The Navy and stakeholder group have agreed to perform an additional round of confirmatory sampling to verify this result. Trend analysis was eliminated from the 2014 LTM report as the analysis done in 2012 indicated that the 2012 data did not conform to the exponential decay models that had been used in the 2003, 2005, 2007, and 2010 LTM reports. Trend analysis will be re-evaluated as part of the upcoming Decision Framework process for OU B Marine.

Non-LTM data were collected within OU B Marine during this five-year review period; however, the Decision Framework Goals and Objectives document (Navy, 2017d) defers analysis of these data. Specifically, it states, “Until the Decision Framework is updated, only data collected for the LTM program (grids) will be used to calculate area-weighted averages. Other data may be evaluated for use as weight of evidence to further understand site conditions, such as identifying contaminant sources or evaluating areas not previously characterized.”

The recently completed Supplemental Mercury Investigation Report (Navy 2017b) concluded that despite uncertainties, enough is known to address mercury source control at BNC and to justify consideration of additional remedial actions for total mercury in sediment to reduce human health risk from mercury contamination.

The OU B Marine Team has put a decision framework process in place. The Decision Framework will be developed during the next review period and will include methods to assess OU B Marine non-LTM data and to guide future sampling and remedy selection.

7.1.2.3 Implementation of Institutional Controls

The IC component of the ROD was implemented, and ICs were historically documented both in the IC plan and in Navy instructions (as cited in the IC plans). However, ICs for OU B Marine were not included in the latest IC plan, and no periodic reporting on the effectiveness of ICs is performed. As agreed by the OU B Marine team during the April 13, 2017 meeting, plans to create an OU B Marine IC Plan to clearly document the OU B Marine IC requirements, and associated inspection, inspection frequency and reporting requirements have been implemented and the draft plan is expected to be completed in January 2018. Development of the IC Plan will follow guidance provided in EPA, 2010.

7.1.3 Functionality of Remedy for OU B Terrestrial

Is the remedy functioning as intended by the ROD? No, the OU B Terrestrial remedy is not functioning as intended by the ROD.

7.1.3.1 Remedial Action Performance

The physical construction components of the OU B Terrestrial remedy have been completed (see Section 4.3.1). However, the remedy for OU B Terrestrial is not functioning as intended by the ROD. Mercury is a COC for OU B Marine. The largest known ongoing source of filtered mercury from BNC to Sinclair Inlet including OU B Marine is from western portion of OU B Terrestrial, located in the southern portion of the Outfall 15 drainage basin. Whole water mercury concentrations in discharges associated with Outfall 15 are unknown and could potentially represent an important source of particulate-bound mercury to sediment. Filtered mercury releases have been assessed and reported by the USGS, and a report that includes an assessment of whole water releases is underway. This ongoing work is necessary to develop an understanding of the magnitude of particulate release, to allow development of an effective approach for Outfall 15 drainage basin source control. In addition, the existing information is not sufficient to dismiss the idea that there may be other ongoing mercury releases elsewhere at BNC that warrant further investigation. For example, recent USGS groundwater modeling (Jones, et al., 2016) at BNC indicates that in addition to direct groundwater discharge in the vicinity of Outfall 15, there is also an area between Dry Docks 5 and 6 where direct groundwater discharge to Sinclair Inlet surface waters occurs. Elevated mercury has been identified in these groundwater discharges. The Navy is engaged with stakeholders to develop a mercury remedy for OU B Marine that addresses mercury source control as well as risks posed by mercury in sediments and bioaccumulation in marine organisms. Source control investigations and remedial actions undertaken within the boundaries of OU B Terrestrial will be administratively part of OU B Marine, not OU B Terrestrial, because they address exposures in the marine environment.

7.1.3.2 System Operation and Monitoring

Periodic groundwater monitoring has been conducted under plans approved by the regulatory agencies, as intended by the ROD. The monitoring data (Section 6.4.1) indicate that, overall, the

low-risk conditions present at the time the ROD was executed have persisted. Monitoring is ongoing as contaminants are being managed in-place.

7.1.3.3 Implementation of Institutional Controls

Inspections of the physical remedy components and ICs continued to be implemented during this five-year review. However, additional improvements are needed for identifying and addressing pavement and storm drain system maintenance, both to ensure the ongoing correction in a timely manner of deficiencies identified during inspections and in documenting whether corrective actions have been implemented and are effective. Updates to the IC Plan will follow guidance provided in EPA, 2010.

7.1.4 Functionality of Cleanup Action for OU C

Is the cleanup action functioning as intended by the CAP? Yes, the cleanup action is functioning as intended by the CAP.

ICs are in place, and both groundwater and free-product monitoring are being conducted as required under the CAP. Although ICs were required in the CAP for OU C, the inspection frequency was not specified. To date, inspections at OU C have been performed as part of five-year reviews, but it would be an improvement to include OU C in annual inspections.

7.1.5 Functionality of Remedy for OU D

Is the remedy functioning as intended by the ROD? Yes, the OU D remedy is functioning as intended by the ROD.

7.1.5.1 Remedial Action Performance

EPA and Navy have established that the surface features installed by the City of Bremerton meet the remedy capping requirements. The storm drain cleaning and repair components of the OU D remedy were implemented together with the similar remedy component for OU B Terrestrial.

7.1.5.2 System Operation and Monitoring

Groundwater monitoring, which is combined with the monitoring program for OU B Terrestrial and provides data from well LTMP-5, is functioning in accordance with the ROD requirements.

7.1.5.3 Implementation of Institutional Controls

The IC inspection component of the remedy for OU D has been memorialized in a Memorandum of Agreement between the City of Bremerton and Navy, and the City conducts annual IC inspections (Navy, 2013i). As required, the MOA was reviewed by both the City and the Navy during this five-year review period and both parties concluded that no changes were warranted

(Cressman, 2016). The inspection reports generated by the City are included in the BNC terrestrial annual remedy inspection reports.

7.1.6 Functionality of Remedy for OU NSC

Is the remedy functioning as intended by the ROD? Yes, the OU NSC remedy continues to function as intended by the ROD.

7.1.6.1 Remedial Action Performance

The physical construction components of the OU NSC remedy were implemented prior to the first five-year review (see Section 4.6.1).

7.1.6.2 System Operation and Monitoring

Periodic groundwater monitoring has been conducted under plans approved by the regulatory agencies, as intended by the ROD. The monitoring data (Section 6.4.1) indicate that the low-risk conditions present at the time of the ROD remain present or have improved. Monitoring is ongoing as contaminants are being managed in-place.

7.1.7 Implementation of Institutional Controls

The inspections of the pavement and storm drain remedy components conducted during this five-year review period have identified and documented needed repairs, and this inspection process is therefore generally functioning as intended by the ROD. The site paving remains intact, interrupting the exposure pathways. Storm drain maintenance has occurred based on the results of these inspections. Ongoing and completed maintenance and repairs to pavement and the storm water system are not documented in the BNC Terrestrial Annual Remedy Inspection Reports. A new section should be added to the annual terrestrial remedy inspection report to describe ongoing and completed maintenance and repairs to pavement and the storm water system. This will help improve the process for identifying and addressing pavement and storm drain system maintenance both to ensure the ongoing correction in a timely manner of deficiencies identified during inspections and in documenting whether corrective actions have been implemented.

7.1.8 Operation and Maintenance Costs

Annual OM&M costs for all OUs were estimated in the RODs to total approximately $810,000 per year. Actual annual OM&M costs for fiscal years 2012 through 2016 for all OUs averaged approximately $1,327,000 per year (Table 7-2). The additional costs beyond the ROD estimate are primarily related to the ongoing evaluation of mercury in Sinclair Inlet and the design for a remedy repair at Charleston Beach. Annual costs were generally higher in the first three years of this review period, compared with costs over the last two years. The difference between projected and actual costs is not indicative of any additional issues regarding remedy functionality.

7.2 Question – Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and RAOs Used at the Time of Remedy Selection Still Valid?

Yes. In most cases, assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection are still valid. In those cases where toxicity data or cleanup levels have changed since the RODs were signed, the changes did not negatively impact the protectiveness to human health and the environment as long as the ICs preventing exposure remain in place and ongoing monitoring is continued until COC concentrations in groundwater and surface water are below the RGs.

This section describes the changes, if any, to ARARs (i.e., the standards and the "to be considered" (TBC) policies and guidance), and basic risk assessment assumptions (methods, exposure, and toxicity) that have occurred since the RODs were signed in order to assess the protectiveness of the remedies at OU A, OU B Marine, OU B Terrestrial, OU D, and OU NSC.

Concentrations of chemicals in groundwater remain above the RGs at many locations in OU A, OU B Terrestrial, and OU NSC, resulting in the need for continued ICs to prevent exposure and the need for ongoing monitoring. Although some of the RGs might be lower if calculated today, the remedy components in general continue to protect against exposures, just as they did at the time the ROD was signed.

The Navy and the OU B Marine stakeholder team are working to address mercury –related human health risks associated with subsistence-level consumption of Sinclair Inlet marine species. Currently, this team is completing tasks that will enable a focused feasibility study for mercury to be completed.

7.2.1 Changes in Standards or TBCs

In the preamble to the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), EPA states that ARARs are generally "frozen" at the time of ROD signature, unless new or modified requirements call into question the protectiveness of the selected remedy. Five-year review guidance (EPA, 2001) indicates that the question of interest in developing the five-year review is not whether a standard identified as an ARAR in the ROD has changed in the intervening period, but whether such a change to a regulation calls into question the protectiveness of the remedy. If the change in the standard would be more stringent, the next stage is to evaluate and compare the old and the new standards and their associated risk. This comparison is done to assess whether the currently calculated risk associated with the standard identified in the ROD is still within EPA's acceptable excess cancer risk range of 10^{-4} to 10^{-6}, or below a hazard index of 1 for noncancer effects. If the old standard is not considered protective, a new cleanup standard may need to be adopted after the five-year review through CERCLA's processes for modifying a remedy.

ARARs have been reviewed during each of the previous three five-year reviews. For this fourth five-year review, all ARARs identified in the RODs for OU A, OU B Marine, OU B Terrestrial,

OU D, and OU NSC were again reviewed for changes that could affect the assessment of whether the remedy is protective.

ARARs that were used in the determination of cleanup levels that have been amended since publication of one or more of the RODs include the following:

- Washington State MTCA Regulations
- Washington State Marine Surface Water Quality Standards for Protection of Aquatic Life and Human Health
- Washington State SMS

For many of the COCs in groundwater, the RG was based on the laboratory PQL. For the other COCs, the RG was based on MTCA regulatory levels. MTCA allows for use of the PQL when the MTCA cleanup level is below the PQL. However, as analytical techniques improve over time, laboratories may be able to achieve lower PQLs for some of these COCs. As part of the ARAR evaluation, current analytical limits of quantitation (LOQs) are compared to PQLs listed in the ROD. In present day terminology for DoD sites, the PQL is referred to as the LOQ in accordance with the DoD Quality Systems Manual for Environmental Laboratories (QSM) [DoD, 2013] and the Navy's Tier II Sampling and Analysis Plan format guidelines. The LOQ is synonymous with the PQL, as defined in WAC 173-340.

The result of the amendments to the regulations is sometimes the lowering of a numeric ARAR. In these instances, the revised ARAR must be evaluated to determine whether there is a negative effect on the protectiveness of the remedy. In other instances, the ARAR remains unchanged or has been raised. In these instances, no further discussion is provided, because the protectiveness of the remedy is not affected.

7.2.1.1 Operable Unit A

For OU A, soil cleanup levels were based on industrial site usage, and groundwater cleanup levels were based on the protection of adjacent surface waters of Sinclair Inlet. For the COCs in soil and groundwater listed in the OU A ROD, no revision to the ARARs was found that would affect the protectiveness of the remedy.

Soil. Table 7-3 compares current ARAR values for soil with those provided in the OU A ROD (Table 8-1 of Navy et al., 1997). Since the time of the third five-year review, there has been no ARAR revision for soil that would affect the protectiveness of the remedy.

As discussed in the previous five-year reviews, the MTCA Method C industrial soil cleanup level for total PCBs increased from 17 to 66 mg/kg for "high risk and persistent PCBs" (as defined by EPA guidance). The lower cleanup level selected in the ROD (17 mg/kg) remains protective of human health and the environment.

As discussed in the preceding five-year review, the MTCA Method C industrial soil cleanup level of 87.5 mg/kg for arsenic is lower than the ROD RG of 219 mg/kg. However, no change to the ROD RG for arsenic is considered necessary. As stated in the second and third five-year reviews, the effect of a lower cleanup level is minimal because the areas with the greatest arsenic concentrations have been paved, thereby effectively preventing the direct contact exposure route.

At the time of the OU A ROD, individual carcinogenic PAHs (cPAHs) were assessed based on the MTCA Method C industrial soil cleanup level for benzo(a)pyrene. The RG for cPAHs in soil required adjusting the concentrations of individual cPAHs based on their relative toxicity to benzo(a)pyrene, then summing up the individual adjusted concentrations and comparing the result to the RG for benzo(a)pyrene. This resulted in a total "toxicity equivalent" concentration (TTEC) based on the toxicity of benzo(a)pyrene (Ecology, 2001). The current MTCA Method C industrial value of 18 mg/kg for benzo(a)pyrene is the same as the RG listed in the ROD. As such, the ROD RG has not changed and remains protective. There are some changes highlighted in Table 7-3 that are presented for informational purposes only; these changes do not impact the protectiveness evaluation for cPAHs. As noted on Table 7-3, current MTCA Method C industrial values also are available for the individual cPAHs, such that the summing step may no longer be required if only one cPAH is present. However, this does not constitute a change in the assessment of the toxicity of these compounds, and the TTEC approach is still required by MTCA.

Groundwater. Table 7-4 compares the RGs presented in the OU A ROD (Table 8-1 of Navy et al., 1997) to current groundwater ARAR values for the protection of surface water and current LOQs.

At OU A, groundwater monitoring is currently only required for arsenic, copper, lead, nickel and zinc and no longer required for the other COCs shown in Table 7-4 in accordance with the recommendations of the first five-year review (Navy, 2002e). Arsenic is the only remaining COC where the RG was based on the PQL recorded in the ROD. As the current LOQ is the same as the ROD PQL, there is no ARAR revision for arsenic in groundwater that would affect the protectiveness of the remedy.

ROD RGs for copper, lead, nickel and zinc were based on the marine ambient water quality criteria (WQC) at the time of the ROD, which as shown in Table 7-4, are lower than current regulatory levels. Thus, there are no ARAR revisions for these four COCs in groundwater that would affect the protectiveness of the remedy.

Even though monitoring is no longer performed for the organic COCs, changes to regulatory levels and quantitation limits are listed in Table 7-4 for completeness. Note that the RGs for all organic COCs were based on the PQL at the time the ROD was completed. When RGs are established as PQLs and the PQLs decrease with improved technology, the five-year review process does not typically recommend revising the RGs during every five-year review. Instead, the five-year review includes an assessment of whether the use of current laboratory analytical techniques might alter the conclusion that the remedy remains protective.

As stated above, quantitation limits (i.e., ROD PQL and current LOQ) for the organic COCs are provided in Table 7-4. When groundwater monitoring at OU A began in 1998, analyses for the COCs were based on ROD PQLs. However, as analytical techniques improved over time, updates were made to the groundwater monitoring program at OU A and the lowest quantitation limits available at that time were used for that groundwater monitoring event. By spring 2002, groundwater samples were analyzed for all organic COCs using quantitation limits less than ROD PQLs and during the Spring 2003 groundwater monitoring event, analyses for the organic COCs were based on quantitation limits similar to the current LOQs listed in Table 7-4. Except for bis(2-ethylhexyl)phthalate, none of the organic COCs were detected above quantitation limits throughout the groundwater monitoring program. Although bis(2-ethylhexyl)phthalate continued to be sporadically detected after remedial actions occurred, concentrations were much less than those detected before the ROD. Because the concentrations of the organic COCs were nondetect (at the lower quantitation limits) or were much less than concentrations observed before the ROD over multiple consecutive sampling events, the organic COCs were dropped from analyte list after spring 2003 in accordance with the first five-year review and 2002/2003 annual monitoring report recommendation to not sample with the approval of EPA and Ecology.

As current laboratory techniques have not significantly changed since the organic COCs were dropped from the groundwater monitoring program, and because the COCs were not detected above the lower quantitation limits while sampling was still being performed during the groundwater monitoring program, RGs remain protective of human health and the environment.

Sediment. Actions at Charleston Beach taken subsequent to the OU A remedy implementation (Described in Section 4.1.2) resulted in the presence of a small area of intertidal sediment within the boundaries of OU A (Figure 4-2). Changes to the Washington State SMS during this five-year review period, as described in Section 7.2.1.2 below, are applicable to the intertidal sediment within OU A. Exceedances of the SMS numeric criteria were identified in sediment samples collected prior to placement of fix mix gravels on Charleston Beach. The numeric criteria used for comparison were not changed during the 2013 revision of the SMS discussed in Section 7.2.1.2 below, and therefore this ARAR change does not affect the protectiveness of the remedy.

7.2.1.2 Operable Unit B Marine

For OU B Marine, Washington State SMS are applicable to the sediment cleanup levels and cleanup actions. The SMS rule was last revised in 2013, after the third five-year review was completed. The amendments adopted in 2013 include the following:

1. Integrate the SMS and MTCA, Chapter 173-340 WAC, cleanup requirements where appropriate
2. Clarify requirements for protection of human health from sediment contamination
3. Clarify requirements for protection of higher trophic level species from sediment contamination

4. Promulgate numeric chemical and biological criteria for freshwater sediment to protect the benthic community
5. Clarify requirements for coordinating source control and cleanup actions at cleanup sites

The original SMS rule did not clearly address how to assess human health and ecological risk from chemicals that bioaccumulate in the food chain. The amendments to Part V of the rule add to the SMS decision framework a mechanism for setting standards to protect human health and the environment in sediment. The mechanism is based on a two-tiered framework establishing sediment cleanup standards using risk-based, background-based, and PQL-based values to select the lower tier SCO and the upper tier cleanup screening level (CSL). Subsequently, the sediment cleanup level is determined by adjusting upwards from the SCO based on technical possibility and net adverse environmental impacts (Ecology, 2015b).

In addition, in the original rule, source control requirements to prevent sediment recontamination following cleanup were difficult to implement. The amendments clarify requirements for coordinating cleanup actions and source control requirements which will help prevent recontamination and make the requirements for cleanup actions attainable.

The OU B Marine ROD (Navy et al., 2000) identified RAOs for sediment and associated MCULs, action levels, and long-term cleanup goals for PCBs and a combined action level for co-located PCBs and mercury. The way in which the cleanup levels and cleanup goals for PCBs and mercury may be interpreted in light of the revised SMS is the focus of the following discussion.

PCBs. The RAO for addressing PCBs in sediment was based on the human health risk assessment finding that unacceptable risks were posed to subsistence seafood consumers, primarily from the presence of PCBs in tissues of bottom-dwelling fish. However, no risk-based cleanup goals were calculated for PCBs in sediment or tissue in the ROD. Instead, the long-term cleanup goals in the ROD for sediment (1.2 mg/kgOC) and tissue (0.023 mg/kg wet weight) were established based on the 90th percentile of sediment and tissue reference area concentrations, inferred at the time to represent natural background.[3] This was done as it was expected that risk-based sediment concentrations would be below natural background, which is the case for most bioaccumulative carcinogenic chemicals such as PCBs. Whether to change the sediment PCB cleanup goal of 1.2 mg/kg OC was one of three issues resolved and documented in the May 2009 Joint Resolution Statement (JRS) by the Dispute Resolution Committee (DRC), consisting of representatives from the Navy, EPA, and Ecology. The DRC concluded that no change in the Sinclair Inlet cleanup goal was warranted and that the goal represents ideal clean conditions and may be at or below background levels for Sinclair Inlet. The rationale in the JRS was based on "a preliminary review of an August 2008 set of PCB Aroclor concentrations in sediment at 70 non-urban locations throughout Puget Sound". These data are identified in the

[3]In OU B Marine ROD Section 9.3.3, both sediment and fish tissue reference-area concentrations included the parenthetical "i.e., natural background".

DRC Navy support documentation as the "DMMP Bold data". The JRS infers that the Bold data evaluation results are consistent with the cleanup goal of 1.2 mg/kg OC, stating "If the [2008] sampling was representative of background, these detections indicate an approximate 96% confidence that the true background is below 2.95 mg/kg OC and an approximately 94% confidence that it is below 1.12 mg/kg OC."

It is recognized that per Ecology's Sediment Cleanup User's Manual (SCUM) II, Ecology has determined that a collective data set (referred to as Bold Plus) is appropriate to establish natural background in Puget Sound, and that the Bold Plus data includes not only the 2008 Bold data, but data from approved samples. However, based on review of the new SMS rule and the DRC's conclusion that the 1.2 mg/kg OC cleanup goal represents ideal clean conditions and may be at or below background, there has been no change in the approach used to establish the OU B Marine cleanup goals for PCBs in sediment that would affect the protectiveness of the selected remedy.

The ROD also defined a MCUL of 3 mg/kgOC for PCBs in OU B Marine sediments, defined as representing a site-specific concentration limit to protect human health and the environment, conditioned by site-specific circumstances (e.g., sensitive habitats, engineering feasibility, and cost). The MCUL of 3 mg/kgOC was based on modeling results for natural recovery, following active remediation using the action levels defined in the ROD. The action level for dredging (12 mg/kgOC) was selected because it was (1) lower than the calculated cost-effectiveness threshold of 14 mg/kgOC, (2) consistent with the Washington State SQS (benthic) criterion, and (3) generally fell within the range of other regional marine sediment cleanup action levels. A PCB action level of 6 mg/kg OC was selected to identify areas of sediment in which enhanced natural recovery actions would be considered (as accomplished by thin-layer capping). Combined with incidental removal of PCBs accomplished by the planned navigational dredging and considering the effects of natural recovery, remediation of PCBs at these action levels predicted attainment of the MCUL of 3 mg/kg OC within 10 years.

The MCUL is defined in the ROD as the primary measurable objective for cleanup of PCBs in OU B Marine sediments. Achievement of the MCUL in shallow sediment (0-to 10-cm depth) signals compliance with the RAO to reduce the concentration of PCBs in sediments to below the minimum cleanup level in the biologically active zone within marine OU B, as a measure expected to reduce PCB concentrations in fish tissue.

With regard to source control, shoreline areas have been stabilized to minimize the potential for erosion of contaminated fill material into the marine environment, and ICs have been implemented to maintain the integrity of the shoreline stabilization measures. Remedial actions have been implemented in the terrestrial areas of BNC to reduce the potential for chemical transport and control the threat of recontamination of the adjacent marine environment from contaminant transport through the stormwater system; infiltration of soil and groundwater into the stormwater system; infiltration of surface water into site soil; and erosion of shoreline soil. However, the 2013 revisions to the SMS clarify Ecology's expectations for demonstrating

control of upland sources that have the potential to re-contaminate areas of sediment remediation (WAC 173-204-500[4]).

Mercury. The 2000 ROD did not select a cleanup goal specific to mercury in sediment. Rather, the ROD selected a combined action level of 6 mg/kgOC PCBs and 3 mg/kg mercury in sediment to achieve the RAO for mercury to selectively remove sediment concentrations of mercury co-located with PCBs. The Washington State SMS SQS for mercury at the time the ROD was signed was 0.41 mg/kg and the MCUL was 0.59 mg/kg. Currently, the SCO is the SQS of 0.41 mg/kg and the sediment cleanup level remains at 0.59 mg/kg. There has been no change in ARARs for mercury in sediment since the signing of the ROD that would affect the selected remedy.

Mercury is now a COC for OU B Marine based on the findings of a supplemental risk evaluation (Navy, 2010d). The Navy and the OU B Marine stakeholder team are working to address mercury–related human health risks associated with subsistence-level consumption of Sinclair Inlet marine species. In early 2017, this team completed the framework document (Navy, 2017d) and SMIR (Navy, 2017c). Currently, this team is completing tasks that will enable a focused feasibility study for mercury to be completed including a mercury source control investigation. The focused feasibility study may include development of site-specific cleanup goals for mercury in sediment and/or tissue to address human health risks from the consumption of mercury in Sinclair Inlet seafood (see also discussion in Section 7.2.2).

Surface water quality standards (Ecology, 2017) were revised since the last five-year review but after the review period of this five-year review. This ARARs revision will be evaluated as part of the planned addendum that will address the protectiveness of OU B Terrestrial.

7.2.1.3 Operable Unit B Terrestrial

The ROD for OU B Terrestrial concluded that under current conditions, with contaminated soil effectively capped by pavement and buildings and groundwater not being used, no action other than ICs was required to ensure protectiveness (Navy et al., 2004a). Therefore, no cleanup levels were established for the site. However, the potential for movement of contaminants off site was identified as a concern. The RAOs were based on the need to prevent exposure to contaminated terrestrial media (i.e., accumulated stormwater system sediment and debris, soil, and groundwater) and to limit transport to the adjacent marine environment (OU B Marine).

To achieve the RAOs for OU B Terrestrial, in addition to ICs, a conditional point of compliance for groundwater was selected at OU B Terrestrial near the shoreline to monitor groundwater discharge from OU B Terrestrial to Sinclair Inlet. Twelve target analytes were selected to be monitored in groundwater and compared against the conditional points of compliance groundwater criteria. Table 7-5 compares current ARAR values for the protection of surface water with those presented in the OU B Terrestrial ROD.

TCE, which is one of the chemicals selected for groundwater monitoring at the conditional point of compliance, is the only chemical that has had a significant change in the groundwater criterion since the ROD was completed (as discussed in Section 7.2.2). The groundwater criterion for TCE is based on the MTCA Method B surface water value, which has lowered because of toxicity changes. The MTCA Method B surface water value has decreased from 55.6 to 12.8 µg/L. Although the current regulatory level is now more conservative, the change does not affect the protectiveness of the remedy as TCE in groundwater is below the current regulatory level in groundwater wells that are monitored for TCE, which includes 410R, 432, and 707. In accordance with the OU B Terrestrial ROD, monitoring for TCE was discontinued in the groundwater monitoring wells bordering Sinclair Inlet (LTMP-1, LTMP-2, LTMP-3, LTMP-4, and LTMP-5) because TCE was not detected in eight consecutive semiannual sampling events. As reported in the 2016 Trend Analysis Report (Navy, 2017b), TCE concentrations measured in wells 410R, 432, and 707 in fall 2016 were adjusted based on a natural attenuation ratio calculated from salinity differences between groundwater samples and Sinclair Inlet values. As such, estimated concentrations in wells for the fall 2016 sampling event, 410R, 432, and 707, were reported as 1.2 µg/L, 0.59 µg/L, and 0.22 µg/L, respectively, much less than the current regulatory value of 12.8 µg/L.

7.2.1.4 Operable Unit C

Compliance levels for OU C are referred to as trigger levels, which were based on MTCA Method A regulatory levels. No soil cleanup value was established for OU C because the contaminant depth was approximately 80 to 120 feet below ground surface.

Groundwater. Table 7-6 compares current ARAR values for the protection of surface water with those presented in the quarterly groundwater monitoring reports of OU C. There has been no ARAR revision for groundwater protective of surface water that would affect the protectiveness of the remedy. For OU C, based on discussions between the Navy and Ecology, and in accordance with MTCA 173-340, MTCA Method A values were used as trigger cleanup levels (Navy, 2007e). No change in MTCA Method A values was found since the trigger values were established.

7.2.1.5 Operable Unit D

The ROD for OU D concluded that as long as contaminated soil was contained in place, no action other than ICs and periodic groundwater monitoring was required to ensure protectiveness (Navy et al., 2005). The ROD-selected RGs for soil were based on the protection of adjacent surface waters of Sinclair Inlet. Ten chemicals were identified as COCs in soil at OU D. The cleanup levels for these 10 COCs are based on MTCA Method B soil values for the protection of surface water, except in cases where background concentrations were higher. Table 7-7 compares current ARAR values for soil based on the protection of surface water with those presented in the OU D ROD. Seven of the 10 COCs in soil have changes in toxicity criteria that have changed the MTCA Method B soil cleanup levels protective of surface water. For five of the seven COCs with changes, cPAHs, 4,4-DDT, dieldrin, cadmium, and mercury, the changes

are insignificant. For PCE and endrin, the changes are significant. The new values, however, are higher (chemicals are less toxic than previously thought) than the previous values. The MTCA Method B soil cleanup level protective of surface water for PCE has increased from 0.0552 to 1.056 mg/kg and for endrin from 0.00076 mg/kg to 0.0431 mg/kg. Note that today's soil cleanup levels protective of surface water for PCE and endrin are higher than maximum concentrations of PCE and endrin reported in the RI (0.17 mg/kg and 0.0033 mg/kg, respectively).

Although the ROD RGs may be slightly lower today for some of the COCs, the original capping remedy prevents chemical transport to the adjacent marine environment.

No cleanup level was established for any other site media at OU D. However, periodic groundwater monitoring was selected as part of the remedy. One monitoring well was selected as the conditional point of compliance for groundwater monitoring of COCs in groundwater near the point of discharge to the marine environment. The groundwater criteria selected for monitoring of the COCs in groundwater were established as the higher of the regulatory level or the PQL and were based on protection of adjacent surface waters of Sinclair Inlet. Table 7-8 compares current ARAR values for the protection of surface water with the "preliminary cleanup levels" presented in the OU D ROD. Since the first five-year review, no change in ARARs has been identified that would affect the protectiveness of the selected remedy as the current regulatory levels for all COCs but cadmium levels are the same as those listed in the ROD. The marine ambient WQC for cadmium has increased from 8.8 to 9.3 µg/L, becoming slightly less conservative. The lower ROD monitoring level for cadmium remains protective.

The ROD monitoring criteria for DDT, dieldrin, endrin, and mercury were based on the PQL at the time of the ROD. As stated above for OU NSC, MTCA allows for use of the PQL when the MTCA cleanup level is below the PQL. Current LOQs for DDT, dieldrin, and endrin are an order of magnitude less than the PQL stated in the ROD. LOQs for DDT and dieldrin are still higher than current regulatory values. Thus, these changes are insignificant and therefore have no effect on the protectiveness of the remedy. The current LOQ for mercury remains the same as the value listed in the ROD. Current analytical methods for endrin can achieve levels below the state WQC of 0.0023 µg/L and current long-term groundwater monitoring at OU D implements these methods. To date, endrin has not been detected in compliance wells as reported in the Long-Term Monitoring Trend Analysis Report (Navy, 2015), which supports that the remedy remains protective.

The ROD-selected groundwater monitoring criterion for copper of 3.1 µg/L is based on the state and federal WQC. The current state and federal WQC for copper is 3.1 µg/L. The ROD preliminary RG remains protective.

7.2.1.6 Operable Unit NSC

For OU NSC, soil cleanup levels were based on industrial site use, and groundwater cleanup levels were based on the protection of adjacent surface waters of Sinclair Inlet. For the COCs in

soil and groundwater listed in the OU NSC ROD, no revision to the ARARs was found that would affect the protectiveness of the remedy.

Soil. Table 7-9 compares current ARAR values for the soil with those documented in the OU NSC ROD (Table 8-2 of Navy et al., 1996). The current MTCA Method C industrial soil cleanup level for total PCBs of 66 mg/kg is higher than the cleanup level selected in the ROD (17 mg/kg); therefore, the RG for total PCBs remains protective of human health and the environment.

As discussed above for OU A, the cPAHs of the OU NSC ROD were adjusted based on their toxicity equivalency to benzo(a)pyrene. While MTCA C industrial values are now available for individual cPAHs using the same TTEC methodology, in the majority of cases (i.e., more than one cPAH present), there is no real difference in the cPAH RG, and the remedies remain protective.

As described in the second five-year review for TPH in soil, the ROD selected an RG of 200 mg/kg based on the MTCA Method A cleanup levels for TPH in soil. Current MTCA Method A values have been available since the second five-year review for each of the specific fuel type fraction ranges of diesel, heavy oil, mineral oil, gasoline with benzene, and gasoline without benzene. As shown in Table 7-9, the ROD-selected RG of 200 mg/kg is protective for all the newer individual TPH compounds, except gasoline. However, the residual TPH in soil is more likely attributable to the diesel range rather than the gasoline range, and the new lower TPH-G levels do not apply to the site. Benzene was not identified as a COC in the risk assessment, indicating that the TPH-G "with benzene" MTCA A value of 30 mg/kg is not relevant. TPH-G was detected at low concentrations at depth (from 8 to 15 feet below ground surface), with a maximum detection of only 160 mg/kg and a frequency of detection of only eight out of 39 samples. In contrast, TPH-D was detected in 30 of 39 samples, with a maximum concentration of 1,800 mg/kg. While the maximum historical TPH-G concentration is above the current TPH-G MTCA A unrestricted level of 100 mg/kg (without benzene), the low frequency of detection in soil combined with the lack of detections of TPH-G in groundwater appear to confirm that the heavier petroleum products are the source of TPH at OU NSC. In addition, the MTCA Method A values are intended to be protective of unrestricted land use, and ICs are in place that will prevent residential use of the site. Therefore, the ROD-selected RG for TPH remains protective.

Groundwater. Table 7-10 compares current ARAR values for the protection of surface water with those presented in the OU NSC ROD (Table 8-1 of Navy et al., 1996). Since the previous five-year review has been performed, no ARAR revision that has been made for groundwater protection of surface water has affected the protectiveness of the remedy. As listed above for OU A, the RGs listed for many of the COCs in the OU NSC ROD are based on the laboratory PQL. For OU NSC, most of the COCs for which PQLs were used are still currently being monitored. The PQL changes are described below.

Arsenic is the only remaining COC where the RG was based on the PQL. As the current LOQ is the same as the ROD PQL, there is no ARAR revision for arsenic in groundwater that would

affect the protectiveness of the remedy. ROD RGs for copper, lead, nickel and zinc were based on the marine ambient WQC at the time of the ROD, which as shown in Table 7-10, are lower than current regulatory levels. Thus, there are no ARAR revisions for these four metals in groundwater that would affect the protectiveness of the remedy.

Groundwater monitoring is no longer performed for the four pesticides and total PCBs; however, changes to regulatory levels and quantitation limits are listed in Table 7-10 for completeness. The RGs for these five COCs were based on the PQL at the time the ROD was completed. When groundwater monitoring at OU NSC began in 1998, analyses for the COCs were based on ROD PQLs. However, as analytical techniques improved over time, updates were made to the groundwater monitoring program and the lowest quantitation limits available at that time were used for that groundwater monitoring event. By spring 2002, groundwater samples were analyzed for these COCs using quantitation limits less than ROD PQLs and similar to the current LOQs listed in Table 7-10. None of the five COCs were detected at the lower quantitation limits. Because the concentrations of these COCs were nondetect at lower quantitation limits over multiple consecutive sampling events, the COCs were dropped from the analyte list after spring 2003 in accordance with the first five-year review and 2002/2003 annual monitoring report recommendation to not sample with the approval of EPA and Ecology. As current laboratory LOQs (lower than ROD PQLs) have not significantly changed since these five COCs were dropped from the groundwater monitoring program, there is no ARAR revision for these COCs in groundwater that would affect the protectiveness of the remedy.

In addition, for TPH in groundwater, the ROD selected an RG of 1,000 µg/L based on the MTCA Method A values for TPH. This value was intended to be compared to the total concentration of all TPH compounds, which was the common approach to reporting and assessing petroleum concentrations at the time the ROD was signed. However, petroleum is now commonly analyzed for the individual carbon-fraction ranges for specific fuel types. MTCA Method A values have been available since the second five-year review for each of the specific fuel-type fraction ranges of diesel, heavy oil, mineral oil, gasoline with benzene, and gasoline without benzene. Because current MTCA A values are no longer available for total TPH, a straight comparison of present and past MTCA Method A levels cannot be made for TPH. The ROD-selected RG of 1,000 µg/L is equal to the current MTCA Method A level for gasoline without benzene, but is less protective than the current MTCA Method A values for the other individual fractions. Because benzene was not selected as a COC in groundwater, it is unlikely to be present. Therefore, use of the ROD RG value of 1,000 µg/L remains appropriate for gasoline monitoring based on current MTCA standards. For diesel monitoring, however, a value of 500 µg/L is more appropriate than the ROD RG of 1,000 µg/L. Similarly, a value of 500 µg/L is more appropriate than the ROD RG of 1,000 µg/L when evaluating monitoring results for heavy oil or mineral oil. The changes in the MTCA Method A groundwater cleanup values for the TPH compounds since the ROD do not affect the protectiveness of the remedy because the current concentrations are less than those observed at the time of the ROD (See Table 7-17 of the five-year review), when risks were found to be acceptable. However, monitoring results should be compared to the current MTCA A values when making decisions regarding monitoring (such

as changes to the monitoring frequency). The current Petroleum Management Plan includes the current MTCA Method A value for comparison.

Vapor Intrusion. The 2001 MTCA revisions included language for the evaluation of the vapor intrusion pathway at sites where the maximum diesel-range organic concentration in soil exceeds 10,000 mg/kg. As discussed in the second five-year review, OU NSC fits this criterion. Therefore, in 2003 (at the request of Ecology), a vapor intrusion evaluation was conducted for OU NSC (Navy, 2004e). This evaluation used modeling to predict air concentrations from soil and groundwater and included an evaluation of the potential health risks to industrial workers associated with inhalation of indoor and outdoor air at OU NSC. Modeled air concentrations were compared to calculated MTCA Method C air cleanup levels. The vapor intrusion evaluation concluded that the vapor intrusion pathway is not a health concern to industrial workers at OU NSC.

For this fourth five-year review, modeled air concentrations from the 2004 vapor intrusion evaluation were compared to current MTCA Method C air cleanup levels provided in the Cleanup Levels and Risk Calculation (CLARC) data tables (Ecology, 2015a). Both the modeled indoor and outdoor air concentrations are below current MTCA Method C air cleanup levels. Thus, revisions to MTCA Method C values since the vapor intrusion evaluation was conducted do not affect the protectiveness of the remedy selected for OU NSC.

7.2.2 Changes in Toxicity or Other Contaminant Characteristics

Changes to toxicity criteria have occurred since the signing of the five RODs. These changes have been highlighted on Tables 7-3 through 7-10 as differences between the ROD regulatory values and current regulatory values. Current regulatory values were obtained from Ecology's CLARC tables, which were last updated in August 2015 with toxicity values used by EPA to calculate the RSLs. The toxicity values used to calculate RSLs are selected using a hierarchy of toxicological sources, with the Integrated Risk Information System (IRIS) as its number one source. In addition, the toxicity values provided in the CLARC data tables were reviewed for each of the COCs and were found to be consistent with the latest IRIS toxicity criteria for all COCs.

In most instances, where differences between the old and new regulatory values have been highlighted, changes to toxicity values do not affect the protectiveness of the remedy. The protectiveness is not affected because the RG was selected as the PQL or the current regulatory level is higher than the value established in the ROD. Thus, the protectiveness of the selected remedy is not affected.

Toxicity values for the supplemental risk evaluations were also reviewed. Inhalation toxicity values used in the supplemental vapor intrusion evaluations at OU NSC and OU B Terrestrial are consistent with current inhalation toxicity values. Thus, the results of those evaluations have not changed. In addition, the toxicity values for mercury and PCBs used to evaluate consumption of seafood have not changed since those evaluations were completed.

Changes in toxicity values for two COCs, arsenic in soil at OU A and TCE in groundwater at OU B Terrestrial, result in RGs that are now higher than the values established in the RODs. At OU A, the remedy remains protective as the combination of ICs and pavement cap will minimize exposure to arsenic in soil. At OU B, while the groundwater RG for TCE is now lower than the value established in the ROD, the protectiveness of the selected remedy is not affected as addressed in Section 7.2.1 for OU B Terrestrial.

7.2.3 Changes in Risk Assessment Methods

Since the RODs were signed and since the third five-year review was completed, EPA issued supplemental guidance updating standard default exposure parameters for use on Superfund sites (EPA, 2014). Standard default updates specifically impacting the risk calculations include the following:

Definition (units)	Previous Value	2014 Value
Resident skin surface area for soil - child (cm^2):	2,800	2,690
Resident skin surface area for soil - adult (cm^2):	5,700	6,032
Worker skin surface area for soil - adult (cm^2):	3,300	3,470
Resident soil adherence factor - child (mg/cm^2):	0.2	0.2
Resident soil adherence factor - adult (mg/cm^2):	0.07	0.07
Worker soil adherence factor - adult (mg/cm^2):	0.2	0.12
Adult Body Weight - adult (kg):	70	80
Resident Exposure Duration (yr):	30	26
Resident Exposure Duration - adult (yr):	24	20

Use of these updated default exposure parameters in place of the original values used in the baseline risk assessments for each of the OUs primarily results in lowering the cancer risks and noncancer hazard estimates for the adult receptors. However, the decrease in cancer risk and noncancer hazard estimates would not be significantly different than the values estimated in the original risk assessments (i.e., less than a factor of 1.5).

Risk-based cleanup levels selected for RGs are based on default exposure parameters set forth in MTCA and, therefore, EPA changes to default exposure parameters do not affect risk-based RGs at any of the OUs.

7.2.4 Changes in Exposure Pathways

Exposure pathways that were identified after the RODs were signed were previously identified in the third five-year review. The additional exposure pathways identified included potential exposures to contaminants previously capped at OU D, vapor intrusion in selected locations of OU B Terrestrial, and exposures to mercury in seafood consumed by subsistence fishers for

OU B Marine. There have been no new exposure pathways identified for any of the OUs during this fourth five-year review; however, amendments have been made to the SMS rule for fish consumption that need to be addressed here. As stated on Ecology's Toxic Cleanup Program website, Ecology planned to include a default fish consumption rate for calculating sediment cleanup levels to protect human health, but elected not to do so at this time. Instead, the rule amendments include a narrative that requires the fish consumption rate to be based on a tribal exposure scenario. As a Suquamish Tribe-specific total seafood consumption rate of 767 grams/day was used in the supplemental risk evaluation for exposures to mercury in seafood (Navy, 2010d), the SMS amendments do not affect the results of the supplemental risk evaluation and conclusions as reported in the 2010 risk evaluation remain the same; that is HQs exceed the target goal of 1 for seafood consumption due to mercury in both Sinclair Inlet and non-urban reference areas of Puget Sound at tribal consumption rates.

7.2.5 Expected Progress Towards Meeting RAOs

The remedies implemented at OU A, OU C, OU D, and OU NSC are meeting RAOs and are currently protecting human health and the environment. Potential exposure pathways and infiltration pathways that could increase contaminant migration and result in unacceptable risks are being controlled and monitored.

For OU B Marine and OU B Terrestrial, the RAOs to limit human exposure to site soils and groundwater are being met; however, the RAO based on the need to contain contaminated terrestrial media (i.e., accumulated stormwater system sediment and debris, soil, and groundwater) and limit transport to the adjacent marine environment is not being met. The Navy is currently taking action to investigate presence of mercury in the environment at OU B Terrestrial and OU B Marine, and identify transport pathways from OU B Terrestrial to OU B Marine.

7.3 Has Any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

In 2016, EPA published a Heath Advisory which identified perfluorinated chemicals (PFCs), more commonly referred to as per- and polyfluoroalkyl substances (PFAS), as an emerging contaminant. BNC exhibits the characteristics of a facility at which aqueous fire-fighting foams could have been used in a manner that could result in the release of PFAS to the environment. Consumption of impacted groundwater is a route of human exposure to PFAS, but consumption of groundwater is not a complete exposure pathway at BNC. BNC has been and continues to be included in the nationwide evaluation plan for suspect PFAS-contaminated sites, being developed by the Navy. However, based on past use and exposure pathways, BNC was ranked as having a low potential for PFAS issues.

Climate change research indicates that the remedies at BNC may be vulnerable to climate change impacts not apparent during remedy selection. In particular, the shoreline location of BNC and the reliance of the remedies on shoreline armoring and capping results in vulnerabilities from sea

level rise and weather pattern changes. These aspects of climate change increase the possibility of flooding/inundation of the shoreline areas, including the storm drain system, and can increase the energy (and therefore erosive force) of storm events. Substantial shoreline erosion over short time periods has been observed at other shoreline sites during strong winter storm surges that occur during extreme high tides.

The updated Charleston Beach remedy repair design will incorporate current climate change initiatives, including Navy regional climate change planning efforts.

7.4 Technical Assessment Summary

The remedies for OU C, OU D, and OU NSC are functioning as intended by the decision documents. The remedies for OU A, OU B Marine, and OU B Terrestrial are not functioning as intended by the decision documents.

The monitoring data indicate that, overall, the low-risk conditions present at the time of the ROD remain or have improved at OU A. However, the work to implement a permanent solution to ongoing erosion at Charleston Beach must be completed to ensure the functionality of the OU A remedy.

The physical components of the OU B Marine remedy are functioning as intended by the ROD. However, mercury source control, as well as risks posed by mercury in sediments and bioaccumulation in marine organisms at BNC, must be addressed for the OU B Marine remedy to be considered functional.

The OU B Terrestrial remedy is not functioning as intended by the ROD. Mercury is a COC for OU B Marine. The largest known ongoing source of filtered mercury from BNC to Sinclair Inlet including OU B Marine is from western portion of OU B Terrestrial, located in the southern portion of the Outfall 15 drainage basin. The Navy is engaged with stakeholders to develop a mercury remedy for OU B Marine that addresses mercury source control as well as risks posed by mercury in sediments and bioaccumulation in marine organisms. With the exception of the issue of mercury, the comparatively low-risk conditions have persisted that were present at OU B Terrestrial at the time the ROD was executed.

No ARAR change has affected the remedy for OUA, OU B Terrestrial, OU C, OU D, or OU NSC since the last five-year review. For OU B Marine, studies are ongoing to address the data gaps to be filled before the protectiveness of the remedy can be assessed with respect to mercury in sediment. Revisions to the SMS regulation in 2013 emphasize the need to implement source control studies in OU B Terrestrial to ensure the future protectiveness of the OU B Marine remedy.

Concentrations of chemicals in groundwater remain above the RGs at many locations in OU A, OU NSC, and OU B Terrestrial, resulting in the need for continued ICs to prevent exposure and the need for ongoing monitoring. Although some of the RGs might be lower if calculated today,

the remedy components continue to protect against exposures, just as they did at the time the ROD was signed. ICs preventing exposure and ongoing monitoring will need to continue until COC concentrations in groundwater are below the RGs.

7.5 Issues

Table 7-11 lists the issues identified as a result of this five-year review that have the potential to affect the protectiveness of the remedies at BNC.

7.6 Other Findings

This section documents other findings that do not have the potential to affect protectiveness.

1. The combined IC/O&M plan should be revised to include the OU C IC requirements.
2. As an improvement to the terrestrial O&M plan, incorporate a requirement to report catch basin cleaning in the annual remedy inspection reports.
3. The results of annual groundwater monitoring are not being used for any decision making regarding remedy protectiveness, other than five-year review analysis regarding data trends. Recommendations for changes to the groundwater monitoring program are presented by OU in Sections 7.6.1 through 7.6.5.

7.6.1 OU A Monitoring Recommendations

The draft trend analysis report available for review during this five-year review (Navy, 2017b) continued the planned approach of recommending adjustments to the analyte list and monitoring frequency for groundwater sampling at OU A, in accordance with the associated work plan (Navy, 2016f). This five-year review considers overall trends in groundwater COC concentrations over this five-year review period and previous five-year review periods, and assesses these trends against the intent of groundwater monitoring as established in the ROD. The groundwater data for OU A indicate that the conditions present at the time of the ROD remain generally unchanged. A substantial body of data now exists (1994 to present) documenting COC trends and current concentrations, compared to concentrations at the time of the ROD. The purposes of groundwater monitoring stated in the OU A ROD were to:

- Verify that groundwater contaminants are not significantly affecting marine waters in Sinclair Inlet.
- Detect potential releases to the marine environment.
- Determine whether contaminant levels in groundwater are being reduced through capping, placement of riprap, and natural processes.

Given the stable contaminant trends, the annual groundwater data being collected exceed the needs for making this three-part assessment, and this five-year review recommends reducing the monitoring frequency for all analytes at all wells to once every five years. The data from

shoreline wells show that concentrations of arsenic, copper, and nickel in groundwater at OU A exceed surface water compliance criteria. The data for OU B Marine did not warrant inclusion of these metals as COCs, indicating that the concentrations in OU A groundwater at the time of the ROD were not significantly affecting marine waters or sediment in Sinclair Inlet. Consistent with the intent of the regional Inter-Agency Agreement between Ecology and EPA (EPA, 2000), OU A was considered a low-risk site, to be managed such that conditions do not worsen.

7.6.2 OU B Terrestrial Monitoring Recommendations

As for OU A, the draft trend analysis report available for assessment during this five-year review (Navy, 2017b) continued the planned approach of recommending adjustments to the analyte list and monitoring frequency for groundwater sampling at OU B Terrestrial, in accordance with the associated work plan (Navy, 2016f). This five-year review considers overall trends in groundwater COC concentrations over this five-year review period and previous five-year review periods, and assesses these trends against the intent of groundwater monitoring as established in the ROD.

The monitoring data for OU B Terrestrial indicate that, overall, the low-risk conditions present at the time the ROD was executed have persisted. The wells selected for LTM at OU B Terrestrial were established in the ROD as conditional points of compliance for groundwater based on the groundwater to surface water pathway. Data from the selected monitoring wells were intended to "verify predictions that site groundwater is protective of the marine environment" (Navy et al., 2004a). The use of data from wells that are representative of groundwater flowing to drydocks was addressed by applying an attenuation factor to the data from those wells prior to comparing the data to the compliance criteria.

Data trends demonstrate that COCs in groundwater at the conditional point of compliance wells located along the shoreline (where the attenuation factor approach is not applied) have not significantly changed over time. The data from shoreline wells show that arsenic, copper, nickel, zinc, and mercury concentrations in groundwater at OU B Terrestrial exceed surface water compliance criteria. The pre-ROD data for OU B Marine did not warrant including arsenic, copper, nickel, or zinc as COCs, indicating that the concentrations in OU B Terrestrial groundwater at the time of the ROD were not significantly affecting marine waters or sediment in Sinclair Inlet, as stated in the ROD. However, concentrations of mercury in OU B Terrestrial may be a significant source of mercury to the marine environment, and further study of this issue is warranted. Given the stable data trends, this five-year review recommends reducing the monitoring frequency at all OU B Terrestrial wells to once every five years.

7.6.3 OU B Marine Monitoring Recommendations

The 2014 sediment monitoring results demonstrate that PCB levels in sediment in OU B Marine have met the MCUL of 3 mg/kgOC, and PCB levels throughout Sinclair Inlet have achieved the cleanup goal of 1.2 mg/kgOC established in the ROD (Navy et al., 2000) for the site. The Navy and stakeholders have agreed that a confirmatory round of monitoring will be conducted to

validate the 2014 monitoring results. The details of the monitoring will be developed by the Navy and stakeholders in conjunction with the Decision Framework process (Navy, 2017d).

7.6.4 OU D Monitoring Recommendations

Based on the data trends in well LTMP-5, this review recommends that the sampling frequency for endrin and cadmium in this well be reduced to once every five years.

7.6.5 OU NSC Monitoring Recommendations

As for the other OUs, the draft trend analysis report available for review during this five-year review (Navy, 2017b) continued the planned approach of recommending adjustments to the analyte list and monitoring frequency for groundwater sampling at OU NSC, in accordance with the associated work plan (Navy, 2016f). This five-year review considers overall trends in groundwater COC concentrations over this five-year review period and previous five-year review periods, and assesses these trends against the intent of groundwater monitoring as established in the ROD.

The monitoring data for OU NSC indicate that the low-risk conditions present at the time of the ROD remain present or have improved. A substantial body of data now exist (1994 to present) documenting COC trends and current concentrations compared to concentrations at the time of the ROD. The purpose of groundwater monitoring established by the OU NSC ROD was to "ensure that trends in contaminant levels remain acceptable." The annual groundwater data being collected exceed the needs for making this trend assessment, and this five-year review recommends reducing the monitoring frequency to once every five years. However, this review also recommends assessing the monitoring well locations and data evaluation methods based on the findings of the USGS groundwater modeling (Jones et al., 2016). The modeling results show that at least some of the monitoring wells currently being sampled are representative of groundwater flowing to Drydock 6, rather than groundwater flowing directly to Sinclair Inlet.

Optimization of the monitoring system at OU NSC, and all terrestrial OUs, is warranted following refinement of the USGS modeling conclusions. Optimization could include:

- Assessment of the optimal locations for monitoring wells to monitor groundwater discharging to Sinclair Inlet
- Consideration of attenuation through the drydock system at OU NSC, and refinement of the attenuation protocol currently used at OU B Terrestrial
- Assessment of the value of continued trend evaluation, versus a simple comparison to the historical data range as proposed in this five-year review (described below)
- Clarification regarding how free product measurements should be reported. Measurable free product should only be recorded as a numerical value when field interface probe readings are greater than 0.01 foot of free product. Intermittent response on the interface

probe, or a reading of 0.01 foot of free product, should be reported as a "trace" of free product. Apparent detections of free product using an interface probe should be verified by direct observation using a transparent bailer and/or oil/water finding paste methods.

7.6.6 Recommendations Regarding Trend Analyses for COCs in Groundwater

The results of trend analyses of COCs in groundwater over time vary, and consistently indicate conditions similar or better than at the time of the RODs for OU A, OU B Terrestrial, OU D, and OU NSC (Navy, 2017b). Additional trend analysis is not warranted. In lieu of trend analysis, each five-year review should compare the groundwater monitoring data to the range of results for each analyte at each well. Examples of these data ranges from the time of the RODs to present are provided in Tables 7-12 through 7-17 for the current analytes other than pesticides (which are typically not detected). If future results are within this historical range, then it can be concluded that the ROD requirements are being met and "contaminant levels remain acceptable." Concentrations outside of the range would be indicative of either issues with the remedy (concentrations greater than the historical range) or decreasing concentrations over time (concentrations less than the historical range). If concentrations are found to be above the historical range, a confirmation sampling event would be triggered. If increased concentrations are confirmed, then the Navy would investigate potential causes (e.g., increased infiltration in the area monitored by the particular well of concern) and take action to address the source of increased concentrations.

Table 7-1. Technical Assessment Summary

Operable Unit	Question A: Is the remedy functioning as intended by the decision document?	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the decision document still valid?	Question C: Has any other information come to light that could call into question the protectiveness of the remedy?
OU A	No	Yes	Yes
OU B Marine	No	Yes	Yes
OU B Terrestrial	No	Yes	Yes
OU C	Yes	Yes	No
OU D	Yes	Yes	Yes
OU NSC	Yes	Yes	Yes

Table 7-2. Operation and Maintenance Cost Summary

Fiscal Year	BNC Terrestrial	OU B Marine	Total
2012	$747,915	$1,316,751	$2,064,666
2013	$901,031	$873,400	$1,774,431
2014	$623,938	$769,787	$1,393,725
2015	$188,318	$314,841	$503,159
2016	$555,346	$341,810	$897,156
Totals	$3,016,548	$3,616,589	$6,633,137
		Annual Mean:	$1,326,627

Table 7-3. Soil Cleanup Levels for OU A

Chemical	ROD Remediation Goal[a] (mg/kg)	ROD Basis	Current Regulatory Level[b] (mg/kg)
Arsenic	219	MTCA C Industrial	87.5
Lead	1,000	MTCA A Industrial	1,000
cPAHs	18[c]	MTCA C Industrial	18
Benzo(a)anthracene	-	NA	180
Benzo(a)pyrene	-	NA	18
Benzo(b)fluoranthene	-	NA	180
Benzo(k)fluoranthene	-	NA	1,800
Chrysene	-	NA	18,000
Dibenz(ah)anthracene	-	NA	18
Indeno(1,2,3-cd)pyrene	-	NA	180
Total PCBs	17	MTCA C Industrial	66

Data sources:

[a] ROD Table 8-1 (Navy et al., 1997).

[b] Department of Ecology, State of Washington, CLARC Data Tables (July 2015); complies with MTCA Cleanup Regulation, WAC 173-340. Values that have significantly changed since the ROD have been highlighted.

[c]The remediation goal (RG) in the ROD for cPAHs (total) is based on the MTCA Method C industrial soil cleanup level for benz(a)pyrene (Department of Ecology, State of Washington, CLARC Data Tables (July 2015); complies with MTCA Cleanup Regulation, chapter 173-340 WAC). The RG for cPAHs in soil requires comparing the TTEC for the seven cPAHs relative to benzo(a)pyrene to the cleanup level derived for benzo(a)pyrene. The 2015 MTCA Method C industrial soil cleanup level for benz(a)pyrene remains at 18 mg/kg; however, MTCA Method C industrial values also are available for individual cPAHs. The individual values may be used if only one cPAH is detected. If multiple cPAHs are present, the TTEC approach must be used.

Yellow highlighted cell indicates the current regulatory value is different from the value at the time of the ROD.

Orange highlighted cell indicates the current regulatory value is greater than the value at the time of the ROD.

Green highlighted cell indicates the current regulatory value is less than the value at the time of the ROD.

- - An individual cleanup goal was not provided in the ROD. Rather, concentrations of these individual cPAHs were normalized to benzo(a)pyrene values using the TTEC approach.

Table 7-4. Groundwater Cleanup Levels for Protection of Surface Water for OU A

Chemical	ROD Regulatory Level[a] (µg/L)	Current Regulatory Level[b] (µg/L)	ROD Basis	ROD PQL[c] (µg/L)	Current LOQ[d,e] (µg/L)	ROD Remediation Goal[f] (µg/L)
Arsenic	0.0982	0.0982	MTCA B SW	0.5	0.50	0.5[g]
Copper	2.5	3.1	State WQC	2.5	0.10	2.5
Lead	5.8	8.1	State WQC	5	0.030	5.8
Nickel	7.9	8.2	State WQC	5	0.20	7.9
Zinc	76.6	81	State WQC	5	0.50	76.6
Benzo(a)anthracene	0.0296	0.296	MTCA B SW	5	0.02	5[hj]
Benzo(a)pyrene	0.0296	0.0296	MTCA B SW	5	0.02	5[hj]
Benzo(b)fluoranthene	0.0296	0.296	MTCA B SW	5	0.02	5[hj]
Benzo(k)fluoranthene	0.0296	2.96	MTCA B SW	5	0.02	5[hj]
Chrysene	0.0296	29.6	MTCA B SW	5	0.02	5[hj]
Indeno(1,2,3-cd)pyrene	0.0296	0.296	MTCA B SW	5	0.02	5[hj]
Bis(2-ethylhexyl) phthalate (BEHP)	3.56	3.56	MTCA B SW	5	1.0	5[hj]
Aldrin	0.0000816	0. 0000811	MTCA B SW	0.01	0.001	0.01[ij]
Dieldrin	0.0000867	0. 0000862	MTCA B SW	0.02	0.001	0.02[ij]
Endrin	0.0023	0.0023	State WQC	0.02	0.001	0.02[ij]
Alpha-chlordane	0.000354	0.0013[c]	MTCA B SW	0.01	0.001	0.01[ij]
Gamma-chlordane	0.000354	0.0013[c]	MTCA B SW	0.01	0.001	0.01[ij]
4,4'-DDD	0.000504	0.000504	MTCA B SW	0.02	0.001	0.02[ij]
4,4'-DDE	0.000356	0.000356	MTCA B SW	0.02	0.001	0.02[ij]
4,4'-DDT	0.000356	0.000353	MTCA B SW	0.02	0.001	0.02[ij]
Aroclor 1260	0.000027	NA	MTCA B SW	0.02	0.005	0.02[ij]

Data sources:

[a] ROD Table 8-1 (Navy et al., 1997).

[b]Department of Ecology, State of Washington, CLARC Data Tables (July 2015); complies with MTCA Cleanup Regulation, WAC 173-340. Values that have significantly changed since the ROD have been highlighted.

[c]PQLs at the time of the ROD.

[d]In present day terminology, the practical quantitation limit (PQL) is referred to as a "limit of quantitation" (LOQ) in accordance with the DoD Quality Systems Manual for Environmental Laboratories (QSM) [DoD 2013] and the Navy's Tier II SAP format guidelines. The LOQ is synonymous with the practical quantitation limit (PQL), as defined in WAC 173-340.

[e]Source of LOQs is ALS Laboratory, Inc. using the following methods: SVOCs by 8270D Low Level, PAHs by 8270D (SIM), PCB Aroclors by 8082A Low Level (for groundwater), pesticides by 8081B Low Level (for groundwater), and total RCRA metals by 6020A.

[f]The ROD states that the remedial goal is the higher of the regulatory level or the PQL, which is allowed by Washington Administrative Code 173-340-700(6).

[g]Neither the regulatory level nor the LOQ has changed since the ROD; therefore, the remediation goal would still be based on the LOQ if a ROD were being signed today.

[h]The regulatory level has stayed the same or increased but a lower LOQ is achievable; therefore, the RG selected would be the regulatory level if a ROD were being signed today.

Table 7-4 (Continued). Groundwater Cleanup Levels for Protection of Surface Water for OU A

[i]Although a lower LOQ is achievable, the regulatory level is still lower than the LOQ; thus, the RG selected still would be the LOQ if a ROD were being signed today.

[j]The LOQs have changed since the ROD was published. However, in accordance with the recommendations of the first five-year review, these chemicals of concern are no longer part of the monitoring program.

Notes:

Yellow highlighted cell indicates a regulatory value that has changed since the time of the ROD.

Orange highlighted cell indicates the current regulatory value is greater than the value at the time of the ROD.

Blue highlighted cell indicates that the chemical is no longer included in the long-term monitoring program.

Table 7-5. Groundwater Cleanup Levels for Protection of Surface Water for OU B Terrestrial

Chemical	ROD Regulatory Level (µg/L)	Current Regulatory Level[a] (µg/L)	ROD Basis	ROD Remediation Goal (µg/L)
Trichloroethene	55.6	12.8	MTCA B SW	55.6
4,4'-DDT	0.000356	0.000353	MTCA B SW	0.000356
4,4'-DDE	0.000356	0.000353	MTCA B SW	0.000356
Aldrin	0.0000816	0.0000811	MTCA B SW	0.0000816
Dieldrin	0.0000867	0.0000862	MTCA B SW	0.0000867
Heptachlor epoxide	0.0000636	0.0000648	MTCA B SW	0.0000636
Arsenic	0.0982	0.0982	Background	5.0
Copper	3.1	3.1	State WQC	3.1
Lead	8.1	8.1	State WQC	8.1
Mercury	0.025	0.025	State WQC	0.025
Nickel	8.2	8.2	State WQC	8.2
Zinc	81	81	State WQC	81

Data sources:

[a]The current regulatory levels were obtained from the CLARC Data Tables (Ecology, 2015). Values that have significantly changed since the ROD have been highlighted.

Notes:

Green highlighted cell indicates the current regulatory value is less than the value at the time of the ROD.

Table 7-6. Groundwater Trigger Levels for Protection of Surface Water for OU C

Chemical	Trigger Level (µg/L)	Current Regulatory Level[a] (µg/L)	Basis[b]	Remediation Goal (µg/L)
Diesel (DRO)	500	500	MTCA Method A	500
Heavy oil (RRO)	500	500		500
Gasoline (GRO without benzene)	1,000	1,000		1,000

Data sources:

[a] The current regulatory levels were obtained from the CLARC Data Tables (Ecology, 2015).

[b] Based on Ecology policy in similar waterfront situations (e.g., Harbor Island and the Seattle waterfront) in the RI/FS report (Navy, 2002g) and ongoing discussions between the Navy and Ecology (Navy, 2007e).

Table 7-7. Soil Cleanup Levels for Protection of Surface Water for OU D

Chemical	ROD Regulatory Level (mg/kg)	Current Regulatory Level[a] (mg/kg)	ROD Basis[a]	ROD Remediation Goal (mg/kg)
Tetrachloroethene	0.0552	1.056	MTCA B	0.0552
cPAHs[b]	0.866	0.574		0.866
4,4'-DDT	0.00729	0.004788		0.00729
Dieldrin	0.0000672	0.0000443		0.0000672
Endrin	0.00076	0.0431		0.00076
Arsenic	0.057	0.057		2.64[c]
Cadmium	1.214	1.283		2.3[c]
Copper	1.066	1.066		21.7[c]
Mercury	0.06	0.0261		0.06[c]
Zinc	101	101		101

Data sources:

[a]MTCA Method B soil levels protective of surface water were calculated using the "Workbook for Calculating Cleanup Levels for Individual Hazardous Substances" (MTCASGL11; Version NO 11; August 2006) from the Washington State Department of Ecology Toxics Cleanup were those provided by the Workbook tool. The target surface water level was set equal to the most stringent current MTCA B surface water standard. Values that have significantly changed since the ROD have been highlighted.

[b]The preliminary RG in the ROD for cPAHs (total) is based on the MTCA Method B soil cleanup level for protection of surface water for benz(a)pyrene. The RG for cPAHs in soil requires comparing the TTEC for the seven cPAHs relative to benzo(a)pyrene to the cleanup level derived for benzo(a)pyrene. Note that individual cancer values for cPAHs are now available because of different chemical property values that been established.

[c]The ROD remediation goal is based on area background concentrations.

Notes:

Orange highlighted cell indicates the current regulatory value is greater than the value at the time of the ROD.

Green highlighted cell indicates the current regulatory value is less than the value at the time of the ROD.

Table 7-8. Groundwater Monitoring Levels for Protection of Surface Water for OU D

Chemical	ROD Regulatory Level (µg/L)	Current Regulatory Level[a] (µg/L)	ROD Basis	Previous PQL (µg/L)	Current LOQ[b,c] (µg/L)	ROD Preliminary Remediation Goal (µg/L)
4,4'-DDT	0.000356	0.000353	MTCA B SW	0.01	0.001	0.01[d]
Dieldrin	0.0000867	0.0000862	MTCA B SW	0.01	0.001	0.01[d]
Endrin	0.0023	0.0023	State WQC	0.01	0.001	0.01[d]
Arsenic	0.0982	0.0982	MTCA B SW	0.5	0.5	5[e]
Cadmium	8.8	9.3	State/federal WQC	1	1	8.8
Copper	2.4	2.4	National Toxics Rule	0.5	0.1	3.1
Mercury	0.025	0.025	State WQC	0.2	0.2	0.2[c]
Zinc	81	81	State WQC	1.8	0.5	81

Data sources:

[a]The current regulatory levels were obtained from the CLARC Data Tables (Ecology, 2015). Values that have significantly changed since the ROD have been highlighted.

[b]In present day terminology, the practical quantitation limit (PQL) is referred to as a "limit of quantitation" (LOQ) in accordance with the DoD Quality Systems Manual for Environmental Laboratories (QSM) [DoD 2013] and the Navy's Tier II SAP format guidelines. The LOQ is synonymous with the practical quantitation limit (PQL), as defined in WAC 173-340.

[c]Source of LOQs is ALS Laboratory, Inc. using the following methods: pesticides by 8081B Low Level (for groundwater), and total RCRA metals by 6020A.

[d]The ROD states that the goal is based on the PQL, which is allowed by Washington Administrative Code 173-340 if cleanup levels are below the PQL. Note, however, that the PQLs have changed since the ROD was published.

[e]The ROD remediation goal for arsenic is based on the area background concentration established in the OU B remedial investigation report.

Notes:

Orange highlighted cell indicates the current regulatory value is greater than the value at the time of the ROD.

Table 7-9. Soil Cleanup Levels for OU NSC

Chemical	ROD Remediation Goal[a] (mg/kg)	ROD Basis	Current Regulatory Level[b] (mg/kg)
Lead	1,000	MTCA A Industrial	1,000
cPAHs[c]	18	MTCA C Industrial	18
Benzo(a)anthracene	-	MTCA C Industrial	180
Benzo(a)pyrene	-	MTCA C Industrial	18
Benzo(b)fluoranthene	-	MTCA C Industrial	180
Benzo(k)fluoranthene	-	MTCA C Industrial	1,800
Chrysene	-	MTCA C Industrial	18,000
Dibenz(a,h)anthracene	-	MTCA C Industrial	18
Indeno(1,2,3-cd)pyrene	-	MTCA C Industrial	180
Total PCBs	17	MTCA C Industrial	66
Total petroleum hydrocarbons	200	MTCA A	NA
Diesel	-	-	2,000
Heavy oil	-	-	2,000
Mineral oil	-	-	4,000
Gasoline with benzene	-	-	30
Gasoline without benzene	-	-	100

Data sources:

[a] ROD Table 8-1 (Navy et al., 1997).

[b]Department of Ecology, State of Washington, CLARC Data Tables (July 2015); complies with MTCA Cleanup Regulation, WAC 173-340. Values that have significantly changed since the ROD have been highlighted.

[c]The RG in the ROD for cPAHs (total) is based on the MTCA Method C industrial soil cleanup level for benz(a)pyrene. The RG for cPAHs in soil requires comparing the TTEC for the seven cPAHs relative to benzo(a)pyrene to the cleanup level derived for benzo(a)pyrene. However, new MTCA Method C industrial values are now available for individual cPAHs. The values may be used if only one cPAH is detected. If multiple cPAHs are present, the TTEC approach must be used.

Notes:

Yellow highlighted cell indicates a regulatory value that has changed since the time of the ROD.

Orange highlighted cell indicates the current regulatory value is greater than the value at the time of the ROD.

- - An individual cleanup goal was not provided in the ROD. Rather, concentrations of these individual cPAHs were normalized to benzo(a)pyrene values using the TTEC approach.

Table 7-10. Groundwater Cleanup Levels for Protection of Surface Water for OU NSC

Chemical	ROD Regulatory Level[a] (µg/L)	Current Regulatory Level[b] (µg/L)	ROD Basis	Previous PQL (µg/L)	Current LOQ[cd] (µg/L)	ROD Remediation Goal (µg/L)
Arsenic	0.0982	0.0982	MTCA B SW	0.5	0.5	0.5 [e]
Copper	2.5	3.1	State WQC	2.5	0.1	2.5
Lead	5.8	8.1	State WQC	5	0.03	5.8
Nickel	7.9	8.2	State WQC	5	0.2	7.9
Alpha-BHC	0.0079	0.0079	MTCA B SW	0.01	0.001	0.01[e]
Alpha-chlordane	0.000354	0.0013[b]	MTCA B SW	0.01	0.001	0.01[e]
Gamma-chlordane	0.000354	0.0013[b]	MTCA B SW	0.01	0.001	0.01[e]
4,4'-DDT	0.000356	0.00035	MTCA B SW	0.02	0.001	0.02[e]
Total PCBs	0.000027	0.00010[f]	MTCA B SW	0.2	0.1	0.2[e]
Total petroleum hydrocarbons	1,000	NA	MTCA A	250	250	1,000
Diesel	-	500	MTCA A	-	-	-
Heavy oil	-	500	MTCA A	-	-	-
Mineral oil	-	500	MTCA A	-	-	-
GRO with benzene	-	800	MTCA A	-	-	-
GRO without benzene	-	1,000	MTCA A	-	-	

Data sources:

[a]ROD Table 8-1 (Navy et al., 1997).

[b]Department of Ecology, State of Washington, CLARC Data Tables (July 2015); complies with MTCA Cleanup Regulation, WAC 173-340. Values that have significantly changed since the ROD have been highlighted.

[c]In present day terminology, the practical quantitation limit (PQL) is referred to as a "limit of quantitation" (LOQ) in accordance with the DoD Quality Systems Manual for Environmental Laboratories (QSM) [DoD 2013] and the Navy's Tier II SAP format guidelines. The LOQ is synonymous with the practical quantitation limit (PQL), as defined in WAC 173-340.

[d]Source of LOQs is ALS Laboratory, Inc. using the following methods: SVOCs by 8270D Low Level, PAHs by 8270D (SIM), PCB Aroclors by 8082A Low Level (for groundwater), pesticides by 8081B Low Level (for groundwater), and total RCRA metals by 6020A.

[e]The ROD states that the goal is based on the PQL, which is allowed by Washington Administrative Code 173-340 if cleanup levels are below the PQL. The PQLs have changed since the ROD was published. However, in accordance with the recommendations of the first five-year review, these chemicals of concern are no longer part of the monitoring program.

[f]Though the current regulatory level has changed, the remediation goal would still be based on the PQL if a ROD were being signed today.

Yellow highlighted cell indicates a regulatory value that has changed since the time of the ROD.

Orange highlighted cell indicates the current regulatory value is greater than the value at the time of the ROD.

- - An individual cleanup goal was not provided in the ROD.

Table 7-11. Issues

Item No.	Issue	Affects Protectiveness	
		Current	Future
OU A, OU B Terrestrial, and OU NSC			
1	Ongoing and completed maintenance and repairs to pavement and the storm water system are not documented in the BNC Terrestrial Annual Remedy Inspection Report.	No	Yes
OU A, OU B Terrestrial, OU D and OU NSC			
2	The terrestrial remedies adjacent to Sinclair Inlet at BNC may be vulnerable to climate change effects, including sea level rise and increasing storm intensity.	No	Yes
3	Recent changes to the water quality may impact protectiveness.	No	Yes
OU A			
4	The 100 percent design for the remedy repair at Charleston Beach is complete, but needs to be revised to account for climate change considerations and to comply with ARARs. Consultation with the stakeholders regarding design changes and remedy repair implementation is still pending.	No	Yes
OU B Marine			
5	OU B Marine IC inspection and reporting requirements are not clearly documented in an IC plan.	Yes	Yes
6	The magnitude and effects of the mercury source in the Outfall 15 drainage basin and the potential mercury source located between Dry Docks 5 and 6 where groundwater discharges directly to Sinclair Inlet are not sufficiently understood.	Yes	Yes
7	A remedy for OU B Marine that addresses mercury source control and considers additional remedial actions for total mercury in sediment to reduce human health risk has not yet been developed.	Yes	Yes
8	Bathymetric survey data from the post-construction survey through the 2012 survey showed elevation changes and the reasons for these changes are not clearly understood.	Yes	Yes
OU B Terrestrial			
9	Recent shoreline inspections indicate erosion along Segment 4.	Yes	Yes
OU B Terrestrial and OU C			
10	In OU B Terrestrial, due to site sampling location limitations in the former Building 871 area, potential cyanide presence in soil and groundwater was not fully defined and the current IC and O&M Plan does not contain future use restrictions for the potentially affected areas. For OU C, the IC inspection frequency is not specified in the Cleanup Action Plan, and therefore IC inspections for OU C have not been included in the BNC IC and O&M Plan. This issue only affects protectiveness for OU B Terrestrial, not for OU C.	Yes	Yes

Notes:
ARAR - applicable or relevant and appropriate requirement
BNC - Bremerton Naval Complex
IC - institutional control
O&M – Operations and Maintenance
OU - operable unit
WQC – Water Quality Criteria (Ecology, 2017)

Table 7-12. Historical Range of Analytical Results for OU A Groundwater Sampling

Sampling Location	Total Arsenic (µg/L)	Total Copper (µg/L)	Total Lead (µg/L)	Total Nickel (µg/L)	Total Zinc (µg/L)
Ambient Level	**5**	**2.2**	**2**	**10**	**18.5**
ROD RG	**0.5**	**2.5**	**5.8**	**7.9**	**76.6**
Current Regulatory Level	**0.0982**	**3.1**	**8.1**	**8.2**	**81**
203	76.3-188	1.24-4.88	0.023-1.6	0.73-2.61	1.08-6.51
204	0.5(U)-3.4	2.9-76.5	0.019(U)-4.2	2.22(U)-48.4	40.6-249
206	1.82 – 7.83	0.06-6.6	0.011 -1.96	0.11-7.97	0.4(U) -584
241	2.64-12.7	0.31(U)-361	0.019(U)-85.8	0.35- 97.7	1.4-1240
346	1.71 – 2.89	0.06 -9.49	0.004-0.16	0.16- 94.9	0.2-6.86

Notes:
Data range evaluations relied on a data downloaded from NIRIS. However, data for well 203 were not available in NIRIS and the data range was instead evaluated based on data tables in published monitoring reports.
µg/L - microgram per liter
OU - operable unit
RG - remediation goal
ROD - Record of Decision
U - not detected above method reporting limit
Data sources: Data values downloaded from the Navy's NIRIS database for the purposes of this data range evaluation are also available in the published monitoring reports for this five year review period (Navy, 2017b; Navy, 2016h, Navy, 2015h,i).

Table 7-13. Historical Range of Analytical Results for OU B Terrestrial Groundwater Sampling – Metals

Sampling Location	Dissolved Arsenic (µg/L)	Dissolved Copper (µg/L)	Dissolved Lead (µg/L)	Dissolved Nickel (µg/L)	Dissolved Zinc (µg/L)	Dissolved Cadmium (µg/L)	Total Mercury (µg/L)
ROD RG	**5**	**3.1**	**8.1**	**8.2**	**81**	**8.8**	**0.025**
Current Regulatory Level	**0.0982**	**3.1**	**8.1**	**8.2**	**81**	**9.3**	**0.025**
LTMP-1	1.06-2.8	2.4-150	0.14-1.38	2.8-29.9	20.5-1070	2.28	0.0568-0.308
LTMP-3	3.74-17.6	62-238	1.09-29.8	5.7-34.5	134-554	0.549-0.565	0.000614-6.69
LTMP-4	0.9-10.9	0.63-64.2	0.02(U)-17.4	2.36-82.4	0.47-87.5	0.02	0.0000021-0.2 (U)
LTMP-5	0.92(U)-2	1.04-48	0.071-7.99	0.74-14.9	6.96-35.2	0.06-0.181	0.00000739-5.24
410R	NA	NA	NA	6.64-15	1.15-1.68	0.114	0.00000876-0.0000534
346	2.1-2.9	0.08 -0.61	0.021	0.47-0.83	0.05(U)-0.38	0.005-0.03(U)	0.00017- 0.00041

Notes:

Data range evaluations relied on a data downloaded from NIRIS. However, data for well 346 were not available in NIRIS and the data range was instead evaluated based on data tables in published monitoring reports.
µg/L - microgram per liter
NA - not analyzed
OU B - Operable Unit B
RG - remediation goal
ROD - Record of Decision
U - not detected above method reporting limit
Data sources: Data values downloaded from the Navy's NIRIS database for the purposes of this data range evaluation are also available in the published monitoring reports for this five year review period (Navy, 2017b; Navy, 2016h, Navy, 2015h,i).

Table 7-14. Historical Range of Analytical Results for OU B Terrestrial Groundwater Sampling – TCE

Sampling Location	TCE (µg/L)
ROD RG	**55.6**
Current Regulatory Level	**12.8**
346	0.5 U*
410R/410R	0.5 (U)- 19
432	NA*
704	NA*
707	NA*

Note:
*Data range evaluations relied on a data downloaded from NIRIS. However, data for wells 346, 432, 704. And 707 were not available in NIRIS and the data ranges were instead evaluated based on data tables in published monitoring reports.
µg/L - microgram per liter
NA - not available
OU B - Operable Unit B
RG - remediation goal
ROD - Record of Decision
TCE - trichloroethene
U - not detected above method reporting limit
Data sources: Data values downloaded from the Navy's NIRIS database for the purposes of this data range evaluation are also available in the published monitoring reports for this five year review period (Navy, 2017b; Navy, 2016h, Navy, 2015h,i).

Table 7-15. Historical Range of Analytical Results for OU B Terrestrial Groundwater Sampling – Petroleum

Sampling Location	TPH-G (µg/L)	TPH-D (µg/L)	TPH-O (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Total Xylenes (µg/L)
PMP Compliance Criterion	**800**	**500**	**500**	**5**	**1,000**	**700**	**1,000**
392/392R	12(U)-2300	110(U)-14000	110(U)-13000	0.5(U)[c]	0.07-0.15	0.5(U)-1(U)	0.5(U)-2(U)
406/406R	50(U)-250(U)	14-110	21-57	0.5(U) [1]	0.13-0.23	0.5(U)-1(U)	0.5(U)-2(U)
428/428R	50(U)-250(U)	12-260	110(U)-520(U)	0.5(U) [1]	0.5(U)-1(U)	0.5(U)-1(U)	1(U)-2(U)
811	250 (U)-1000	420-2600	NA*	0.12-0.5 (U)	0.3-0.5(U)	0.5(U)-0.63	0.5(U)-16.7
346	12(U)-250(U)	16-28	38(U)-530(U)	0.059(U)-0.5(U)	0.07(U)-0.11	0.051(U)-0.092(U)	0.0007(U)-1(U)

Notes:
µg/L - microgram per liter
OU B - Operable Unit B
TPH-D - total petroleum hydrocarbons—diesel
TPH-O - total petroleum hydrocarbons as diesel and heavy oil
TPH-G - total petroleum hydrocarbons—gasoline
U - not detected above method reporting limit
NS- Not sampled
[1]There were no detections at this well.
NA*- TPH-O data not available in NIRIS.
Data sources: Data values downloaded from the Navy's NIRIS database for the purposes of this data range evaluation are also available in the published monitoring reports for this five year review period (Navy, 2017b; Navy, 2016h, Navy, 2015h,i).

Table 7-16. Historical Range of Analytical Results for OU C

Well ID	TPH-D (mg/L)	TPH-O (mg/L)
Trigger Level	**0.5**	**0.5**
GMWT-9	0.042-1.3	0.030 - 0.490
GMWT 22	0.036(U)-0.430	0.030(U)-0.130
GMWT 23	0.037-0.360	0.050-0.270
346	0.016 -0.28 (U)	0.097(U)-0.28 (U)

Notes:
Bold value exceeds the trigger level
TPH D - total petroleum hydrocarbons—diesel
TPH O - total petroleum hydrocarbons—diesel extended (heavy oil)
U - not detected above reporting limit
Data sources: Data values downloaded from the Navy's NIRIS database for the purposes of this data range evaluation are also available in the published monitoring reports for this five year review period (Navy, 2017b; Navy, 2016h, Navy, 2015h,i).

Table 7-17. Summary of Analytical Results for OU NSC Groundwater Sampling

Sampling Location	Total Arsenic (µg/L)	Total Copper (µg/L)	Total Lead (µg/L)	Total Nickel (µg/L)	TPH (Total) (µg/L)	TPH-D (µg/L)	TPH-G (µg/L)	TPH-O (µg/L)
Ambient Level	**5**	**2.2**	**2**	**10**	**NE**	**NE**	**NE**	**NE**
ROD RG	**0.5**	**2.5**	**5.8**	**7.9**	**1,000**	**NE**	**NE**	**NE**
Current Reg. Level	**0.0982**	**3.1**	**8.1**	**8.2**	**NE**	**500**	**800**	**500**
310/310R	0.38-38.7	0.23-138	0.009-0.73	0.31-21.5	12(U)-900	30(U)-58	12(U)-140	54(U)-110
380	0.1(U)-0.5	0.33-89	0.031(U)-2.72	1.46-51.2	12(U)-332	40-120	12(U)-180	120-230
386	0.33-19.3	0.68-4.1	0.01(U)-1.5	1.07-29.4	21(U)-400	20(U)-34	12(U)-22	55-180
392/392R	0.06-4.11	0.082-70.6	0.019(U)-6.48	0.19(U)-5.6	5421-13212	110-14000	12(U)-2300	110(U))-13000
346	1.71 -3.31	0.11-9.49	0.004-0.16	0.16-94.9	0.31 -778	28 – 270(U)	12(U)-250(U)	38(U) – 530 (U)

Notes:
U = The analyte not detected at the specified quantitation limit.
µg/L - microgram per liter
NE - not established
OU NSC - Operable Unit Naval Supply Center
Reg. - Regulatory
RG - remediation goal
ROD - Record of Decision
TPH - total petroleum hydrocarbon
TPH-D - total petroleum hydrocarbons—diesel
TPH-O - total petroleum hydrocarbons as diesel and heavy oil
TPH-G - total petroleum hydrocarbons—gasoline
Data sources: Data values downloaded from the Navy's NIRIS database for the purposes of this data range evaluation are also available in the published monitoring reports for this five year review period (Navy, 2017b; Navy, 2016h, Navy, 2015h,i).

8.0 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

This section presents the recommendations and follow-up actions identified as a result of the five-year review process. Table 8-1 summarizes the recommendations that have the potential to affect current or future protectiveness of human health or the environment.

Table 8-1. Recommendations and Follow-Up Actions

Item No.	Recommendation/ Follow-Up Action	Party Responsible	Oversight Agency	Milestone Date	Follow-Up Action: Affects Protectiveness	
					Current	Future
OU A, OU B Terrestrial, and OU NSC						
1	Develop and add a new section to the BNC Terrestrial Annual Remedy Inspection Report to describe ongoing and completed maintenance and repairs to pavement and the storm water system.	Navy	EPA, Ecology	December 2018	No	Yes
OU A, OU B Terrestrial, OU D, and OU NSC						
2	Leverage ongoing Navy regional planning to begin an assessment of the vulnerability of the BNC remedies to climate change, in support of a future adaptation plan for BNC OUs. Yearly climate change planning updates will be provided to the stakeholder team.	Navy	EPA, Ecology	October 2021	No	Yes
3	Evaluate how changes to Water Quality Criteria may impact protectiveness.	Navy	EPA, Ecology	December 2020	No	Yes
OU A						
4	A. Revise the remedy repair design at Charleston Beach to account for climate change and compliance with ARARs, including performance of a habitat benefit analysis. Complete a consultation with the stakeholder group regarding plans for implementation of the remedy repair at Charleston Beach.	Navy	EPA, Ecology	December 2019	No	Yes
4	B. Complete construction of the Charleston Beach remedy repair.	Navy	EPA, Ecology	December 2020	No	Yes
OU B Marine						
5	Prepare an OU B Marine IC plan to clearly document the OU B Marine IC requirements, and associated inspection, inspection frequency and reporting requirements.	Navy	EPA, Ecology	June 2018	Yes	Yes
6	A. Perform a source control evaluation, focused on transport of mercury through the storm drain system and direct discharge of groundwater to OU B Marine, and prepare an EE/CA and Action Memorandum to address mercury source control.	Navy	EPA, Ecology	December 2019	Yes	Yes

Table 8-1 (Continued). Recommendations and Follow-Up Actions

6	B. Implement source control actions selected in the Action Memorandum.	Navy	EPA, Ecology	December 2020	Yes	Yes
7	A. Prepare a focused feasibility study for mercury.	Navy	EPA, Ecology	January 2020	Yes	Yes
7	B. Prepare a ROD amendment (or new ROD or ESD) for mercury after the focused feasibility study is completed.	Navy	EPA, Ecology	February 2021	Yes	Yes
8	Complete a review and revalidation of the bathymetric survey data from the post-construction survey through the 2012 survey in the CAD pit, ENR and thick cap areas to validate if the physical components are functioning as intended by the ROD.	Navy	EPA, Ecology	June 2018	Yes	Yes
OU B Terrestrial						
9	A. Develop a plan to stabilize the shoreline along Segment 4, while considering actions needed in light of the USGS' finding that groundwater discharges to surface water in this area. Involve both the OU B Marine and BNC Terrestrial teams in planning for action along Segment 4.	Navy	EPA, Ecology	December 2018	Yes	Yes
9	B. Implement the plan to stabilize the shoreline along Segment 4.	Navy	EPA, Ecology	December 2020	Yes	Yes
OU B Terrestrial and OU C						
10	Update the BNC Terrestrial IC and O&M Plan to include the OU C ICs required by the Cleanup Action Plan and to include restrictions for future use of Building 871 area due to potential cyanide presence in soil and groundwater. This issue only affects protectiveness for OU B Terrestrial, not for OU C.	Navy	EPA, Ecology	December 2018	Yes	Yes

9.0 CERTIFICATION OF PROTECTIVENESS

An overall protectiveness determination of the remedies for the BNC site cannot be made at this time and will be deferred until further information for three OUs is obtained (i.e., additional mercury information for OU B Terrestrial and OU B Marine is obtained). Following collection and evaluation of the necessary additional information, protectiveness determinations will be made for the site as a whole and the individual OUs no later than December 2020

The remedy implemented at OU A is protective in the short term, based on the recent intertidal sediment sampling and interim erosion protection measures being implemented at Charleston Beach. However, to achieve long-term protectiveness, a permanent remedy repair must be selected and implemented in consultation with stakeholders.

A protectiveness determination of the remedy for OU B Marine cannot be made until further information is obtained. The polychlorinated biphenyl (PCB) sediment cleanup level specified in the ROD for OU B Marine was achieved in 2014, and this conclusion will be confirmed by an additional sampling event. However, the protectiveness of the OU B Marine remedy remains in question because of sources of mercury to OU B Marine. Mercury is a chemical of concern (COC) for OU B Marine. The magnitude and effects of the mercury source in the Outfall 15 drainage basin, and the potential mercury source located between Dry Docks 5 and 6 where groundwater discharges directly to Sinclair Inlet are not sufficiently understood. Source control evaluations are incomplete and a remedy has not been selected for mercury in the marine environment. The Navy is engaged with stakeholders to develop a focused feasibility study and identify a remedy for OU B Marine that addresses mercury source control and considers additional remedial actions for total mercury in sediment to reduce human health risk. At the completion of the additional sampling event and the mercury source control evaluation, the protectiveness of the remedy for OU B Marine will be reevaluated.

A protectiveness determination of the remedy for OU B Terrestrial cannot be made until further information is obtained. Evaluations of OU B Terrestrial as a source of mercury to the marine environment are incomplete. At the completion of source control evaluation, the protectiveness of the remedy for OU B Terrestrial will be reevaluated. In the interim, the pathways for human exposure are being controlled through ICs that control access to the site, control excavation in contaminated areas, prevent the consumption of groundwater, and limit activities on site to industrial use.

The remedy implemented at OU C currently protects human health and the environment. The cleanup action implemented under the state MTCA regulation continues to prevent migration of free and dissolved phase petroleum hydrocarbon from affecting Dry Dock 6 and Sinclair Inlet in order to protect human health and the environment. ICs remain in place to prohibit activities that interfere with monitoring activities and prevent release of petroleum hydrocarbons.

The remedy implemented at OU D currently protects human health and the environment. Exposure pathways and infiltration pathways that could increase contaminant migration and result in unacceptable risks are being controlled and monitored. The conditions and COC concentrations found presently in groundwater are similar to those at the time the ROD was executed. Conditions at the time of ROD execution were found not to pose unacceptable risks to human health and the environment as long as exposures and contaminant migration were controlled.

The remedy implemented at OU NSC currently protects human health and the environment. Exposure pathways and infiltration pathways that could increase contaminant migration and result in unacceptable risks are being controlled and monitored. The conditions and COC concentrations found presently in groundwater are similar to those at the time the ROD was executed. Conditions at the time of ROD execution were found not to pose unacceptable risks to human health and the environment as long as exposures and contaminant migration were controlled.

10.0 NEXT REVIEW

The next five-year review is scheduled for 2022.

11.0 REFERENCES

Bloom, N.S. 1992. On the Chemical Form of Mercury in Edible Fish and Marine Invertebrate Tissue. Can. J. Fish. Aquat. Sci. 49:1010-1017.

Cressman, T. 2016. Personal Correspondence. Email with Pamela M. Sargent, PE., NAVFAC NW, concurring with Navy finding that no modifications are needed to the Memorandum of Agreement. July 14, 2016.

Huffman, R.L., R.J. Wagner, J. Toft, J. Cordell, J.F. DeWild, R.S. Dinicola, G.R. Aiken, D.P. Krabbenhoft, M. Marvin-DiPasquale, A.R. Stewart, P.W. Moran, and A.J. Paulson. 2012. *Mercury Species and Other Selected Constituent Concentrations in Water, Sediment, and Biota of Sinclair Inlet, Kitsap County, Washington. U.S. Geological Survey Data Series.* 658, 64 p + Appendices. 2007–10. http://pubs.usgs.gov/ds/658/

Jones, J.L., K.H. Johnson, and L.M. Frans. 2016. Numerical Simulation of Groundwater Flow at Puget Sound Naval Shipyard, Naval Base Kitsap, Bremerton, Washington. U.S. Geological Survey Open-File Report 2016-1135, 35 p. http://dx.doi.org/10.3133/ofr20161135

Paulson, A.J., M.E. Keys, and K.L. Scholting. 2010. *Mercury in Sediment, Water, and Biota of Sinclair Inlet, Puget Sound, Washington, 1989–2007*. USGS Open-File Report 2009-1285. 2010. http://pubs.usgs.gov/of/2009/1285/

Paulson, A.J., R.S. Dinicola, M.A. Noble, R.J. Wagner, R.L. Huffman, P.W. Moran, and J.F. DeWild. 2012. *Sources and Sinks of Filtered Total Mercury and Concentrations of Total Mercury of Solids and of Filtered Methylmercury, Sinclair Inlet, Kitsap County, Washington, 2007–10*. USGS Scientific Investigations Report 2012–5223. 2012. http://pubs.usgs.gov/sir/2012/5223/

Paulson, A.J., K.E. Conn, and J.F. DeWild. 2013. *Improved Estimates of Filtered Total Mercury Loadings and Total Mercury Concentrations of Solids from Potential Sources to Sinclair Inlet, Kitsap County, Washington*. U.S. Geological Survey Scientific Investigations Report 2013-5081. 2013. http://pubs.usgs.gov/sir/2013/5081/

Suquamish Tribe. 2000. Fish Consumption Survey of the Suquamish Indian Tribe of the Port Madison Indian Reservation, Puget Sound Region. Prepared by The Suquamish Tribe, Port Madison Indian Reservation, Fisheries Department. Suquamish, Washington. August 2000.

U.S. Army Corps of Engineers (USACE). 1994. *Hydrographic Surveying Manual*, EM 1110-2-1003.

U.S. Army Corps of Engineers, U.S. EPA Region 10, Washington State Department of Natural Resources, and Washington State Department of Ecology (USACE, EPA, WDNR and Ecology). 2009. *OSV Bold Summer 2008 Survey. Data Report – Final*. June 25, 2009.

U.S. Environmental Protection Agency (EPA). 2014. Human Health Evaluation Manual, supplemental Guidance: Update of Standard Default Exposure Factors. OSWER Directive 9200.1-120. February.

———. 2012a. Memorandum to National Superfund Program Managers: Clarifying the Use of Protectiveness Determinations for Comprehensive Environmental Response, Compensation and Liability Act Five-Year Reviews. September 23.

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

———. 2010. Interim Final Institutional Controls: A Guide to Planning, Implementing, Maintaining, and Enforcing Institutional Controls at Contaminated Sites (OSWER 9355.0-89, EPA 540-F-00-005)

———. 2007. Letter from Daniel Opalski, Director, Office of Environmental Cleanup, EPA, to Captain Robert Schlesinger, Commanding Officer, NAVFAC NW, re: Bremerton Naval Complex achievement of "construction complete."

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

———. 2000. *Environmental Protection Agency Region 10, Washington State Department of Ecology, Superfund Management in Washington.* February 23, 2000.

U.S. Navy. 2017a. *Draft Annual Remedy Inspection Report, Puget Sound Naval Shipyard (PSNS) Complex Superfund Site, Bremerton, Washington*. Prepared for NAVFAC NW by Sealaska under Contract No. N44255-14-D-9011, Task Order 37. March 10, 2017.

———. 2017b. *Draft 2016 Data Summary and Trend Analysis Report, Puget Sound Naval Shipyard (PSNS) Complex Superfund Site, Naval Base Kitsap Bremerton, Bremerton, Washington.* Prepared for NAVFAC NW by Sealaska under Contract No. N44255-14-D-9011, Task Order 37, March 3, 2017.

———. 2017c. *Supplemental Mercury Investigation Report, PSNS Superfund Site, Bremerton Naval Complex, Bremerton, Washington.* Prepared for NAVFAC NW by URS Group, Inc. under Contract No. N44255-09-D-4001, Task Order 51. February 28, 2017.

———. 2017d. *Goals and Objectives for Decision Framework Process for PCBs and Mercury in OU B Marine, Bremerton Naval Complex, Puget Sound Naval Shipyard.* Technical memorandum prepared by NAVFAC NW for the OU B Project Managers Team. February 16, 2017.

———. 2016a. *Addendum to the Third Five-Year Review Bremerton Naval Complex (Puget Sound Naval Shipyard Complex Superfund Site), Bremerton, Washington.* June 2016.

———. 2016b. *Final Operation and Maintenance and Institutional Control Plan, Puget Sound Naval Shipyard (PSNS) Complex Superfund Site, Naval Base Kitsap Bremerton, Bremerton, Washington*. Prepared for NAVFAC NW by Sealaska, under Contract No. N44255-09-D-4005, Task Order 85. March 30, 2016.

———. 2016c. *Final 2014 OU B Marine Phase 2 Long-term Monitoring Report, PSNS Superfund Site, Bremerton Naval Complex, Bremerton, Washington*. Prepared for NAVFAC NW by URS Group, Inc., under Contract No. N44255-09-D-4001, Task Order 87. November 11, 2016.

———. 2016d. *Final 2012 OU B Marine Long-term Monitoring Report, PSNS Superfund Site, Bremerton Naval Complex, Bremerton, Washington*. Prepared for NAVFAC NW by URS Group, Inc. under Contract No. N44255-09-D-4001, Task Order 38. January 15, 2016.

———. 2016e. *Final 2015 Annual Remedy Inspection Report, Puget Sound Naval Shipyard (PSNS) Complex Superfund Site, Bremerton, Washington*. Prepared for NAVFAC NW by Sealaska under Contract No. N44255-09-D-4005, Task Order 85. March 29, 2016.

———. 2016f. *Final Long-Term Monitoring, Inspection, and Improvement Plan for OU A, OU NSC, OU B T, PMP, OU C, and OU D, Naval Base Kitsap Bremerton LTM, Bremerton, Washington.* Prepared for NAVFAC NW by Sealaska under Contract No. N44255-14-D-9011, Task Order 19, and Amended under N44255-14-D-9011, Task Order 37 September 6, 2016.

———. 2016g. *Final 2014 OU B Marine Phase 1 Long-term Monitoring Report, PSNS Superfund Site, Bremerton Naval Complex, Bremerton, Washington*. Prepared for NAVFAC NW by URS Group, Inc., under Contract No. N44255-09-D-4001, Task Order 87. February 3, 2016.

———. 2016h. *Fall 2015 Long Term Monitoring Data Summary Report for OU A, OU NSC, OU BT, PMP, OU C and OU D.Naval Base Kitsap Bremerton, Washington*. Prepared for NAVFAC NW by Sealaska Environmental Services, LLC under Contract No. N44255-14-D-9011, Task Order 19. April 22, 2016.

———. 2016i. *Sediment Sampling for Salt Water Main Break, Waterfront Area, Vicinity of Dry Dock 4, Naval Base Kistap-Bremerton*. Prepared by NAVFAC NW. October 31, 2016.

———. 2016j. *Bremerton Naval Complex, Fourth Five-Year Review Kickoff Meeting Summary*. Meeting between Navy and stakeholder team, November 15, 2016.

———. 2016k. Naval Base Kitsap Instruction (NAVBASEKITSAPINST) 5401.1B Naval Base Kitsap Commander's Critical Information Requirements and Standing Orders. Dated March 28, 2016.

———2016l. *Long Term Monitoring Trend Analysis Report for OU A, OU NSC, OU BT, PMP OU C and OU D, Naval Base Kitsap Bremerton, Washington*. Prepared for NAVFAC NW by Sealaska Environmental Services, LLC under Contract No. N44255-09-D-4005, Task Order 85. March 29, 2016.

———2016m. *Waterfront Facilities Inspections and Assessments at Naval Station Kitsap - Bremerton, Bremerton, Washington*. Prepared for NAVFAC EXWC by Appledore Marine Engineering, LLC under Contract N39430-15-D-1612, Delivery Order 0007. September 26, 2016.

———. 2015a. *100 Percent, Revision 2, Basis of Design for Operable Unit A, Charleston Beach Long-Term Erosion Control Protection Remedy Design, Bremerton Naval Complex, Bremerton, Washington*. Prepared for NAVFAC NW by URS Group, Inc. under Contract No. N44255-09-D-4001, Task Order 67. October 30, 2015.

———. 2015b. *Final 2013 Sinclair Inlet Marine Monitoring Data Report, PSNS Superfund Site, Bremerton Naval Complex, Bremerton, Washington*. Prepared for NAVFAC NW by URS Group, Inc. under Contract No. N44255-09-D-4001, Task Order 51. February 23, 2015.

———2015c. *Final Operation and Maintenance Plan, Puget Sound Naval Shipyard (PSNS) Complex Superfund Site, Naval Base Kitsap Bremerton, Washington*. Prepared for NAVFAC NW by Sealaska under Contract No. N44255-09-D-4005, Task Order 72. July 29, 2015.

———. 2015d. *Final Institutional Control Work Plan, Puget Sound Naval Shipyard (PSNS) Complex Superfund Site, Naval Base Kitsap Bremerton, Bremerton, Washington*. Prepared by Sealaska under contract No. N44255-09-D-4005, Task Order 72. June 22, 2015.

———. 2015e. *Final 2014 Annual Remedy Inspection Report, Puget Sound Naval Shipyard (PSNS) Complex Superfund Site, Bremerton, Washington*. Prepared for NAVFAC NW by Sealaska under Contract No. N44255-09-D-4005, Task Order 72. April 27, 2015.

———. 2015f. *OJAG (Code 11) Case File Number: ACC# 15-161.* Letter from Theron R. Korsak (U.S. Navy) to Harold Holmen (Astoria Seafoods, LLC). November 4, 2015.

———. 2015g. *Basis of Design for Operable Unit A, Charleston Beach Long-Term Erosion Control Protection Remedy Design, Bremerton Naval Complex, Bremerton, Washington. 100 Percent, Revision 2*. Prepared for NAVFAC NW by URS Group, Inc. under Contract No. N44255-09-D-4001, Delivery Order 0067. October 30, 2015.

———. 2015h. *Fall 2014 Long -Term Monitoring Data Summary Report for OU A, OU NSC, OU BT, PMP and OU C, Naval Base Kitsap Bremerton, Washington*. Prepared for NAVFAC NW by Sealaska Environmental Services, LLC., under Contract No. N44255-09-D-4005, Task Order 85. October 15, 2015.

———. 2015i. *Long Term Monitoring Trend Analysis Report for OU A, OU NSC, OU BT, PMP OU C and OU D, Naval Base Kitsap Bremerton, Washington*. Prepared for NAVFAC NW by Sealaska Environmental Services, LLC under Contract No. N44255-09-D-4005, Task Order 72. March 27, 2015.

———. 2015j. Waterfront Facilities Inspections and Assessments at Naval Station Kitsap - Bremerton, Bremerton, Washington. Prepared for NAVFAC EXWC by Appledore Marine Engineering, LLC under Contract N39430-15-D-1612, Delivery Order 0005. September 29, 2105.

———. 2015k. Well Abandonment/Relocation and Storm Drain Line Repair Report, Naval Station Kitsap - Bremerton, Bremerton, Washington. Prepared for NAVFAC EXWC by URS Group, Inc. under Contract No. N44255-09-D-4001, Delivery Order 0011 January 12, 2015

———. 2015l. Puget Sound Naval Shipyard Physical Security Plan - PSNS&IMFINST P5530.1B, 25 February 2015.

———. 2014a. *Final 2013 Annual Remedy Inspection Report, Naval Base Kitsap Bremerton, Bremerton, Washington*. Prepared for NAVFAC NW by Sealaska under Contract No. N44255-09-D-4005, Task Order 59. January 30, 2014.

———. 2014b. *Final Institutional Control Work Plan, Naval Base Kitsap Bremerton, Bremerton, Washington*. Prepared for NAVFAC NW by Sealaska under Contract No. N44255-09-D-4005, Task Order 59. March 20, 2014.

———. 2014c. *Final Operation and Maintenance Plan, Naval Base Kitsap Bremerton, Bremerton, Washington*. Prepared for NAVFAC NW by Sealaska under Contract No. N44255-09-D-4005, Task Order 59. April 25, 2014.

———. 2014d. *Long-Term Monitoring Trend Analysis Report for OU A, OU NSC, OU BT, PMP and OU C, Spring 2012 through Winter/Spring 2013,Naval Base Kitsap Bremerton, Washington*. Prepared for NAVFAC NW by Sealaska Environmental Services, LLC., under Contract No. N44255-09-D-4005, Task Order 59. January 23, 2014.

———. 2014e. *Summer/Fall 2013 Long-Term Monitoring Data Summary Report for OU A, OU NSC, OU BT, PMP and OU C, Naval Base Kitsap Bremerton, Washington*. Prepared for NAVFAC NW by Sealaska Environmental Services, LLC., under Contract No. N44255-09-D-4005, Task Order 72. April 28, 2014.

———. 2014f. *Winter/Spring 2014 Long -Term Monitoring Data Summary Report for OU BT and OU C, Naval Base Kitsap Bremerton, Washington*. Prepared for NAVFAC NW by Sealaska Environmental Services, LLC., under Contract No. N44255-09-D-4005, Task Order 72. July 29, 2014.

———. 2014g. *Long-Term Monitoring, Inspection and Improvement Plan for OU A, OU NSC, OU BT, PMP, OU C and OU D, Naval Base Kitsap Bremerton, Washington*. Prepared for NAVFAC NW by Sealaska Environmental Services, LLC., under Contract No. N44255-09-D-4005, Task Order 85. July 18, 2014.

———. 2014h. *Data Summary Technical Memorandum for Non-Long -Term Monitoring Investigations, Naval Base Kitsap Bremerton, Washington*. Prepared for NAVFAC NW by Sealaska Environmental Services, LLC., under Contract No. N44255-09-D-4005, Task Order 72. August 22, 2014.

———. 2014i. *Final 2014 Operable Unit B Marine Long-term Monitoring Plan, Bremerton Naval Complex, Bremerton, Washington*. Prepared by URS for Naval Facilities Engineering Command, Northwest, under Contract N44255-09-D-4001. September 12, 2014.

———. 2013a. *Final 2012 Annual Remedy Inspection, Controls, and Management Report, Naval Base Kitsap at Bremerton, Bremerton, Washington*. Prepared for NAVFAC NW by Sealaska under Contract No. N44255-09-D-4005, Task Order 42. January 11, 2013.

———. 2013b. *Final 2013 Soil and Groundwater Sampling Results Report, TCE Northern Plume Area, Naval Base Kitsap Bremerton, Bremerton, Washington.* Prepared for NAVFAC NW by URS Group, Inc. under Contract No. N44255-09-D-4001, Delivery Order 0039. September 5, 2013.

———. 2013c. *Final Monitoring Plan for Non-Long-Term Monitoring Wells, Naval Base Kitsap at Bremerton, Bremerton, Washington.* Prepared by Sealaska Environmental Services, LLC under Contract No. N44255-09-D-4005, Task Order 072. August 13, 2013.

———. 2013d. *Winter/Spring 2013 Long Term Monitoring Data Summary Report, Naval Base Kitsap Bremerton, Washington*. Prepared for NAVFAC NW by Sealaska Environmental Services, LLC., under Contract No. N44255-09-D-4005, Task Order 59. August 9, 2013.

———. 2013e. *Summer/Fall 2012 Long-Term Monitoring Data Summary Report for OU A, OU NSC, OU BT, PMP and OU C, Naval Base Kitsap Bremerton, Washington*. Prepared for NAVFAC NW by Sealaska Environmental Services, LLC., under Contract No. N44255-09-D-4005, Task Order 59. October 9, 2013.

———. 2013f. *Long-Term Monitoring Trend Analysis Report for OU A, OU NSC, OU BT, PMP and OU C, Spring 2011 through Winter 2012, Naval Base Kitsap Bremerton, Washington*. Prepared for NAVFAC NW by Sealaska Environmental Services, LLC., under Contract No. N44255-09-D-4005, Task Order 42. January 11, 2013.

———. 2013g. *Long-Term Monitoring, Inspection and Improvement Plan for OU A, OU NSC, OU BT, PMP, OU C and OU D, Naval Base Kitsap Bremerton, Washington*. Prepared for NAVFAC NW by Sealaska Environmental Services, LLC., under Contract No. N44255-09-D-4005, Task Order 72. September 20, 2013.

———. 2013h. *Data Summary Technical Memorandum for Non-Long Term Monitoring Investigations, Naval Base Kitsap Bremerton, Washington*. Prepared for NAVFAC NW by Sealaska Environmental Services, LLC., under Contract No. N44255-09-D-4005, Task Order 59. November 1, 2013.

———. 2013i. *Memorandum of Agreement Between the Department of the Navy and City of Bremerton*. Executed May 6, 2013.

———. 2013j. *Final 2013 Sinclair Inlet Marine Monitoring Sampling and Analysis Plan, Bremerton Naval Complex. Bremerton, Washington.* Prepared by URS for Naval Facilities Engineering Command, Northwest, under Contract N44255-09-D-4001. June 24.2013.

———. 2012a. *Final Third Five-Year Review, Bremerton Naval Complex, Bremerton, Washington.* October 12, 2012.

———. 2012b. *Draft Monitoring Well Installation Completion Report, Naval Base Kitsap at Bremerton, Bremerton, Washington*. Prepared for NAVFAC NW by Sealaska under Contract No. N44255-09-D-4005, Task Order 26. January 27, 2012.

———. 2012c. *Final Vapor Intrusion Follow-Up Report, Operable Unit B Terrestrial, Bremerton Naval Complex, Bremerton, Washington*. Prepared for NAVFAC NW by URS under Contract No. N44255-09-D-4001, Task Order 11. March 2012.

———. 2012d. *CERCLA Remedy Repair Alternatives Evaluation for Long-Term Protection of Charleston Beach, Operable Unit A, Bremerton Naval Complex, Bremerton, Washington.* Prepared for Naval Facilities Engineering Command Northwest by URS Group, Inc. under Contract No. N44255-05-D-5100, Delivery Order 0057. Silverdale, Washington. September 14, 2012.

———. 2012e. *Spring 2012 Long-Term Monitoring Data Summary Report for OU BT, OU C and PMP, Naval Base Kitsap Bremerton, Washington*. Prepared for NAVFAC NW by Sealaska Environmental Services, LLC., under Contract No. N44255-09-D-4005, Task Order 42. October 4, 2012.

———. 2012f. *Summer 2011 Long-Term Monitoring Data Summary Report for OU A, OU NSC, OU BT, and OU C, Naval Base Kitsap Bremerton, Washington*. Prepared for NAVFAC NW by Sealaska Environmental Services, LLC., under Contract No. N44255-09-D-4005, Task Order 42. July 27, 2012.

———. 2012g. *Fall 2011 Long-Term Monitoring Data Summary Report for OU BT, OU C, and PMP, Naval Base Kitsap Bremerton, Washington*. Prepared for NAVFAC NW by Sealaska Environmental Services, LLC., under Contract No. N44255-09-D-4005, Task Order 42. May 18, 2012.

———. 2012h. *Annual Non-Long Term Monitoring Data Summary Technical Memorandum, , Naval Base Kitsap Bremerton, Washington*. Prepared for NAVFAC NW by Sealaska Environmental Services, LLC., under Contract No. N44255-09-D-4005, Task Order 42. November 30, 2012.

———. 2012i. *Final Long-Term Monitoring, Inspection and Improvement Plan for OU A, OU NSC, OU B T, PMP, OU C and OU D, Naval Base Kitsap - Bremerton, Bremerton, Washington*. Prepared for NAVFAC NW by Sealaska under Contract No. N44255-09-D-4005, Task Order 59. September 19 2012

———. 2012j. *Final 2010 Marine Monitoring Report, Bremerton Naval Complex, Bremerton, Washington.* Prepared by URS Group, Inc. for Naval Facilities Engineering Command Northwest under Contract No. N44255-09-D-4001, Delivery Order 0009. April 17, 2012.

———. 2012k. *Operable Unit B Marine Monitoring Plan, Bremerton Naval Complex, Bremerton, Washington.* Prepared by URS for Naval Facilities Engineering Command, Northwest, under Contract N44255-09-D-4001. May 4, 2012

———. 2011a. *Navy/Marine Corps Policy for Conducting Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Statutory Five-Year Reviews.* June 7, 2011.

———. 2011b. *Final Long-Term Monitoring Plan for OU A, OU NSC, OU B T, PMP, and OU C, Naval Base Kitsap - Bremerton, Bremerton, Washington*. Prepared for NAVFAC NW by Sealaska under Contract No. N44255-09-D-4005, Task Order 42. October 2011.

———. 2011c. *2011 Addendum to Second Five Year Review Report, Bremerton Naval Complex, dated 21 October 2007*. June 2011.

———. 2011d. *Final Long-Term Monitoring Summer 2009 to Fall 2010 Trend Analysis Report, Naval Base Kitsap at Bremerton, Bremerton, Washington*. Prepared for NAVFAC NW by Sealaska under Contract No. N44255-09-D-4005, Task Order 19. November 30, 2011.

———. 2010a. *Draft Operable Unit D Remedy Evaluation Report, Bremerton Naval Complex, Bremerton, Washington.* Prepared for NAVFAC NW by URS under Contract No. N44255-09-D-4001, Task Order 6. April 2010.

———. 2010b. *Final Charleston Beach Characterization Report, Bremerton Naval Complex, Bremerton, Washington.* Prepared for NAVFAC NW by URS Group, Inc., under Contract No. N44255-05-D-5100, Task Order 44. April 2010.

———. 2010c. *Final Beach Dynamics Study for Charleston Beach, Operable Unit A Marine, Bremerton Naval Complex, Bremerton, Washington.* Prepared for NAVFAC NW by URS under Contract No. N44255-05-D-5100, Task Order 57. January 2010.

———. 2010d. *Final Technical Memorandum: Human Health Risk Evaluation of Mercury in Sinclair Inlet Seafood, OU B Marine, Bremerton Naval Complex, Bremerton, Washington.* Prepared by URS Group, Inc. for Naval Facilities Engineering Command Northwest under Contract No. N44255-05-D-5100, Delivery Order 0028. August 2010.

———. 2009a. *Phase I Vapor Intrusion Evaluation: Conceptual Site Model Report, Bremerton Naval Complex, Bremerton, Washington.* Prepared for NAVFAC NW by URS Group, Inc. under Contract No. N44255-05-D-5100. Delivery Order 55. February 2009.

———. 2009b. *Phase II Vapor Intrusion Study: Vapor Intrusion Pathway Quantitative Assessment, Bremerton Naval Complex, Bremerton, Washington.* Prepared for NAVFAC NW by URS Group, Inc. under Contract No. N44255-05-D-5100. Delivery Order 55. October 2009.

———. 2009c. *Final Institutional Control Work Plan, Bremerton Naval Complex, Bremerton, Washington*. Prepared for NAVFAC NW by SES-TECH under Contract No. N44255-05-D-5101, Task Order 49. May 2009.

———. 2009d. *Final Long-Term Monitoring 2007/2008 Trend Analysis Report for OU A, OU NSC, OU BT, PMP, and OU C, Bremerton Naval Complex, Bremerton, Washington.* Prepared for NAVFAC NW by SES-TECH under Contract No. N44255-05-D-5101, Task Order 49. April 2009.

———. 2009e. Final Operation and Maintenance Plan, Bremerton Naval Complex, Bremerton, Washington. Prepared for NAVFAC NW by SES-TECH under Contract No. N44255-05-D-5101, Task Order 49. April 2009.

———. 2009e. *Final 2007 Marine Monitoring Report, Bremerton Naval Complex, Bremerton, Washington.* Prepared by URS Group, Inc. for Naval Facilities Engineering Command Northwest under Contract No. N44255-05-D-5100, Delivery Order 0012. July 2, 2009.

———. 2008a. *Final Institutional Control Work Plan, Bremerton Naval Complex, Bremerton, Washington*. Prepared for NAVFAC NW by SES-TECH under Contract No. N44255-05-D-5101, Task Order 37. September 2008.

———. 2008b. *Final Community Relations Plan for Bremerton Naval Complex, Bremerton, Washington.* Prepared for NAVFAC NW by URS Group, Inc. under Contract No. N44255-05-D-5100, Task Order 35. July 2008.

———. 2008c. Naval Base Kitsap Shipyard Anti-Terrorism/Force Protection Plan - NAVBASEKITSAPINST 5530.6 CH-5

———. 2008d. Final Project Plans - Long-Term Monitoring Plan, Site Safety and Health Plan, and Quality Control Plan for Long-Term Monitoring at OU A, OU NSC, OU BT, PMP, and OU C, Bremerton Naval Complex, Bremerton, Washington. Prepared for NAVFAC NW by SES-TECH under Contract No. N44255-05-D-5101, Task Order 49. July 2008.

———. 2007a. *Memorandum of Agreement for Excavation Management at Naval Based Kitsap at Bremerton, Bremerton Naval Complex, Bremerton, Washington*. September 5, 2007.

———. 2007b. Puget Sound Naval Shipyard and Intermediate Maintenance Facility (PSNS&IMF) Instruction 5090.50, Naval Base Kitsap Instruction 5090.14, Bremerton Naval Complex, Bremerton, Washington. October 2007.

———. 2007c. *Second Five-Year Review, Bremerton Naval Complex, Bremerton, Washington*. Prepared by URS Group for NAVFAC NW under Contract No. N44255-05-D-5100, Delivery Order 17. October 2007.

———. 2007d. *Final Remedial Action Report, Vegetated Cap Construction, Operable Unit D, Bremerton Naval Complex, Bremerton, Washington*. Prepared for Naval Facilities

Engineering Command Northwest by Tetra Tech EC, Inc. under Contract No. N44255-01-D-2000, RAC 3/Task Order 36. Silverdale, Washington. March 2007.

———. 2007e. *Final Cleanup Action Plan, Operable Unit C, Bremerton Naval Complex, Bremerton, Washington.* Prepared for NAVFAC NW under Contract Number N44255-05-D-5101, Task Order 20. September 2007.

———. 2007f. *Action Memorandum, OU A Charleston Beach, Bremerton Naval Complex.* September 5, 2007.

———. 2006a. *Final Operation and Maintenance Plan, Bremerton Naval Complex, Bremerton, Washington*. Prepared for NAVFAC NW by Tetra Tech EC, Inc., under Contract No. N44255-01-D-2000, Task Order 18. February 2006.

———. 2006b. *Final Institutional Control Work Plan, Bremerton Naval Complex, Bremerton, Washington*. Prepared for NAVFAC NW by Tetra Tech EC, Inc., under Contract No. N44255-01-D-2000, Task Order 18. February 2006.

———. 2006c. *Final Remedial Action Report, Storm Drain Cleaning, Inspection, and Repair, Operable Unit B Terrestrial, Bremerton Naval Complex, Bremerton, Washington*. Prepared for Naval Facilities Engineering Command Northwest by Tetra Tech EC, Inc. under Contract No. N44255-01-D-2000, RAC 3/Task Order 9. Silverdale, Washington. September 2006.

———. 2006d. *Final 2003 Marine Monitoring Report, Bremerton Naval Complex, Bremerton, Washington*. Prepared by URS Group, Inc. for Naval Facilities Engineering Command Northwest under Contract No. N44255-02-D-2008, Delivery Order 0039. February 2, 2006.

———. 2006e. *Final 2005 Marine Monitoring Report, Bremerton Naval Complex, Bremerton, Washington*. Prepared by URS Group, Inc. for Naval Facilities Engineering Command Northwest under Contract No. N44255-02-D-2008, Delivery Order 0039. July 21, 2006.

———. 2006f. *Final Remedial Action Report, Erosion Control System, Operable Unit B Terrestrial. Phase II Remedial Action Shoreline Protection.* Prepared by Tetra Tech Inc. for Naval Facilities Engineering Command Northwest under Contract No. N44255-01-D-2000, Task Order 017. April 4, 2006

———. 2005a.*Final Removal Action Closure Report, Asphalt Pavement Cap, East End Capping – Operable Unit D.* Prepared by Tetra Tech FW Inc. for Naval Facilities Engineering Command Northwest under Contract No. N44255-01-D-2000, Task Order 021. January 10, 2005.

———. 2004a. *Final Closure Report, Enhanced Natural Recovery for Operable Unit B Marine Confined Aquatic Disposal (CAD) Pit, Bremerton Naval Complex, Bremerton, Washington*. Prepared for NAVFAC NW by Tetra Tech FW, Inc., under Contract No. N44255-01-D-2000, Task Order 15. June 2004.

———. 2004b. *Final Long-Term Monitoring Plan, Operable Unit B Terrestrial, Bremerton Naval Complex, Bremerton, Washington.* Prepared for Engineering Field Activity, Northwest, by URS Group, Inc., under Contract No. N44255-02-D-2008, Delivery Order 0033. July 2004.

———. 2004c. *Final Closure Report, Bremerton Naval Complex, Steam Sparging Removal/Disposal at OU C, Bremerton, Washington.* Prepared for EFA NW by GeoEngineers, Inc., under Contract No. N68711-02-D-8306. November 2004.

———. 2004d. *Final Remedial Investigation/Feasibility Study Report, Operable Unit D, Bremerton Naval Complex, Bremerton, Washington*. Prepared for Engineering Field Activity, Northwest, by URS Group, Inc., under Contract No. N44255-02-D-2008. March 2004.

———. 2004e. Technical Memorandum, Screening Evaluation of Vapor Pathway at Operable Unit (OU) NSC, Fleet Industrial Supply Center, Bremerton Naval Station, Bremerton, Washington. Prepared by URS Group, Inc., for Engineering Field Activity, Northwest, under Contract No. N44255-020-D-2008. Poulsbo, Washington. January 2004.

———. 2004f. *Project Summary, R Street Sanitary Sewer and Storm Drain Repairs*Prepared by Tetra Tech FW Inc. for Naval Facilities Engineering Command Northwest under Contract No. N44255-01-D-2000, Task Order 031 and 40. November 17, 2004.

———. 2004g. *Final Closure Report, Bremerton Naval Complex, Operable Unit B Paving Upgrades* (GeoEngineers, Inc) Prepared by GeoEngineers Inc. for Naval Facilities Engineering Command Northwest under Contract No. N68711-02-D-8306, Task Order 003. April 8, 2004.

———. 2003a. *2003 Amended Petroleum Management Plan, Bremerton Naval Complex, Bremerton, Washington.* Prepared by URS Group, Inc., Seattle, Washington for EFA NW under Contract No. N44255-02-D-2008, Delivery Order 0024. December 2003.

———. 2003b. *Final 2002/2003 Annual Report, Groundwater Monitoring and Remedy Inspection. Operable Unit A, Bremerton Naval Complex, Bremerton, Washington.* Prepared by The Environmental Company, Inc., for EFA NW under Contract No. N44255-98-D-4416, CTO 049. July 2003.

———. 2003c. *Final Operable Unit B Marine Monitoring Plan, Bremerton Naval Complex, Bremerton, Washington*. Prepared for EFA NW by URS Group, Inc., under Contract No. N44255-98-D-4409, Delivery Order 21. September 2003.

———. 2002a. *2001 Annual Monitoring Report, Operable Unit A, Bremerton Naval Complex, Bremerton, Washington*. Prepared by The Environmental Company, Inc., for EFA NW under Contract No. N44255-98-D-4416, CTO 013. October 2002.

———. 2002b. *Final Petroleum Management Plan, Bremerton Naval Complex, Bremerton, Washington.* Prepared for Engineering Field Activity, Northwest by The Environmental Company, Inc., under Contract No. N44255-98-D-4416, CTO 022. March 2002.

———. 2002c. *Final Remedial Investigation Report, Operable Unit B, Bremerton Naval Complex, Bremerton, Washington*. Prepared for Engineering Field Activity, Northwest by URS Consultants under CLEAN Contract No. N62474-89-D-9295, CTO 0131. March 2002.

———. 2002d. *Final Feasibility Study, Operable Unit B, Bremerton Naval Complex, Bremerton, Washington*. Prepared for Engineering Field Activity, Northwest by URS Consultants, Inc. under CLEAN Contract No. N62474-89-D-9295. May 2002.

———. 2002e. *Final Five-Year Review of Record of Decision, Bremerton Naval Complex, Bremerton, Washington*. Prepared for Engineering Field Activity, Northwest by URS Group, Inc., under Contract No. N44255-00-D-2476, Delivery Order 0017. Executed October 31, 2002.

———. 2002f. *OU B Marine Post Construction Report and FY00 MCON Project P-338 Closure Report, Bremerton Naval Complex, Bremerton, Washington.* Prepared for Engineering Field Activity, Northwest by Foster Wheeler Environmental Corporation, under Contract N44255-95-D-6030. November 2002.

———. 2002g. *Focused Remedial Investigation and Screening-Level Feasibility Study, Steam Sparging Area, Operating Unit C, Puget Sound Naval Shipyard, Bremerton, Washington.* Prepared for Engineering Field Activity, Northwest, by Hart Crowser under Contract N44255-98-D-4408. Poulsbo, Washington. April 2002.

———. 2002h. *Final Closure Report, Treatability Study, Operable Unit B.* Prepared by Foster Wheeler Environmental Corporation for Naval Facilities Engineering Command Northwest under Contract No. N44255-95-D-6030, Delivery Order 0104 017. November 5, 2002.

———. 2002i. Final Closure Report, Charleston Beach Habitat Restoration Project, Bremerton Naval Complex, Bremerton, WA. Prepared for Engineering Field Activity, Northwest by

Foster Wheeler Environmental Corporation, under Contract N44255-95-D-6030, Delivery Order No. 92. June 28, 2002.

———. 2000a. *Addendum to Final Remedial Action Report, Repairs at Operable Unit A, Naval Station Bremerton, Bremerton, Washington.* Prepared for Engineering Field Activity, Northwest by Foster Wheeler Environmental Corporation, under RAC II Delivery Order 0075. December 2000.

———. 2000b. *Final Monitoring Plan for Operable Unit A, Revision 1, Operable Unit A, Bremerton Naval Complex, Bremerton, Washington.* Prepared for Engineering Field Activity, Northwest by URS Greiner, Inc., under CLEAN Contract N62474-89-D-9295. Poulsbo, Washington. October 2000.

———. 2000c. *Final Monitoring Plan for Operable Unit NSC, Revision 1, Operable Unit NSC, Bremerton Naval Complex, Bremerton, Washington.* Prepared for Engineering Field Activity, Northwest, by URS Greiner, Inc. under CLEAN Contract N62474-89-D-9295. Poulsbo, Washington. October 2000.

———. 2000d. *Remedial Action Report, Paving Sites, Operable Unit B* (FWENC),

———. 1999a. *Remedial Action Closeout Report, Remedial Actions at Operable Unit Naval Supply Center, Fleet and Industrial Supply Center, Bremerton, Washington*. Prepared for Engineering Field Activity, Northwest, by Foster Wheeler Environmental Corporation under RAC II Delivery Order 0027. April 1999.

———. 1999b. *Final Remedial Action Report, Remedial Design/Remedial Action, Operable Unit A, Puget Sound Naval Shipyard, Bremerton, Washington.* Prepared for Engineering Field Activity, Northwest by Foster Wheeler Environmental Corporation under RAC II Delivery Order 0006. August 1999.

———. 1998a. *Closure Report, Site 1-C2, Operable Unit B* (FWENC 1998)

———. 1996. *Draft Remedial Investigation Report, Operable Unit B, Puget Sound Naval Shipyard, Bremerton, Washington.* Prepared for Engineering Field Activity, Northwest by URS Consultants, Inc. under CLEAN Contract No. N62474-89-D-9295. September 1996.

———. 1995a. *Final Remedial Investigation Report, Operable Unit NSC, Bremerton Naval Complex, Bremerton, Washington*. Prepared for EFA NW by URS Consultants, Inc. under CLEAN Contract No. N62474-89-D-9295. September 1995.

———. 1995b. *Final Feasibility Study, Operable Unit NSC, Bremerton Naval Complex, Bremerton, Washington*. Prepared for EFA NW by URS Consultants, Inc. under CLEAN Contract No. N62474-89-D-9295. November 1995.

———. 1995c. *Final Remedial Investigation Report, Operable Unit A, Bremerton Naval Complex, Bremerton, Washington*. Prepared for EFA NW by URS Consultants, Inc. under CLEAN Contract No. N62474-89-D-9295. August 1995.

———. 1995d. *Final Feasibility Study, Operable Unit A, Bremerton Naval Complex, Bremerton, Washington*. Prepared for EFA NW by URS Consultants, Inc. under CLEAN Contract No. N62474-89-D-9295. October 1995.

———. 1992. *Site Inspection Report, Puget Sound Naval Shipyard, Bremerton, Washington.* Prepared by URS Consultants, Inc., for Engineering Field Activity, Northwest, under CLEAN Contract N62474-89-D-9295. Poulsbo, Washington. May 1992.

———. 1990. *Preliminary Assessment Supplemental Report, Puget Sound Naval Shipyard, Bremerton, Washington.* NEESA 13-022A. Ordnance Environmental Support Office. Indian Head, Maryland. June 1990.

———. 1983 *Initial Assessment Study of Naval Shipyard Puget Sound, Bremerton, Washington.* NEESA 13-022. Naval Energy and Environmental Support Activity. Port Hueneme, California. March 1983.

U.S. Navy, Washington State Department of Ecology, and U.S. Environmental Protection Agency (U.S. Navy et al.). 2005. *Final Record of Decision, Bremerton Naval Complex, OU D, Bremerton, Washington.* May 11, 2005.

———. 2004a. *Final Record of Decision, Operable Unit B Terrestrial, Bremerton Naval Complex, Bremerton, Washington.* March 8, 2004.

———. 2004b. *Explanation of Significant Differences, Bremerton Naval Complex, OU B Marine.* February 19, 2004.

———. 2000. *Final Record of Decision, BNC OU B Marine, Bremerton, Washington.* June 13, 2000.

———. 1997. *Final Record of Decision, Operable Unit A, Missouri Beach Parking Lot and Charleston Beach, Bremerton Naval Complex, Bremerton, Washington.* Executed January 29, 1997.

———. 1996. *Final Record of Decision, Operable Unit NSC, Fleet and Industrial Supply Center, Bremerton Naval Complex, Bremerton, Washington.* Executed December 13, 1996.

Washington State Department of Ecology (Ecology). 2017. Water Quality Standards for Surface Waters of the State of Washington Chapter 173-201A WAC. Revised March 2017. Publication no. 06-10-091.

———. 2015a. Cleanup Levels and Risk Calculation (CLARC) Data Tables. July. Accessed at https://fortress.wa.gov/ecy/clarc/CLARCDataTables.aspx.

———. 2015b. *Sediment Cleanup Users Manual II, Guidance for Implementing the Cleanup Provisions of the Sediment Management Standards, Chapter 173-204 WAC*. Publication No. 12-09-057. March.

———. 2007. Letter from Ben Amoah-Forson (Ecology) to Suzanna M. Jefferis (Navy) re: Letter of Approval for the *Final Cleanup Action Plan (CAP), Operable Unit C, Bremerton Naval Complex, Bremerton, Washington, September 2006*. December 17, 2007.

———. 2001. *Evaluating the Toxicity and Assessing the Carcinogenic Risk of Environmental Mixtures Using Toxicity Equivalency Factors.* Updated per new rule amendments adopted by Department of Ecology on October 12, 2007.

———. 2000. *Water Quality Certification/Modification, Corps Public Notice 1998-2-01967, Navigation Dedgring, PSDDA Disposal, and Reconstruction of Pier D*. June 14, 2000.

APPENDIX A

Data from Additional Investigations and Monitoring

2013 Non-LTM Data, TCE Northern Plume Area Investigation, Excerpted from Navy (2013b)

Table A-1. 2013 Soil Sample Results

Sample ID	Location	Depth (ft bgs)	1,1-DCE (µg/kg)	1,2-DCA (µg/kg)	Carbon Tetrachloride (µg/kg)	Chloroform (µg/kg)	cis-1,2-DCE (µg/kg)	PCE (µg/kg)	TCE (µg/kg)	Vinyl Chloride (µg/kg)	Total Cyanide (mg/kg)
SB908-8	SB908	8	0.74 U	0.74 U	0.99 U	0.74 U	0.74 U	0.86 J	0.74 U	0.74 U	NA
SB908-10	SB908	10	0.39 U	0.39 U	0.52 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	NA
SB909-10	SB908	10	0.45 U	0.45 U	0.6 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	NA
SBDUP6-012213	SB908	10	0.61 U	0.61 U	0.81 U	0.61 U	0.61 U	0.61 U	0.61 U	0.61 U	NA
SB910-8	SB910	8	0.38 U	0.38 U	0.51 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	NA
SB910-10	SB910	10	0.41 U	0.41 U	0.55 U	0.41 U	0.41 U	0.41 U	0.41 U	0.41 U	NA
SB911-11.5	SB911	11.5	0.72 U	0.72 U	0.96 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	NA
SB912-8	SB912	8	0.68 U	0.68 U	0.91 U	0.68 U	0.68 U	0.68 U	2.7	0.68 U	NA
SBDUP7-012213	SB912	8	0.63 U	0.63 U	0.84 U	0.63 U	0.63 U	0.63 U	2.5	0.63 U	NA
SB912-13	SB912	13	0.63 U	0.63 U	0.84 U	0.63 U	0.63 U	0.63 U	4.3	0.63 U	NA
SB912-17	SB912	17	0.57 U	0.57 U	0.75 U	0.57 U	0.57 U	0.57 U	5.1	0.57 U	NA
SB913-8	SB913	8	0.57 U	0.57 U	0.76 U	0.57 U	0.57 U	0.57 U	0.57 U	0.57 U	NA
SB913-9.5	SB913	9.5	0.63 U	0.63 U	0.84 U	0.63 U	0.63 U	0.63 U	0.63 U	0.63 U	NA
SB914-10	SB914	10	0.58 U	0.58 U	0.78 U	0.58 U	0.58 U	0.58 U	2.6	0.58 U	NA
SBDUP1-011613	SB914	10	0.65 U	0.65 U	0.86 U	0.65 U	0.65 U	0.65 U	1.6	0.65 U	NA
SB915-10	SB915	10	0.62 U	0.62 U	0.82 U	0.62 U	0.62 U	0.62 U	0.62 U	0.62 U	NA
SBDUP2-011613	SB915	10	0.63 U	0.63 U	0.84 U	0.63 U	0.63 U	0.63 U	0.63 U	0.63 U	NA
SB915-15	SB915	15	0.57 U	0.57 U	0.77 U	0.57 U	0.57 U	0.57 U	0.57 U	0.57 U	NA
SB915-20	SB915	20	0.54 U	0.54 U	0.72 U	0.54 U	0.54 U	0.54 U	0.55 J	0.54 U	NA
SB915-25	SB915	25	0.58 U	0.58 U	0.77 U	0.58 U	0.58 U	0.58 U	0.45 J	0.58 U	NA
SB915-30	SB915	30	0.56 U	0.56 U	0.74 U	0.56 U	0.56 U	0.56 U	0.61 J	0.56 U	NA
SB915-35	SB915	35	0.62 U	0.62 U	0.82 U	0.62 U	0.62 U	0.62 U	0.75 J	0.62 U	NA
SB915-40	SB915	40	0.65 U	0.65 U	0.87 U	0.65 U	0.65 U	0.65 U	1 J	0.65 U	NA
SB915-45	SB915	45	0.57 U	0.57 U	0.76 U	0.57 U	0.57 U	2	0.62 J	0.57 U	NA
SB915-50	SB915	50	0.57 U	0.57 U	0.76 U	0.57 U	0.57 U	2.6	0.55 J	0.57 U	NA
SB915-55	SB915	55	0.6 U	0.6 U	0.8 U	0.6 U	0.6 U	4.9	0.6 U	0.6 U	NA
SB916-10	SB916	10	0.66 U	0.66 U	0.88 U	0.66 U	0.66 U	0.66 U	0.66 U	0.66 U	3.3
SBDUP5-011713	SB916	10	0.59 U	0.59 U	0.79 U	0.59 U	0.59 U	0.59 U	0.59 U	0.59 U	NA
SBDUPCYA3-011713	SB916	10	NA	NA	NA	NA	NA	NA	NA	NA	0.83
SB916-15	SB916	15	0.56 U	0.56 U	0.75 U	0.56 U	0.56 U	0.56 U	0.35 J	0.56 U	0.83
SB916-20	SB916	20	0.64 U	0.64 U	0.85 U	0.64 U	0.64 U	0.64 U	0.89 J	0.64 U	0.79
SB916-25	SB916	25	0.54 U	0.54 U	0.73 U	0.54 U	0.54 U	0.54 U	0.82 J	0.54 U	0.85
SB916-30	SB916	30	0.56 U	0.56 U	0.74 U	0.56 U	0.56 U	0.56 U	0.28 J	0.56 U	0.81
SB916-35	SB916	35	0.6 U	0.6 U	0.79 U	0.6 U	0.6 U	0.6 U	0.37 J	0.6 U	0.82

Table A-1 (Continued). 2013 Soil Sample Results

Sample ID	Location	Depth (ft bgs)	1,1-DCE (µg/kg)	1,2-DCA (µg/kg)	Carbon Tetrachloride (µg/kg)	Chloroform (µg/kg)	cis-1,2-DCE (µg/kg)	PCE (µg/kg)	TCE (µg/kg)	Vinyl Chloride (µg/kg)	Total Cyanide (mg/kg)
SB916-40	SB916	40	0.69 U	0.69 U	0.92 U	0.69 U	0.69 U	0.69 U	0.41 J	0.69 U	0.81
SB916-45	SB916	45	0.65 U	0.65 U	0.86 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.79
SB916-50	SB916	50	0.31 J	0.59 U	0.79 U	0.59 U	0.59 U	0.59 U	0.59 U	0.59 U	0.84
SB916-55	SB916	55	0.54 U	0.54 U	0.72 U	0.54 U	0.54 U	0.54 U	0.31 J	0.54 U	0.84
SB917-10	SB917	10	0.71 U	0.71 U	0.94 U	0.71 U	0.71 U	0.71 U	0.71 U	0.71 U	2
SBDUP4-011713	SB917	10	0.53 U	0.53 U	0.7 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	NA
SBDUPCYA2-011713	SB917		NA	NA	NA	NA	NA	NA	NA	NA	2.3
SB917-15	SB917	15	0.79 U	0.79 U	1.1 U	0.79 U	0.79 U	0.79 U	0.79 U	0.79 U	0.85
SB917-20	SB917	20	0.64 U	0.64 U	0.86 U	0.64 U	0.64 U	0.64 U	0.64 U	0.64 U	0.84
SB917-25	SB917	25	0.63 U	0.63 U	0.84 U	0.63 U	0.63 U	0.63 U	0.63 U	0.63 U	0.89
SB917-30	SB917	30	0.28 U	0.28 U	0.38 U	0.28 U	0.28 U	0.28 U	0.22 J	0.28 U	0.82
SB917-35	SB917	35	0.61 U	0.61 U	0.81 U	0.61 U	0.61 U	0.61 U	0.61 U	0.61 U	0.8
SB917-40	SB917	40	0.62 U	0.62 U	0.82 U	0.62 U	0.62 U	0.62 U	0.38 J	0.62 U	0.81
SB917-45	SB917	45	0.59 U	0.59 U	0.79 U	0.59 U	0.59 U	0.59 U	0.3 J	0.59 U	0.8
SB917-50	SB917	50	0.55 U	0.55 U	0.73 U	0.55 U	0.55 U	0.51 J	0.75 J	0.55 U	0.86
SB917-55	SB917	55	0.56 U	0.56 U	0.75 U	0.56 U	0.56 U	0.56 U	0.56 U	0.56 U	0.89
SB918-10	SB918	10	0.58 U	0.58 U	0.77 U	0.58 U	0.58 U	0.58 U	0.58 U	0.58 U	0.84
SBDUP3-011713	SB918	10	0.54 U	0.54 U	0.72 U	0.54 U	0.54 U	0.54 U	0.54 U	0.54 U	NA
SBDUPCYA-011713	SB918	10	NA	NA	NA	NA	NA	NA	NA	NA	0.82
SB918-15	SB918	15	0.59 U	0.59 U	0.78 U	0.59 U	0.59 U	0.59 U	0.59 U	0.59 U	0.85
SB918-20	SB918	20	0.5 U	0.5 U	0.67 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.82
SB918-25	SB918	25	0.54 U	0.54 U	0.72 U	0.54 U	0.54 U	0.54 U	0.54 U	0.54 U	0.82
SB918-30	SB918	30	0.63 U	0.63 U	0.83 U	0.63 U	0.63 U	0.63 U	0.63 U	0.63 U	0.81
SB918-35	SB918	35	0.59 U	0.59 U	0.79 U	0.59 U	0.59 U	0.59 U	0.59 U	0.59 U	2.1
SB918-40	SB918	40	0.61 U	0.61 U	0.81 U	0.61 U	0.61 U	0.61 U	0.61 U	0.61 U	1.7
SB918-45	SB918	45	0.63 U	0.63 U	0.84 U	0.63 U	0.63 U	0.63 U	0.38 J	0.63 U	1.3
SB918-50	SB918	50	NS	NS	NS	NS	NS	NS	NS	NS	NS
SB918-55	SB918	55	0.61 U	0.61 U	0.82 U	0.61 U	0.61 U	0.61 U	0.61 U	0.61 U	1.8
MTCA Method B Soil Cleanup Level			4,000,000	110,000	14,000	800,000	160,000	480,000	12,000	670	1,600
EPA Residential Regional Screening Level			240,000	430	610	290	160,000	22,000	910	60	47
EPA Industrial Regional Screening Level			1,100,000	2,200	3,000	1,500	2,000,000	110,000	6,400	1,700	610

Notes:
J - associated value considered to be an estimate
NA - not applicable
NS - Refusal was met with direct-push tools prior to reaching saturated conditions that yielded a groundwater sample.
U - not detected at specified reporting limit

Table A-2. Summary Groundwater Sample Results from 2013 and Previous Sampling Events

Sample ID	Location	Sample Year	1,1-DCE (µg/L)		1,2-DCA (µg/L)		Carbon Tetrachloride (µg/L)		Chloroform (µg/L)		cis-,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)		Vinyl Chloride (µg/L)		Cyanide (mg/L)
26276	403	1995	0.5	U	0.5	U	0.5	UJ	0.27	J	0.5	U	0.5	U	**7.8**		0.5	U	NP
26339	423	1995	0.5	U	0.5	U	0.5	U	**2.6**		2		**3,900**	J	**3.1**		0.5	U	NP
26329	425	1995	0.5	U	0.5	U	0.5	U	**2.9**		0.96		0.5	U	**96**		0.5	U	NP
MW-425-011013	425	Jan 2013	0.06	U	0.05	U	0.05	U	**2**		0.58		0.05	J	**97**	J	0.02	U	NP
MW-432-011113	432	Jan 2013	0.06	U	0.05	U	0.05	U	0.65		0.034	J	0.067	J	**31**		0.02	U	NP
26318	433	1995	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	NP
MW-433-011013	433	Jan 2013	0.06	U	0.05	U	0.05	U	0.06	U	0.05	U	0.05	U	0.038	J	0.02	U	NP
26324	704	1995	0.5	U	0.5	U	0.5	U	**18**		0.5	U	0.5	U	0.5	U	0.5	U	NP
MW-704-011013	704	Jan 2013	0.06	U	0.05	U	0.05	U	**1.5**		0.05	U	0.06	J	0.027	J	0.02	U	NP
26275	707	1995	0.5	U	0.5	U	0.5	U	**1.5**		5		8.8		**11**		0.5	U	NP
MW-707-010813	707	Jan 2013	0.06	U	0.05	U	0.05	U	0.65		0.44		0.41		**1.7**		0.02	U	NP
BRI-11-GW-104	904	Jul 2011	0.02	U	0.02	U	0.025		0.11	UJ	0.02	U	0.02	U	**4.9**	**J**	0.02	U	NP
OUBT-11-312	904	Nov 2011	0.02	U	0.02	U	0.02	J	0.1	J	0.02	U	0.15	J	**6.0**		0.02	U	NP
OUBT-12-203	904	Mar 2012	0.02	U	0.02	U	0.019	J	0.13		0.02	U	0.02	U	**4.5**		0.02	U	NP
OUBT-12-315	904	Sep 2012	0.02	U	0.02	U	0.022		0.14		0.02	U	0.02	U	**5.8**		0.02	U	NP
MW-904-011013	904	Jan 2013	0.06	U	0.05	U	0.05	U	0.11		0.05	U	0.067	J	**2.7**		0.02	U	NP
BRI-11-GW-106	905	Jul 2011	0.02	U	0.02	U	0.032		0.09	UJ	0.45		**76**		**1.2**		0.02	U	NP
OUBT-11-313	905	Nov 2011	0.02	U	0.02	U	0.024		0.072	J	0.49		**69**		**1.9**		0.02	U	NP
OUBT-12-205	905	Mar 2012	0.02	U	0.02	U	0.3		0.085	UJ	0.39		**67**		**1.9**		0.02	UJ	NP
OUBT-12-316	905	Oct 2012	0.02	U	0.02	U	0.023		0.068		0.029	J	**43**		**2.4**		0.02	U	NP
MW-905-011013	905	Jan 2013	0.06	U	0.05	U	0.05	U	0.085	J	0.25	J	**36**		**2.4**		0.02	U	NP
MW-DUP-011013	905	Jan 2013	0.06	U	0.05	U	0.05	U	0.11		0.27		**36**		**2.5**		0.02	U	NP
BRI-11-GW-107	907	Jul 2011	0.02	U	0.02	U	0.013	J	0.61		0.36		0.078		**1.4**		0.02	U	NP
OUBT-11-314	907	Nov 2011	0.0062	J	0.02	U	0.010	J	0.69	J	0.27		0.37		**1.2**		0.02	U	NP
OUBT-12-206	907	Mar 2012	0.0078	J	0.02	U	0.011	J	**0.72**		0.35		0.42		**1.3**		0.02	UJ	NP
OUBT-12-317	907	Oct 2012	0.0063	J	0.02	U	0.011	J	0.63		0.23		0.42		**1.1**		0.02	U	NP
MW-907	907	Jan 2013	0.06	U	0.05	U	0.05	U	**0.73**		0.22		0.1		**1.1**		0.02	U	NP
SB908-GW	SB908	Feb 2013	0.06	U	0.05	U	0.031	J	0.06	U	0.06	J	0.41		0.17		0.02	U	NP
SB909-GW	SB909	Feb 2013	0.06	U	0.05	U	0.05	U	0.044	J	0.32	J	**21**		**1.2**		0.02	U	NP
SB910-GW	SB910	Feb 2013	0.06	U	0.05	U	0.05	U	0.06	U	0.05	U	0.049	J	0.05	U	0.02	U	NP
SB911-GW	SB911	Feb 2013	NS		NS		NS		NS		NS		NS		NS		NS		NP
SB912-GW	SB912	Feb 2013	NS		NS		NS		NS		NS		NS		NS		NS		NP

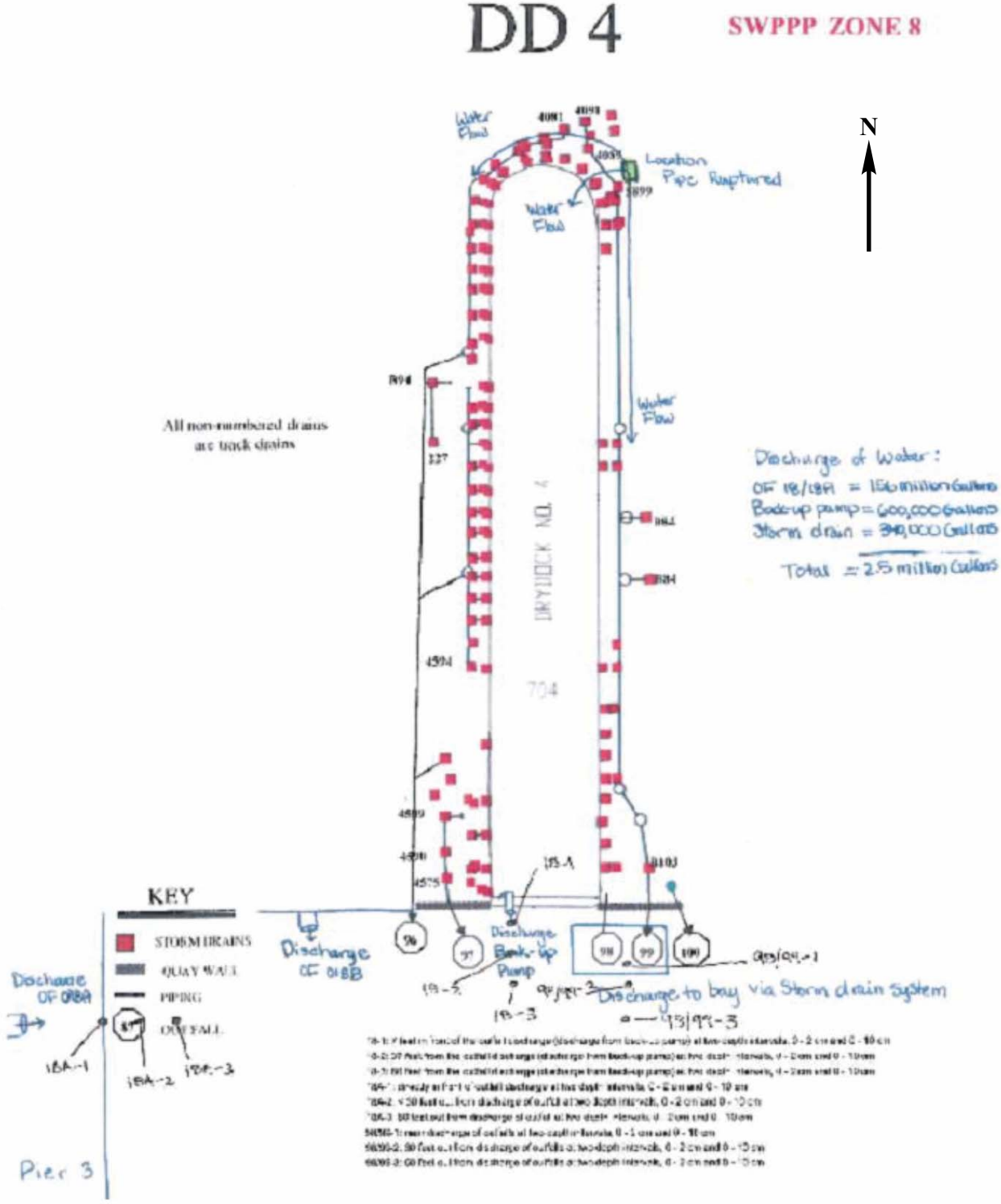
Table A-2 (Continued). Summary Groundwater Sample Results from 2013 and Previous Sampling Events

Sample ID	Location	Sample Year	1,1-DCE (µg/L)	1,2-DCA (µg/L)	Carbon Tetrachloride (µg/L)	Chloroform (µg/L)	cis-,2-DCE (µg/L)	PCE (µg/L)	TCE (µg/L)	Vinyl Chloride (µg/L)	Cyanide (mg/L)
B913-GW	SB913	Feb 2013	NS	NS	NS	NS	NS	NS	NS	NS	NP
SB914-GW	SB914	Feb 2013	0.12 U	0.1 U	0.22 U	0.12 U	0.1 U	0.1 U	**9.6**	0.04 U	NP
SB915-GW	SB915	Feb 2013	0.12 U	0.1 U	0.27 U	0.11 J	0.3 J	**40**	**1.6**	0.04 U	NP
SBDUP-GW-011613	SB915	Feb 2013	0.12 U	0.1 U	0.1 U	0.12 J	0.28 J	**42**	**2.1**	0.04 U	NP
SB916-GW	SB916	Feb 2013	0.14 J	0.15 U	0.15 U	0.25 J	0.15 U	0.64	**1.1**	0.06 U	0.05 U
SB917-GW	SB917	Feb 2013	0.078 J	0.1 U	0.1 U	0.37	0.1 U	0.41	0.62	0.04 U	0.05 U
SBDUP-CYAGW-011713	SB917	Feb 2013	NA	NA	NA	NA	NA	NA	NA	NA	0.05 U
SB918-GW	SB918	Feb 2013	0.18 U	0.15 U	0.15 U	0.32	0.15 U	0.37	0.39	0.06 U	0.05 U
Maximum Contaminant Level			7	5	5	NE	70	5	5	2	0.2
MTCA Method B Groundwater Screening Level for VI			85	2.4	0.3	0.7	161.7	12.8	0.9	0.3	NA
EPA Residential Groundwater Screening Level for VI			196.3	2.3	0.3	0.7	377.2	12.5	1.0	0.1	16.3

Notes:
Bolded value is above the lowest screening level or maximum contaminant level.

J - associated value considered to be an estimate
NP - Sampling for specified analyte was not planned at this location.
NS - Refusal was met with direct-push tools prior to reaching saturated conditions that yielded a groundwater sample.
U - not detected at specified reporting limit

Data Excerpted from Salt Water Main Break Report (Navy, 2016i)



U.S. NAVY	Bremerton Naval Complex FOURTH FIVE-YEAR REVIEW	**Figure A-1** **Sediment Sampling Locations for the Salt Water Main Break**

Table A-3. Sample Locations: 18-1

Result Parameter Name	Sampling Category	Sample IDs								Difference from 0-2cm to 0-10cm	Unit	% difference relative to the 0-10cm value
		0-2cm Sample ID	Value	Unit	Result Data Qualifier	0-10cm Sample ID	Value	Unit	Result Data Qualifier			
Total Solids	TS	18-1:0-2cm	29.89	%		18-1:0-10cm	31.61	%		1.72	%	5.44%
Total Organic Carbon	TOC	18-1:0-2cm	4.19	%	*	18-1:0-10cm	3.3	%		-0.89	%	26.97%
Total PCBs	PCBs	18-1:0-2cm	499.8	µg/kg		18-1:0-10cm	446.8	µg/kg		-53	%	11.86%
Carbon-normalized Total PCBs	CN-PCBs	18-1:0-2cm	NC	mg/kgOC		18-1:0-10cm	13.54	mg/kgOC		NC	mg/kgOC	NC
Particle/Grain Size > 2mm (Gravel)	Grain Size	18-1:0-2cm	14.3	%		18-1:0-10cm	3	%		-11.3	%	376.67%
Particle/Grain Size, 2mm - 1mm (Very Coarse Sand)	Grain Size	18-1:0-2cm	6.4	%		18-1:0-10cm	4.2	%		-2.2	%	52.38%
Particle/Grain Size, 1mm - 0.5mm (Coarse Sand)	Grain Size	18-1:0-2cm	4.4	%		18-1:0-10cm	3	%		-1.4	%	46.67%
Particle/Grain Size, 0.5mm - 0.25mm (Medium Sand)	Grain Size	18-1:0-2cm	3.9	%		18-1:0-10cm	3.8	%		-0.1	%	2.63%
Particle/Grain Size, 0.25mm - 0.125mm (Fine Sand)	Grain Size	18-1:0-2cm	3.2	%		18-1:0-10cm	2.8	%		-0.4	%	14.29%
Particle/Grain Size, 125µm - 63µm (Very Fine Sand)	Grain Size	18-1:0-2cm	3.9	%		18-1:0-10cm	3.9	%		0	%	0.00%
Particle/Grain Size, 63µm - 31µm (Silt)	Grain Size	18-1:0-2cm	5.6	%		18-1:0-10cm	7.3	%		1.7	%	23.29%
Particle/Grain Size, 31µm - 15.6µm (Silt)	Grain Size	18-1:0-2cm	19.9	%		18-1:0-10cm	17.4	%		-2.5	%	14.37%
Particle/Grain Size, 15.6µm - 7.8µm (Silt)	Grain Size	18-1:0-2cm	12.3	%		18-1:0-10cm	18.6	%		6.3	%	33.87%
Particle/Grain Size, 7.8µm - 3.9µm (Silt)	Grain Size	18-1:0-2cm	4.5	%		18-1:0-10cm	8.7	%		4.2	%	48.28%
Particle/Grain Size, 3.9µm - 2.0µm (Clay)	Grain Size	18-1:0-2cm	5	%		18-1:0-10cm	6.4	%		1.4	%	21.88%
Particle/Grain Size, 2.0µm - 1.0µm (Clay)	Grain Size	18-1:0-2cm	5.6	%		18-1:0-10cm	7.4	%		1.8	%	24.32%
Particle/Grain Size < 1.0µm (Clay)	Grain Size	18-1:0-2cm	10.9	%		18-1:0-10cm	13.5	%		2.6	%	19.26%
Particle/Grain Size, Fines (Silt/Clay)	Grain Size	18-1:0-2cm	63.8	%		18-1:0-10cm	79.3	%		15.5	%	19.55%
Aluminum	Metals	18-1:0-2cm	16900	mg/kg		18-1:0-10cm	17900	mg/kg		1000	mg/kg	5.59%
Antimony	Metals	18-1:0-2cm	0.6	mg/kg	U	18-1:0-10cm	0.7	mg/kg		NC	mg/kg	NC
Arsenic	Metals	18-1:0-2cm	17	mg/kg		18-1:0-10cm	27.4	mg/kg		10.4	mg/kg	37.96%
Barium	Metals	18-1:0-2cm	55	mg/kg		18-1:0-10cm	53	mg/kg		-2	mg/kg	3.77%
Beryllium	Metals	18-1:0-2cm	0.6	mg/kg	U	18-1:0-10cm	0.6	mg/kg	U	NC	mg/kg	NC
Cadmium	Metals	18-1:0-2cm	4.9	mg/kg		18-1:0-10cm	2	mg/kg		-2.9	mg/kg	145.00%
Calcium	Metals	18-1:0-2cm	31100	mg/kg		18-1:0-10cm	13100	mg/kg		-18000	mg/kg	137.40%
Chromium	Metals	18-1:0-2cm	47	mg/kg		18-1:0-10cm	68	mg/kg		21	mg/kg	30.88%
Cobalt	Metals	18-1:0-2cm	9	mg/kg		18-1:0-10cm	10.8	mg/kg		1.8	mg/kg	16.67%
Copper	Metals	18-1:0-2cm	297	mg/kg		18-1:0-10cm	295	mg/kg		-2	mg/kg	0.68%
Iron	Metals	18-1:0-2cm	36000	mg/kg		18-1:0-10cm	32900	mg/kg		-3100	mg/kg	9.42%
Lead	Metals	18-1:0-2cm	76.2	mg/kg		18-1:0-10cm	93.3	mg/kg		17.1	mg/kg	18.33%
Magnesium	Metals	18-1:0-2cm	10000	mg/kg		18-1:0-10cm	10300	mg/kg		300	mg/kg	2.91%
Manganese	Metals	18-1:0-2cm	374	mg/kg		18-1:0-10cm	357	mg/kg		-17	mg/kg	4.76%
Mercury	Mercury	18-1:0-2cm	0.91	mg/kg		18-1:0-10cm	1.27	mg/kg		0.36	mg/kg	28.35%
Nickel	Metals	18-1:0-2cm	49	mg/kg		18-1:0-10cm	59	mg/kg		10	mg/kg	16.95%
Potassium	Metals	18-1:0-2cm	3380	mg/kg		18-1:0-10cm	3490	mg/kg		110	mg/kg	3.15%
Selenium	Metals	18-1:0-2cm	2	mg/kg		18-1:0-10cm	2	mg/kg		0	mg/kg	0.00%
Silver	Metals	18-1:0-2cm	0.6	mg/kg		18-1:0-10cm	0.8	mg/kg		0.2	mg/kg	25.00%
Sodium	Metals	18-1:0-2cm	25400	mg/kg		18-1:0-10cm	24400	mg/kg		-1000	mg/kg	4.10%
Thallium	Metals	18-1:0-2cm	0.6	mg/kg	U	18-1:0-10cm	0.6	mg/kg	U	NC	mg/kg	NC
Vanadium	Metals	18-1:0-2cm	44.1	mg/kg		18-1:0-10cm	49.6	mg/kg		5.5	mg/kg	11.09%
Zinc	Metals	18-1:0-2cm	540	mg/kg		18-1:0-10cm	390	mg/kg		-150	mg/kg	38.46%
Phenol	sVOCs	18-1:0-2cm	150	µg/kg		18-1:0-10cm	93	µg/kg		-57	µg/kg	61.29%
Bis-(2-Chloroethyl) Ether	sVOCs	18-1:0-2cm	120	µg/kg	U	18-1:0-10cm	58	µg/kg	U	NC	µg/kg	NC
2-Chlorophenol	sVOCs	18-1:0-2cm	120	µg/kg	U	18-1:0-10cm	58	µg/kg	U	NC	µg/kg	NC
1,3-Dichlorobenzene	sVOCs	18-1:0-2cm	120	µg/kg	U	18-1:0-10cm	58	µg/kg	U	NC	µg/kg	NC

Table A-3 (Continued). Sample Locations: 18-1

Result Parameter Name	Sampling Category	Sample IDs								Difference from 0-2cm to 0-10cm	Unit	% difference relative to the 0-10cm value
		0-2cm Sample ID	Value	Unit	Result Data Qualifier	0-10cm Sample ID	Value	Unit	Result Data Qualifier			
1,4-Dichlorobenzene	sVOCs	18-1:0-2cm	120	µg/kg	U	18-1:0-10cm	58	µg/kg	U	NC	µg/kg	NC
Benzyl Alcohol	sVOCs	18-1:0-2cm	120	µg/kg	U	18-1:0-10cm	58	µg/kg	U	NC	µg/kg	NC
1,2-Dichlorobenzene	sVOCs	18-1:0-2cm	120	µg/kg	U	18-1:0-10cm	58	µg/kg	U	NC	µg/kg	NC
2-Methylphenol	sVOCs	18-1:0-2cm	120	µg/kg	U	18-1:0-10cm	58	µg/kg	U	NC	µg/kg	NC
2,2'-Oxybis(1-Chloropropane)	sVOCs	18-1:0-2cm	120	µg/kg	U	18-1:0-10cm	58	µg/kg	U	NC	µg/kg	NC
4-Methylphenol	sVOCs	18-1:0-2cm	120	µg/kg	U	18-1:0-10cm	58	µg/kg	U	NC	µg/kg	NC
N-Nitroso-Di-N-Propylamine	sVOCs	18-1:0-2cm	120	µg/kg	U	18-1:0-10cm	58	µg/kg	U	NC	µg/kg	NC
Hexachloroethane	sVOCs	18-1:0-2cm	120	µg/kg	U	18-1:0-10cm	58	µg/kg	U	NC	µg/kg	NC
Nitrobenzene	sVOCs	18-1:0-2cm	120	µg/kg	U	18-1:0-10cm	58	µg/kg	U	NC	µg/kg	NC
Isophorone	sVOCs	18-1:0-2cm	120	µg/kg	U	18-1:0-10cm	58	µg/kg	U	NC	µg/kg	NC
2-Nitrophenol	sVOCs	18-1:0-2cm	120	µg/kg	U	18-1:0-10cm	58	µg/kg	U	NC	µg/kg	NC
2,4-Dimethylphenol	sVOCs	18-1:0-2cm	590	µg/kg	U	18-1:0-10cm	290	µg/kg	U	NC	µg/kg	NC
Benzoic Acid	sVOCs	18-1:0-2cm	1200	µg/kg	J	18-1:0-10cm	330	µg/kg	J	-870	µg/kg	263.64%
bis(2-Chloroethoxy) Methane	sVOCs	18-1:0-2cm	120	µg/kg	U	18-1:0-10cm	58	µg/kg	U	NC	µg/kg	NC
2,4-Dichlorophenol	sVOCs	18-1:0-2cm	590	µg/kg	U	18-1:0-10cm	290	µg/kg	U	NC	µg/kg	NC
1,2,4-Trichlorobenzene	sVOCs	18-1:0-2cm	120	µg/kg	U	18-1:0-10cm	58	µg/kg	U	NC	µg/kg	NC
Naphthalene	sVOCs	18-1:0-2cm	65	µg/kg	J	18-1:0-10cm	38	µg/kg	J	-27	µg/kg	71.05%
Carbon Normalized Naphthalene	CN-SVOC	18-1:0-2cm	NC	mg/kgOC		18-1:0-10cm	1.15	mg/kgOC		NC	mg/kgOC	NC
4-Chloroaniline	sVOCs	18-1:0-2cm	590	µg/kg	U	18-1:0-10cm	290	µg/kg	U	NC	µg/kg	NC
Hexachlorobutadiene	sVOCs	18-1:0-2cm	120	µg/kg	U	18-1:0-10cm	58	µg/kg	U	NC	µg/kg	NC
4-Chloro-3-methylphenol	sVOCs	18-1:0-2cm	590	µg/kg	U	18-1:0-10cm	290	µg/kg	U	NC	µg/kg	NC
2-Methylnaphthalene	sVOCs	18-1:0-2cm	120	µg/kg	U	18-1:0-10cm	58	µg/kg	U	NC	µg/kg	NC
Hexachlorocyclopentadiene	sVOCs	18-1:0-2cm	590	µg/kg	U	18-1:0-10cm	290	µg/kg	U	NC	µg/kg	NC
2,4,6-Trichlorophenol	sVOCs	18-1:0-2cm	590	µg/kg	U	18-1:0-10cm	290	µg/kg	U	NC	µg/kg	NC
2,4,5-Trichlorophenol	sVOCs	18-1:0-2cm	590	µg/kg	U	18-1:0-10cm	290	µg/kg	U	NC	µg/kg	NC
2-Chloronaphthalene	sVOCs	18-1:0-2cm	120	µg/kg	U	18-1:0-10cm	58	µg/kg	U	NC	µg/kg	NC
2-Nitroaniline	sVOCs	18-1:0-2cm	590	µg/kg	U	18-1:0-10cm	290	µg/kg	U	NC	µg/kg	NC
Dimethylphthalate	sVOCs	18-1:0-2cm	120	µg/kg	U	18-1:0-10cm	58	µg/kg	U	NC	µg/kg	NC
Acenaphthylene	sVOCs	18-1:0-2cm	35	µg/kg	J	18-1:0-10cm	58	µg/kg	U	NC	µg/kg	NC
Carbon Normalized Acenaphthylene	CN-SVOC	18-1:0-2cm	NC	mg/kgOC		18-1:0-10cm	1.76	mg/kgOC		NC	mg/kgOC	NC
3-Nitroaniline	sVOCs	18-1:0-2cm	590	µg/kg	U	18-1:0-10cm	290	µg/kg	U	NC	µg/kg	NC
Acenaphthene	sVOCs	18-1:0-2cm	88	µg/kg	J	18-1:0-10cm	35	µg/kg	J	-53	µg/kg	151.43%
Carbon Normalized Acenaphthene	CN-SVOC	18-1:0-2cm	NC	mg/kgOC		18-1:0-10cm	1.06	mg/kgOC		NC	mg/kgOC	NC
2,4-Dinitrophenol	sVOCs	18-1:0-2cm	1200	µg/kg	U	18-1:0-10cm	580	µg/kg	U	NC	µg/kg	NC
4-Nitrophenol	sVOCs	18-1:0-2cm	590	µg/kg	U	18-1:0-10cm	290	µg/kg	U	NC	µg/kg	NC
Dibenzofuran	sVOCs	18-1:0-2cm	65	µg/kg	J	18-1:0-10cm	29	µg/kg	J	-36	µg/kg	124.14%
2,6-Dinitrotoluene	sVOCs	18-1:0-2cm	590	µg/kg	U	18-1:0-10cm	290	µg/kg	U	NC	µg/kg	NC
2,4-Dinitrotoluene	sVOCs	18-1:0-2cm	590	µg/kg	U	18-1:0-10cm	290	µg/kg	U	NC	µg/kg	NC
Diethylphthalate	sVOCs	18-1:0-2cm	120	µg/kg	U	18-1:0-10cm	58	µg/kg	U	NC	µg/kg	NC
4-Chlorophenyl-phenylether	sVOCs	18-1:0-2cm	120	µg/kg	U	18-1:0-10cm	58	µg/kg	U	NC	µg/kg	NC
Fluorene	sVOCs	18-1:0-2cm	120	µg/kg	U	18-1:0-10cm	41	µg/kg	J	NC	µg/kg	NC
Carbon Normalized Fluorene	CN-SVOC	18-1:0-2cm	NC	mg/kgOC		18-1:0-10cm	1.24	mg/kgOC		NC	mg/kgOC	NC
4-Nitroaniline	sVOCs	18-1:0-2cm	590	µg/kg	U	18-1:0-10cm	290	µg/kg	U	NC	µg/kg	NC
4,6-Dinitro-2-Methylphenol	sVOCs	18-1:0-2cm	1200	µg/kg	U	18-1:0-10cm	580	µg/kg	U	NC	µg/kg	NC
N-Nitrosodiphenylamine	sVOCs	18-1:0-2cm	120	µg/kg	U	18-1:0-10cm	58	µg/kg	U	NC	µg/kg	NC

Table A-3 (Continued). Sample Locations: 18-1

Result Parameter Name	Sampling Category	Sample IDs								Difference from 0-2cm to 0-10cm	Unit	% difference relative to the 0-10cm value
		0-2cm Sample ID	Value	Unit	Result Data Qualifier	0-10cm Sample ID	Value	Unit	Result Data Qualifier			
4-Bromophenyl-phenylether	sVOCs	18-1:0-2cm	120	µg/kg	U	18-1:0-10cm	58	µg/kg	U	NC	µg/kg	NC
Hexachlorobenzene	sVOCs	18-1:0-2cm	120	µg/kg	U	18-1:0-10cm	58	µg/kg	U	NC	µg/kg	NC
Pentachlorophenol	sVOCs	18-1:0-2cm	300	µg/kg	J	18-1:0-10cm	290	µg/kg	U	NC	µg/kg	NC
Phenanthrene	sVOCs	18-1:0-2cm	570	µg/kg		18-1:0-10cm	320	µg/kg		-250	µg/kg	78.13%
Carbon Normalized Phenanthrene	CN-SVOC	18-1:0-2cm	NC	mg/kgOC		18-1:0-10cm	9.70	mg/kgOC		NC	mg/kgOC	NC
Carbazole	sVOCs	18-1:0-2cm	110	µg/kg	JQ	18-1:0-10cm	67	µg/kg	Q	-43	µg/kg	64.18%
Anthracene	sVOCs	18-1:0-2cm	160	µg/kg		18-1:0-10cm	96	µg/kg		-64	µg/kg	66.67%
Carbon Normalized Anthracene	CN-SVOC	18-1:0-2cm	NC	mg/kgOC		18-1:0-10cm	2.91	mg/kgOC		NC	mg/kgOC	NC
Di-n-Butylphthalate	sVOCs	18-1:0-2cm	250	µg/kg		18-1:0-10cm	440	µg/kg		190	µg/kg	43.18%
Fluoranthene	sVOCs	18-1:0-2cm	940	µg/kg		18-1:0-10cm	950	µg/kg		10	µg/kg	1.05%
Carbon Normalized Fluoranthene	CN-SVOC	18-1:0-2cm	NC	mg/kgOC		18-1:0-10cm	28.79	mg/kgOC		NC	mg/kgOC	NC
Pyrene	sVOCs	18-1:0-2cm	920	µg/kg		18-1:0-10cm	1000	µg/kg		80	µg/kg	8.00%
Carbon Normalized Pyrene	CN-SVOC	18-1:0-2cm	NC	mg/kgOC		18-1:0-10cm	30.30	mg/kgOC		NC	mg/kgOC	NC
Butylbenzylphthalate	sVOCs	18-1:0-2cm	150	µg/kg		18-1:0-10cm	79	µg/kg		-71	µg/kg	89.87%
3,3'-Dichlorobenzidine	sVOCs	18-1:0-2cm	590	µg/kg	U	18-1:0-10cm	290	µg/kg	U	NC	µg/kg	NC
Benzo(a)anthracene	sVOCs	18-1:0-2cm	290	µg/kg		18-1:0-10cm	230	µg/kg		-60	µg/kg	26.09%
Carbon Normalized Benzo(a)anthracene	CN-SVOC	18-1:0-2cm	NC	mg/kgOC		18-1:0-10cm	6.97	mg/kgOC		NC	mg/kgOC	NC
bis(2-Ethylhexyl)phthalate	sVOCs	18-1:0-2cm	6500	µg/kg		18-1:0-10cm	470	µg/kg		-6030	µg/kg	1282.98%
Chrysene	sVOCs	18-1:0-2cm	560	µg/kg		18-1:0-10cm	460	µg/kg		-100	µg/kg	21.74%
Carbon Normalized Chrysene	CN-SVOC	18-1:0-2cm	NC	mg/kgOC		18-1:0-10cm	13.94	mg/kgOC		NC	mg/kgOC	NC
Di-n-Octyl phthalate	sVOCs	18-1:0-2cm	120	µg/kg	U	18-1:0-10cm	58	µg/kg	U	NC	µg/kg	NC
Benzo(a)pyrene	sVOCs	18-1:0-2cm	380	µg/kg		18-1:0-10cm	280	µg/kg		-100	µg/kg	35.71%
Carbon Normalized Benzo(a)pyrene	CN-SVOC	18-1:0-2cm	NC	mg/kgOC		18-1:0-10cm	8.48	mg/kgOC		NC	mg/kgOC	NC
Indeno(1,2,3-cd)pyrene	sVOCs	18-1:0-2cm	240	µg/kg		18-1:0-10cm	180	µg/kg		-60	µg/kg	33.33%
Carbon Normalized Indeno(1,2,3-cd)pyrene	CN-SVOC	18-1:0-2cm	NC	mg/kgOC		18-1:0-10cm	5.45	mg/kgOC		NC	mg/kgOC	NC
Dibenzo(a,h)anthracene	sVOCs	18-1:0-2cm	120	µg/kg	U	18-1:0-10cm	64	µg/kg		-56	µg/kg	87.50%
Carbon Normalized Dibenzo(a,h)anthracene	CN-SVOC	18-1:0-2cm	NC	mg/kgOC		18-1:0-10cm	1.94	mg/kgOC		NC	mg/kgOC	NC
Benzo(g,h,i)perylene	sVOCs	18-1:0-2cm	290	µg/kg		18-1:0-10cm	230	µg/kg		-60	µg/kg	26.09%
Carbon Normalized Benzo(g,h,i)perylene	CN-SVOC	18-1:0-2cm	NC	mg/kgOC		18-1:0-10cm	6.97	mg/kgOC		NC	mg/kgOC	NC
1-Methylnaphthalene	sVOCs	18-1:0-2cm	120	µg/kg	U	18-1:0-10cm	58	µg/kg	U	NC	µg/kg	NC
Total Benzofluoranthenes	sVOCs	18-1:0-2cm	750	µg/kg		18-1:0-10cm	670	µg/kg		-80	µg/kg	11.94%
Carbon Normalized Total Benzofluoranthenes	CN-SVOC	18-1:0-2cm	NC	mg/kgOC		18-1:0-10cm	20.30	mg/kgOC		NC	mg/kgOC	NC

*TOC value outside range normally accepted for use in carbon normalization.

Calculated value - not in the EDD

NC = not calculated. If analyltes are not detected, carbon normalized values and differences are not calculated. Also, if TOC value is outside the 0.5 to 3.5 range, carbon normalized values are not calculated.

Table A-4. Sample Locations: 18-2

Result Parameter Name	Sampling Category	Sample IDs								Difference from 0-2cm to 0-10cm	Unit	% difference relative to the 0-10cm value
		0-2cm Sample ID	Value	Unit	Result Data Qualifier	0-10cm Sample ID	Value	Unit	Result Data Qualifier			
Total Solids	TS	18-2:0-2cm	42.43	%		18-2:0-10cm	44.38	%		1.95	%	4.39%
Total Organic Carbon	TOC	18-2:0-2cm	2.9	%		18-2:0-10cm	2.72	%		-0.18	%	6.62%
Total PCBs	PCBs	18-2:0-2cm	351.8	µg/kg		18-2:0-10cm	414	µg/kg		62.2	%	15.02%
Carbon-normalized Total PCBs	CN-PCBs	18-2:0-2cm	12.13	mg/kgOC		18-2:0-10cm	15.22	mg/kgOC		3.09	mg/kgOC	20.30%
Particle/Grain Size > 2mm (Gravel)	Grain Size	18-2:0-2cm	25.2	%		18-2:0-10cm	4.5	%		-20.7	%	460.00%
Particle/Grain Size, 2mm - 1mm (Very Coarse Sand)	Grain Size	18-2:0-2cm	5.7	%		18-2:0-10cm	3.6	%		-2.1	%	58.33%
Particle/Grain Size, 1mm - 0.5mm (Coarse Sand)	Grain Size	18-2:0-2cm	5.3	%		18-2:0-10cm	6.7	%		1.4	%	20.90%
Particle/Grain Size, 0.5mm - 0.25mm (Medium Sand)	Grain Size	18-2:0-2cm	6.4	%		18-2:0-10cm	4.5	%		-1.9	%	42.22%
Particle/Grain Size, 0.25mm - 0.125mm (Fine Sand)	Grain Size	18-2:0-2cm	4.9	%		18-2:0-10cm	2.1	%		-2.8	%	133.33%
Particle/Grain Size, 125µm - 63µm (Very Fine Sand)	Grain Size	18-2:0-2cm	3.7	%		18-2:0-10cm	2.3	%		-1.4	%	60.87%
Particle/Grain Size, 63µm - 31µm (Silt)	Grain Size	18-2:0-2cm	7.4	%		18-2:0-10cm	8.1	%		0.7	%	8.64%
Particle/Grain Size, 31µm - 15.6µm (Silt)	Grain Size	18-2:0-2cm	19.5	%		18-2:0-10cm	11.5	%		-8	%	69.57%
Particle/Grain Size, 15.6µm - 7.8µm (Silt)	Grain Size	18-2:0-2cm	5.7	%		18-2:0-10cm	15.8	%		10.1	%	63.92%
Particle/Grain Size, 7.8µm - 3.9µm (Silt)	Grain Size	18-2:0-2cm	3.5	%		18-2:0-10cm	10.4	%		6.9	%	66.35%
Particle/Grain Size, 3.9µm - 2.0µm (Clay)	Grain Size	18-2:0-2cm	2.7	%		18-2:0-10cm	8.9	%		6.2	%	69.66%
Particle/Grain Size, 2.0µm - 1.0µm (Clay)	Grain Size	18-2:0-2cm	3.8	%		18-2:0-10cm	8.2	%		4.4	%	53.66%
Particle/Grain Size < 1.0µm (Clay)	Grain Size	18-2:0-2cm	6.2	%		18-2:0-10cm	13.4	%		7.2	%	53.73%
Particle/Grain Size, Fines (Silt/Clay)	Grain Size	18-2:0-2cm	48.8	%		18-2:0-10cm	76.3	%		27.5	%	36.04%
Aluminum	Metals	18-2:0-2cm	12500	mg/kg		18-2:0-10cm	22200	mg/kg		9700	mg/kg	43.69%
Antimony	Metals	18-2:0-2cm	4.9	mg/kg		18-2:0-10cm	1.3	mg/kg		-3.6	mg/kg	276.92%
Arsenic	Metals	18-2:0-2cm	135	mg/kg		18-2:0-10cm	61.9	mg/kg		-73.1	mg/kg	118.09%
Barium	Metals	18-2:0-2cm	389	mg/kg		18-2:0-10cm	152	mg/kg		-237	mg/kg	155.92%
Beryllium	Metals	18-2:0-2cm	0.8	mg/kg		18-2:0-10cm	0.5	mg/kg		-0.3	mg/kg	60.00%
Cadmium	Metals	18-2:0-2cm	1.8	mg/kg		18-2:0-10cm	1.7	mg/kg		-0.1	mg/kg	5.88%
Calcium	Metals	18-2:0-2cm	174000	mg/kg		18-2:0-10cm	33200	mg/kg		-140800	mg/kg	424.10%
Chromium	Metals	18-2:0-2cm	106	mg/kg		18-2:0-10cm	90	mg/kg		-16	mg/kg	17.78%
Cobalt	Metals	18-2:0-2cm	21.9	mg/kg		18-2:0-10cm	28.6	mg/kg		6.7	mg/kg	23.43%
Copper	Metals	18-2:0-2cm	3790	mg/kg		18-2:0-10cm	685	mg/kg		-3105	mg/kg	453.28%
Iron	Metals	18-2:0-2cm	48600	mg/kg		18-2:0-10cm	66600	mg/kg		18000	mg/kg	27.03%
Lead	Metals	18-2:0-2cm	536	mg/kg		18-2:0-10cm	153	mg/kg		-383	mg/kg	250.33%
Magnesium	Metals	18-2:0-2cm	8960	mg/kg		18-2:0-10cm	11700	mg/kg		2740	mg/kg	23.42%
Manganese	Metals	18-2:0-2cm	1220	mg/kg		18-2:0-10cm	770	mg/kg		-450	mg/kg	58.44%
Mercury	Mercury	18-2:0-2cm	0.71	mg/kg		18-2:0-10cm	1.48	mg/kg		0.77	mg/kg	52.03%
Nickel	Metals	18-2:0-2cm	119	mg/kg		18-2:0-10cm	130	mg/kg		11	mg/kg	8.46%
Potassium	Metals	18-2:0-2cm	2600	mg/kg		18-2:0-10cm	3860	mg/kg		1260	mg/kg	32.64%
Selenium	Metals	18-2:0-2cm	2	mg/kg		18-2:0-10cm	2	mg/kg		0	mg/kg	0.00%
Silver	Metals	18-2:0-2cm	1.3	mg/kg		18-2:0-10cm	1.2	mg/kg		-0.1	mg/kg	8.33%
Sodium	Metals	18-2:0-2cm	14400	mg/kg		18-2:0-10cm	13800	mg/kg		-600	mg/kg	4.35%
Thallium	Metals	18-2:0-2cm	0.4	mg/kg	U	18-2:0-10cm	0.4	mg/kg	U	NC	mg/kg	NC
Vanadium	Metals	18-2:0-2cm	58.9	mg/kg		18-2:0-10cm	57.7	mg/kg		-1.2	mg/kg	2.08%
Zinc	Metals	18-2:0-2cm	2850	mg/kg		18-2:0-10cm	880	mg/kg		-1970	mg/kg	223.86%
Phenol	sVOCs	18-2:0-2cm	120	µg/kg		18-2:0-10cm	90	µg/kg		-30	µg/kg	33.33%
Bis-(2-Chloroethyl) Ether	sVOCs	18-2:0-2cm	59	µg/kg	U	18-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
2-Chlorophenol	sVOCs	18-2:0-2cm	59	µg/kg	U	18-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
1,3-Dichlorobenzene	sVOCs	18-2:0-2cm	59	µg/kg	U	18-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC

Table A-4 (Continued). Sample Locations: 18-2

Result Parameter Name	Sampling Category	Sample IDs								Difference from 0-2cm to 0-10cm	Unit	% difference relative to the 0-10cm value
		0-2cm Sample ID	Value	Unit	Result Data Qualifier	0-10cm Sample ID	Value	Unit	Result Data Qualifier			
1,4-Dichlorobenzene	sVOCs	18-2:0-2cm	88	µg/kg		18-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
Benzyl Alcohol	sVOCs	18-2:0-2cm	59	µg/kg	U	18-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
1,2-Dichlorobenzene	sVOCs	18-2:0-2cm	59	µg/kg	U	18-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
2-Methylphenol	sVOCs	18-2:0-2cm	59	µg/kg	U	18-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
2,2'-Oxybis(1-Chloropropane)	sVOCs	18-2:0-2cm	59	µg/kg	U	18-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
4-Methylphenol	sVOCs	18-2:0-2cm	180	µg/kg		18-2:0-10cm	90	µg/kg		-90	µg/kg	100.00%
N-Nitroso-Di-N-Propylamine	sVOCs	18-2:0-2cm	59	µg/kg	U	18-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
Hexachloroethane	sVOCs	18-2:0-2cm	59	µg/kg	U	18-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
Nitrobenzene	sVOCs	18-2:0-2cm	59	µg/kg	U	18-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
Isophorone	sVOCs	18-2:0-2cm	59	µg/kg	U	18-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
2-Nitrophenol	sVOCs	18-2:0-2cm	59	µg/kg	U	18-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
2,4-Dimethylphenol	sVOCs	18-2:0-2cm	290	µg/kg	U	18-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Benzoic Acid	sVOCs	18-2:0-2cm	310	µg/kg	J	18-2:0-10cm	250	µg/kg	J	-60	µg/kg	24.00%
bis(2-Chloroethoxy) Methane	sVOCs	18-2:0-2cm	59	µg/kg	U	18-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
2,4-Dichlorophenol	sVOCs	18-2:0-2cm	290	µg/kg	U	18-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
1,2,4-Trichlorobenzene	sVOCs	18-2:0-2cm	59	µg/kg	U	18-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
Naphthalene	sVOCs	18-2:0-2cm	73	µg/kg		18-2:0-10cm	60	µg/kg		-13	µg/kg	21.67%
Carbon Normalized Naphthalene	CN-SVOC	18-2:0-2cm	2.52	mg/kgOC		18-2:0-10cm	2.21	mg/kgOC		-0.31	mg/kgOC	14.11%
4-Chloroaniline	sVOCs	18-2:0-2cm	290	µg/kg	U	18-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Hexachlorobutadiene	sVOCs	18-2:0-2cm	59	µg/kg	U	18-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
4-Chloro-3-methylphenol	sVOCs	18-2:0-2cm	290	µg/kg	U	18-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
2-Methylnaphthalene	sVOCs	18-2:0-2cm	59	µg/kg	U	18-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
Hexachlorocyclopentadiene	sVOCs	18-2:0-2cm	290	µg/kg	U	18-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
2,4,6-Trichlorophenol	sVOCs	18-2:0-2cm	290	µg/kg	U	18-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
2,4,5-Trichlorophenol	sVOCs	18-2:0-2cm	290	µg/kg	U	18-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
2-Chloronaphthalene	sVOCs	18-2:0-2cm	59	µg/kg	U	18-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
2-Nitroaniline	sVOCs	18-2:0-2cm	290	µg/kg	U	18-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Dimethylphthalate	sVOCs	18-2:0-2cm	59	µg/kg	U	18-2:0-10cm	30	µg/kg	J	-29	µg/kg	96.67%
Acenaphthylene	sVOCs	18-2:0-2cm	26	µg/kg	J	18-2:0-10cm	45	µg/kg	J	19	µg/kg	42.22%
Carbon Normalized Acenaphthylene	CN-SVOC	18-2:0-2cm	0.90	mg/kgOC		18-2:0-10cm	1.65	mg/kgOC		0.76	mg/kgOC	45.81%
3-Nitroaniline	sVOCs	18-2:0-2cm	290	µg/kg	U	18-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Acenaphthene	sVOCs	18-2:0-2cm	170	µg/kg		18-2:0-10cm	57	µg/kg	J	-113	µg/kg	198.25%
Carbon Normalized Acenaphthene	CN-SVOC	18-2:0-2cm	5.86	mg/kgOC		18-2:0-10cm	2.10	mg/kgOC		-3.77	mg/kgOC	179.73%
2,4-Dinitrophenol	sVOCs	18-2:0-2cm	590	µg/kg	U	18-2:0-10cm	600	µg/kg	U	NC	µg/kg	NC
4-Nitrophenol	sVOCs	18-2:0-2cm	290	µg/kg	U	18-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Dibenzofuran	sVOCs	18-2:0-2cm	79	µg/kg		18-2:0-10cm	42	µg/kg	J	-37	µg/kg	88.10%
2,6-Dinitrotoluene	sVOCs	18-2:0-2cm	290	µg/kg	U	18-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
2,4-Dinitrotoluene	sVOCs	18-2:0-2cm	290	µg/kg	U	18-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Diethylphthalate	sVOCs	18-2:0-2cm	59	µg/kg	U	18-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
4-Chlorophenyl-phenylether	sVOCs	18-2:0-2cm	59	µg/kg	U	18-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
Fluorene	sVOCs	18-2:0-2cm	200	µg/kg		18-2:0-10cm	75	µg/kg		-125	µg/kg	166.67%
Carbon Normalized Fluorene	CN-SVOC	18-2:0-2cm	6.90	mg/kgOC		18-2:0-10cm	2.76	mg/kgOC		-4.14	mg/kgOC	150.11%
4-Nitroaniline	sVOCs	18-2:0-2cm	290	µg/kg	U	18-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
4,6-Dinitro-2-Methylphenol	sVOCs	18-2:0-2cm	590	µg/kg	U	18-2:0-10cm	600	µg/kg	U	NC	µg/kg	NC
N-Nitrosodiphenylamine	sVOCs	18-2:0-2cm	59	µg/kg	U	18-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC

Table A-4 (Continued). Sample Locations: 18-2

Result Parameter Name	Sampling Category	Sample IDs								Difference from 0-2cm to 0-10cm	Unit	% difference relative to the 0-10cm value
		0-2cm Sample ID	Value	Unit	Result Data Qualifier	0-10cm Sample ID	Value	Unit	Result Data Qualifier			
4-Bromophenyl-phenylether	sVOCs	18-2:0-2cm	59	µg/kg	U	18-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
Hexachlorobenzene	sVOCs	18-2:0-2cm	59	µg/kg	U	18-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
Pentachlorophenol	sVOCs	18-2:0-2cm	290	µg/kg	U	18-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Phenanthrene	sVOCs	18-2:0-2cm	1900	µg/kg		18-2:0-10cm	340	µg/kg		-1560	µg/kg	458.82%
Carbon Normalized Phenanthrene	CN-SVOC	18-2:0-2cm	65.52	mg/kgOC		18-2:0-10cm	12.50	mg/kgOC		-53.02	mg/kgOC	424.14%
Carbazole	sVOCs	18-2:0-2cm	130	µg/kg	Q	18-2:0-10cm	60	µg/kg	Q	-70	µg/kg	116.67%
Anthracene	sVOCs	18-2:0-2cm	500	µg/kg		18-2:0-10cm	110	µg/kg		-390	µg/kg	354.55%
Carbon Normalized Anthracene	CN-SVOC	18-2:0-2cm	17.24	mg/kgOC		18-2:0-10cm	4.04	mg/kgOC		-13.20	mg/kgOC	326.33%
Di-n-Butylphthalate	sVOCs	18-2:0-2cm	110	µg/kg		18-2:0-10cm	330	µg/kg		220	µg/kg	66.67%
Fluoranthene	sVOCs	18-2:0-2cm	3400	µg/kg		18-2:0-10cm	690	µg/kg		-2710	µg/kg	392.75%
Carbon Normalized Fluoranthene	CN-SVOC	18-2:0-2cm	117.24	mg/kgOC		18-2:0-10cm	25.37	mg/kgOC		-91.87	mg/kgOC	362.17%
Pyrene	sVOCs	18-2:0-2cm	2200	µg/kg		18-2:0-10cm	580	µg/kg		-1620	µg/kg	279.31%
Carbon Normalized Pyrene	CN-SVOC	18-2:0-2cm	75.86	mg/kgOC		18-2:0-10cm	21.32	mg/kgOC		-54.54	mg/kgOC	255.77%
Butylbenzylphthalate	sVOCs	18-2:0-2cm	85	µg/kg		18-2:0-10cm	920	µg/kg		835	µg/kg	90.76%
3,3'-Dichlorobenzidine	sVOCs	18-2:0-2cm	290	µg/kg	U	18-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Benzo(a)anthracene	sVOCs	18-2:0-2cm	1100	µg/kg		18-2:0-10cm	260	µg/kg		-840	µg/kg	323.08%
Carbon Normalized Benzo(a)anthracene	CN-SVOC	18-2:0-2cm	37.93	mg/kgOC		18-2:0-10cm	9.56	mg/kgOC		-28.37	mg/kgOC	296.82%
bis(2-Ethylhexyl)phthalate	sVOCs	18-2:0-2cm	500	µg/kg		18-2:0-10cm	330	µg/kg		-170	µg/kg	51.52%
Chrysene	sVOCs	18-2:0-2cm	1200	µg/kg		18-2:0-10cm	410	µg/kg		-790	µg/kg	192.68%
Carbon Normalized Chrysene	CN-SVOC	18-2:0-2cm	41.38	mg/kgOC		18-2:0-10cm	15.07	mg/kgOC		-26.31	mg/kgOC	174.52%
Di-n-Octyl phthalate	sVOCs	18-2:0-2cm	59	µg/kg	U	18-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
Benzo(a)pyrene	sVOCs	18-2:0-2cm	860	µg/kg		18-2:0-10cm	390	µg/kg		-470	µg/kg	120.51%
Carbon Normalized Benzo(a)pyrene	CN-SVOC	18-2:0-2cm	29.66	mg/kgOC		18-2:0-10cm	14.34	mg/kgOC		-15.32	mg/kgOC	106.83%
Indeno(1,2,3-cd)pyrene	sVOCs	18-2:0-2cm	530	µg/kg		18-2:0-10cm	260	µg/kg		-270	µg/kg	103.85%
Carbon Normalized Indeno(1,2,3-cd)pyrene	CN-SVOC	18-2:0-2cm	18.28	mg/kgOC		18-2:0-10cm	9.56	mg/kgOC		-8.72	mg/kgOC	91.19%
Dibenzo(a,h)anthracene	sVOCs	18-2:0-2cm	220	µg/kg		18-2:0-10cm	72	µg/kg		-148	µg/kg	205.56%
Carbon Normalized Dibenzo(a,h)anthracene	CN-SVOC	18-2:0-2cm	7.59	mg/kgOC		18-2:0-10cm	2.65	mg/kgOC		-4.94	mg/kgOC	186.59%
Benzo(g,h,i)perylene	sVOCs	18-2:0-2cm	610	µg/kg		18-2:0-10cm	330	µg/kg		-280	µg/kg	84.85%
Carbon Normalized Benzo(g,h,i)perylene	CN-SVOC	18-2:0-2cm	21.03	mg/kgOC		18-2:0-10cm	12.13	mg/kgOC		-8.90	mg/kgOC	73.38%
1-Methylnaphthalene	sVOCs	18-2:0-2cm	44	µg/kg	J	18-2:0-10cm	39	µg/kg	J	-5	µg/kg	12.82%
Total Benzofluoranthenes	sVOCs	18-2:0-2cm	1700	µg/kg		18-2:0-10cm	880	µg/kg		-820	µg/kg	93.18%
Carbon Normalized Total Benzofluoranthenes	CN-SVOC	18-2:0-2cm	58.62	mg/kgOC		18-2:0-10cm	32.35	mg/kgOC		-26.27	mg/kgOC	81.19%

*TOC value outside range normally accepted for use in carbon normalization.

Calculated value - not in the EDD

NC = not calculated. If analyltes are not detected, carbon normalized values and differences are not calculated. Also, if TOC value is outside the 0.5 to 3.5 range, carbon normalized values are not calculated.

Table A-5. Sample Locations: 18-3

Result Parameter Name	Sampling Category	Sample IDs								Difference from 0-2cm to 0-10cm	Unit	% difference relative to the 0-10cm value
		0-2cm Sample ID	Value	Unit	Result Data Qualifier	0-10cm Sample ID	Value	Unit	Result Data Qualifier			
Total Solids	TS	18-3:0-2cm	23.26	%		18-3:0-10cm	33.17	%		9.91	%	29.88%
Total Organic Carbon	TOC	18-3:0-2cm	4.16	%	*	18-3:0-10cm	2.34	%		-1.82	%	77.78%
Total PCBs	PCBs	18-3:0-2cm	346	µg/kg		18-3:0-10cm	462.2	µg/kg		116.2	%	25.14%
Carbon-normalized Total PCBs	CN-PCBs	18-3:0-2cm	NC	mg/kgOC		18-3:0-10cm	19.75	mg/kgOC		NC	mg/kgOC	NC
Particle/Grain Size > 2mm (Gravel)	Grain Size	18-3:0-2cm	0.1	%		18-3:0-10cm	10	%		9.9	%	99.00%
Particle/Grain Size, 2mm - 1mm (Very Coarse Sand)	Grain Size	18-3:0-2cm	1.3	%		18-3:0-10cm	4.1	%		2.8	%	68.29%
Particle/Grain Size, 1mm - 0.5mm (Coarse Sand)	Grain Size	18-3:0-2cm	1.9	%		18-3:0-10cm	3	%		1.1	%	36.67%
Particle/Grain Size, 0.5mm - 0.25mm (Medium Sand)	Grain Size	18-3:0-2cm	1.1	%		18-3:0-10cm	3.7	%		2.6	%	70.27%
Particle/Grain Size, 0.25mm - 0.125mm (Fine Sand)	Grain Size	18-3:0-2cm	1	%		18-3:0-10cm	3.9	%		2.9	%	74.36%
Particle/Grain Size, 125µm - 63µm (Very Fine Sand)	Grain Size	18-3:0-2cm	1.7	%		18-3:0-10cm	4.4	%		2.7	%	61.36%
Particle/Grain Size, 63µm - 31µm (Silt)	Grain Size	18-3:0-2cm	6.2	%		18-3:0-10cm	6.1	%		-0.1	%	1.64%
Particle/Grain Size, 31µm - 15.6µm (Silt)	Grain Size	18-3:0-2cm	26.8	%		18-3:0-10cm	27.8	%		1	%	3.60%
Particle/Grain Size, 15.6µm - 7.8µm (Silt)	Grain Size	18-3:0-2cm	20.6	%		18-3:0-10cm	12.4	%		-8.2	%	66.13%
Particle/Grain Size, 7.8µm - 3.9µm (Silt)	Grain Size	18-3:0-2cm	7.9	%		18-3:0-10cm	3.6	%		-4.3	%	119.44%
Particle/Grain Size, 3.9µm - 2.0µm (Clay)	Grain Size	18-3:0-2cm	7.6	%		18-3:0-10cm	4.9	%		-2.7	%	55.10%
Particle/Grain Size, 2.0µm - 1.0µm (Clay)	Grain Size	18-3:0-2cm	6.4	%		18-3:0-10cm	4.8	%		-1.6	%	33.33%
Particle/Grain Size < 1.0µm (Clay)	Grain Size	18-3:0-2cm	17.3	%		18-3:0-10cm	11.4	%		-5.9	%	51.75%
Particle/Grain Size, Fines (Silt/Clay)	Grain Size	18-3:0-2cm	92.8	%		18-3:0-10cm	71	%		-21.8	%	30.70%
Aluminum	Metals	18-3:0-2cm	20600	mg/kg		18-3:0-10cm	16100	mg/kg		-4500	mg/kg	27.95%
Antimony	Metals	18-3:0-2cm	0.8	mg/kg	U	18-3:0-10cm	0.5	mg/kg	U	NC	mg/kg	NC
Arsenic	Metals	18-3:0-2cm	16.6	mg/kg		18-3:0-10cm	22.5	mg/kg		5.9	mg/kg	26.22%
Barium	Metals	18-3:0-2cm	58	mg/kg		18-3:0-10cm	64	mg/kg		6	mg/kg	9.38%
Beryllium	Metals	18-3:0-2cm	0.8	mg/kg	U	18-3:0-10cm	0.5	mg/kg	U	NC	mg/kg	NC
Cadmium	Metals	18-3:0-2cm	2.5	mg/kg		18-3:0-10cm	2	mg/kg		-0.5	mg/kg	25.00%
Calcium	Metals	18-3:0-2cm	9590	mg/kg		18-3:0-10cm	51900	mg/kg		42310	mg/kg	81.52%
Chromium	Metals	18-3:0-2cm	52	mg/kg		18-3:0-10cm	68	mg/kg		16	mg/kg	23.53%
Cobalt	Metals	18-3:0-2cm	10.4	mg/kg		18-3:0-10cm	10.2	mg/kg		-0.2	mg/kg	1.96%
Copper	Metals	18-3:0-2cm	243	mg/kg		18-3:0-10cm	324	mg/kg		81	mg/kg	25.00%
Iron	Metals	18-3:0-2cm	31200	mg/kg		18-3:0-10cm	32100	mg/kg		900	mg/kg	2.80%
Lead	Metals	18-3:0-2cm	74.8	mg/kg		18-3:0-10cm	80.7	mg/kg		5.9	mg/kg	7.31%
Magnesium	Metals	18-3:0-2cm	12100	mg/kg		18-3:0-10cm	8910	mg/kg		-3190	mg/kg	35.80%
Manganese	Metals	18-3:0-2cm	386	mg/kg		18-3:0-10cm	355	mg/kg		-31	mg/kg	8.73%
Mercury	Mercury	18-3:0-2cm	0.9	mg/kg		18-3:0-10cm	1.7	mg/kg		0.8	mg/kg	47.06%
Nickel	Metals	18-3:0-2cm	47	mg/kg		18-3:0-10cm	69	mg/kg		22	mg/kg	31.88%
Potassium	Metals	18-3:0-2cm	4280	mg/kg		18-3:0-10cm	3100	mg/kg		-1180	mg/kg	38.06%
Selenium	Metals	18-3:0-2cm	2	mg/kg		18-3:0-10cm	2	mg/kg		0	mg/kg	0.00%
Silver	Metals	18-3:0-2cm	0.8	mg/kg	U	18-3:0-10cm	0.7	mg/kg		NC	mg/kg	NC
Sodium	Metals	18-3:0-2cm	34900	mg/kg		18-3:0-10cm	21300	mg/kg		-13600	mg/kg	63.85%
Thallium	Metals	18-3:0-2cm	0.8	mg/kg	U	18-3:0-10cm	0.5	mg/kg	U	NC	mg/kg	NC
Vanadium	Metals	18-3:0-2cm	55.8	mg/kg		18-3:0-10cm	48.2	mg/kg		-7.6	mg/kg	15.77%
Zinc	Metals	18-3:0-2cm	280	mg/kg		18-3:0-10cm	390	mg/kg		110	mg/kg	28.21%
Phenol	sVOCs	18-3:0-2cm	50	µg/kg	J	18-3:0-10cm	58	µg/kg		8	µg/kg	13.79%
Bis-(2-Chloroethyl) Ether	sVOCs	18-3:0-2cm	59	µg/kg	U	18-3:0-10cm	58	µg/kg	U	NC	µg/kg	NC
2-Chlorophenol	sVOCs	18-3:0-2cm	59	µg/kg	U	18-3:0-10cm	58	µg/kg	U	NC	µg/kg	NC
1,3-Dichlorobenzene	sVOCs	18-3:0-2cm	59	µg/kg	U	18-3:0-10cm	58	µg/kg	U	NC	µg/kg	NC

Table A-5 (Continued). Sample Locations: 18-3

Result Parameter Name	Sampling Category	Sample IDs								Difference from 0-2cm to 0-10cm	Unit	% difference relative to the 0-10cm value
		0-2cm Sample ID	Value	Unit	Result Data Qualifier	0-10cm Sample ID	Value	Unit	Result Data Qualifier			
1,4-Dichlorobenzene	sVOCs	18-3:0-2cm	59	µg/kg	U	18-3:0-10cm	58	µg/kg	U	NC	µg/kg	NC
Benzyl Alcohol	sVOCs	18-3:0-2cm	59	µg/kg	U	18-3:0-10cm	58	µg/kg	U	NC	µg/kg	NC
1,2-Dichlorobenzene	sVOCs	18-3:0-2cm	59	µg/kg	U	18-3:0-10cm	58	µg/kg	U	NC	µg/kg	NC
2-Methylphenol	sVOCs	18-3:0-2cm	59	µg/kg	U	18-3:0-10cm	58	µg/kg	U	NC	µg/kg	NC
2,2'-Oxybis(1-Chloropropane)	sVOCs	18-3:0-2cm	59	µg/kg	U	18-3:0-10cm	58	µg/kg	U	NC	µg/kg	NC
4-Methylphenol	sVOCs	18-3:0-2cm	56	µg/kg	J	18-3:0-10cm	110	µg/kg		54	µg/kg	49.09%
N-Nitroso-Di-N-Propylamine	sVOCs	18-3:0-2cm	59	µg/kg	U	18-3:0-10cm	58	µg/kg	U	NC	µg/kg	NC
Hexachloroethane	sVOCs	18-3:0-2cm	59	µg/kg	U	18-3:0-10cm	58	µg/kg	U	NC	µg/kg	NC
Nitrobenzene	sVOCs	18-3:0-2cm	59	µg/kg	U	18-3:0-10cm	58	µg/kg	U	NC	µg/kg	NC
Isophorone	sVOCs	18-3:0-2cm	59	µg/kg	U	18-3:0-10cm	58	µg/kg	U	NC	µg/kg	NC
2-Nitrophenol	sVOCs	18-3:0-2cm	59	µg/kg	U	18-3:0-10cm	58	µg/kg	U	NC	µg/kg	NC
2,4-Dimethylphenol	sVOCs	18-3:0-2cm	300	µg/kg	U	18-3:0-10cm	290	µg/kg	U	NC	µg/kg	NC
Benzoic Acid	sVOCs	18-3:0-2cm	230	µg/kg	J	18-3:0-10cm	220	µg/kg	J	-10	µg/kg	4.55%
bis(2-Chloroethoxy) Methane	sVOCs	18-3:0-2cm	59	µg/kg	U	18-3:0-10cm	58	µg/kg	U	NC	µg/kg	NC
2,4-Dichlorophenol	sVOCs	18-3:0-2cm	300	µg/kg	U	18-3:0-10cm	290	µg/kg	U	NC	µg/kg	NC
1,2,4-Trichlorobenzene	sVOCs	18-3:0-2cm	59	µg/kg	U	18-3:0-10cm	58	µg/kg	U	NC	µg/kg	NC
Naphthalene	sVOCs	18-3:0-2cm	47	µg/kg	J	18-3:0-10cm	58	µg/kg		11	µg/kg	18.97%
Carbon Normalized Naphthalene	CN-SVOC	18-3:0-2cm	NC	mg/kgOC		18-3:0-10cm	2.48	mg/kgOC		NC	mg/kgOC	NC
4-Chloroaniline	sVOCs	18-3:0-2cm	300	µg/kg	U	18-3:0-10cm	290	µg/kg	U	NC	µg/kg	NC
Hexachlorobutadiene	sVOCs	18-3:0-2cm	59	µg/kg	U	18-3:0-10cm	58	µg/kg	U	NC	µg/kg	NC
4-Chloro-3-methylphenol	sVOCs	18-3:0-2cm	300	µg/kg	U	18-3:0-10cm	290	µg/kg	U	NC	µg/kg	NC
2-Methylnaphthalene	sVOCs	18-3:0-2cm	59	µg/kg	U	18-3:0-10cm	58	µg/kg	U	NC	µg/kg	NC
Hexachlorocyclopentadiene	sVOCs	18-3:0-2cm	300	µg/kg	U	18-3:0-10cm	290	µg/kg	U	NC	µg/kg	NC
2,4,6-Trichlorophenol	sVOCs	18-3:0-2cm	300	µg/kg	U	18-3:0-10cm	290	µg/kg	U	NC	µg/kg	NC
2,4,5-Trichlorophenol	sVOCs	18-3:0-2cm	300	µg/kg	U	18-3:0-10cm	290	µg/kg	U	NC	µg/kg	NC
2-Chloronaphthalene	sVOCs	18-3:0-2cm	59	µg/kg	U	18-3:0-10cm	58	µg/kg	U	NC	µg/kg	NC
2-Nitroaniline	sVOCs	18-3:0-2cm	300	µg/kg	U	18-3:0-10cm	290	µg/kg	U	NC	µg/kg	NC
Dimethylphthalate	sVOCs	18-3:0-2cm	59	µg/kg	U	18-3:0-10cm	58	µg/kg	U	NC	µg/kg	NC
Acenaphthylene	sVOCs	18-3:0-2cm	30	µg/kg	J	18-3:0-10cm	29	µg/kg	J	-1	µg/kg	3.45%
Carbon Normalized Acenaphthylene	CN-SVOC	18-3:0-2cm	NC	mg/kgOC		18-3:0-10cm	1.24	mg/kgOC	J	NC	mg/kgOC	NC
3-Nitroaniline	sVOCs	18-3:0-2cm	300	µg/kg	U	18-3:0-10cm	290	µg/kg	U	NC	µg/kg	NC
Acenaphthene	sVOCs	18-3:0-2cm	47	µg/kg	J	18-3:0-10cm	64	µg/kg		17	µg/kg	26.56%
Carbon Normalized Acenaphthene	CN-SVOC	18-3:0-2cm	NC	mg/kgOC		18-3:0-10cm	2.74	mg/kgOC		NC	mg/kgOC	NC
2,4-Dinitrophenol	sVOCs	18-3:0-2cm	590	µg/kg	U	18-3:0-10cm	580	µg/kg	U	NC	µg/kg	NC
4-Nitrophenol	sVOCs	18-3:0-2cm	300	µg/kg	U	18-3:0-10cm	290	µg/kg	U	NC	µg/kg	NC
Dibenzofuran	sVOCs	18-3:0-2cm	30	µg/kg	J	18-3:0-10cm	35	µg/kg	J	5	µg/kg	14.29%
2,6-Dinitrotoluene	sVOCs	18-3:0-2cm	300	µg/kg	U	18-3:0-10cm	290	µg/kg	U	NC	µg/kg	NC
2,4-Dinitrotoluene	sVOCs	18-3:0-2cm	300	µg/kg	U	18-3:0-10cm	290	µg/kg	U	NC	µg/kg	NC
Diethylphthalate	sVOCs	18-3:0-2cm	59	µg/kg	U	18-3:0-10cm	58	µg/kg	U	NC	µg/kg	NC
4-Chlorophenyl-phenylether	sVOCs	18-3:0-2cm	59	µg/kg	U	18-3:0-10cm	58	µg/kg	U	NC	µg/kg	NC
Fluorene	sVOCs	18-3:0-2cm	35	µg/kg	J	18-3:0-10cm	55	µg/kg	J	20	µg/kg	36.36%
Carbon Normalized Fluorene	CN-SVOC	18-3:0-2cm	NC	mg/kgOC		18-3:0-10cm	2.35	mg/kgOC	J	NC	mg/kgOC	NC
4-Nitroaniline	sVOCs	18-3:0-2cm	300	µg/kg	U	18-3:0-10cm	290	µg/kg	U	NC	µg/kg	NC
4,6-Dinitro-2-Methylphenol	sVOCs	18-3:0-2cm	590	µg/kg	U	18-3:0-10cm	580	µg/kg	U	NC	µg/kg	NC
N-Nitrosodiphenylamine	sVOCs	18-3:0-2cm	59	µg/kg	U	18-3:0-10cm	58	µg/kg	U	NC	µg/kg	NC

Table A-5 (Continued). Sample Locations: 18-3

Result Parameter Name	Sampling Category	Sample IDs								Difference from 0-2cm to 0-10cm	Unit	% difference relative to the 0-10cm value
		0-2cm Sample ID	Value	Unit	Result Data Qualifier	0-10cm Sample ID	Value	Unit	Result Data Qualifier			
4-Bromophenyl-phenylether	sVOCs	18-3:0-2cm	59	µg/kg	U	18-3:0-10cm	58	µg/kg	U	NC	µg/kg	NC
Hexachlorobenzene	sVOCs	18-3:0-2cm	59	µg/kg	U	18-3:0-10cm	58	µg/kg	U	NC	µg/kg	NC
Pentachlorophenol	sVOCs	18-3:0-2cm	300	µg/kg	U	18-3:0-10cm	290	µg/kg	U	NC	µg/kg	NC
Phenanthrene	sVOCs	18-3:0-2cm	240	µg/kg		18-3:0-10cm	440	µg/kg		200	µg/kg	45.45%
Carbon Normalized Phenanthrene	CN-SVOC	18-3:0-2cm	NC	mg/kgOC		18-3:0-10cm	18.8	mg/kgOC		NC	mg/kgOC	NC
Carbazole	sVOCs	18-3:0-2cm	41	µg/kg	QJ	18-3:0-10cm	73	µg/kg	Q	32	µg/kg	43.84%
Anthracene	sVOCs	18-3:0-2cm	80	µg/kg		18-3:0-10cm	120	µg/kg		40	µg/kg	33.33%
Carbon Normalized Anthracene	CN-SVOC	18-3:0-2cm	NC	mg/kgOC		18-3:0-10cm	5.13	mg/kgOC		NC	mg/kgOC	NC
Di-n-Butylphthalate	sVOCs	18-3:0-2cm	94	µg/kg		18-3:0-10cm	110	µg/kg		16	µg/kg	14.55%
Fluoranthene	sVOCs	18-3:0-2cm	490	µg/kg		18-3:0-10cm	770	µg/kg		280	µg/kg	36.36%
Carbon Normalized Fluoranthene	CN-SVOC	18-3:0-2cm	NC	mg/kgOC		18-3:0-10cm	32.91	mg/kgOC		NC	mg/kgOC	NC
Pyrene	sVOCs	18-3:0-2cm	400	µg/kg		18-3:0-10cm	590	µg/kg		190	µg/kg	32.20%
Carbon Normalized Pyrene	CN-SVOC	18-3:0-2cm	NC	mg/kgOC		18-3:0-10cm	25.21	mg/kgOC		NC	mg/kgOC	NC
Butylbenzylphthalate	sVOCs	18-3:0-2cm	53	µg/kg	J	18-3:0-10cm	55	µg/kg	J	2	µg/kg	3.64%
3,3'-Dichlorobenzidine	sVOCs	18-3:0-2cm	300	µg/kg	U	18-3:0-10cm	290	µg/kg	U	NC	µg/kg	NC
Benzo(a)anthracene	sVOCs	18-3:0-2cm	160	µg/kg		18-3:0-10cm	270	µg/kg		110	µg/kg	40.74%
Carbon Normalized Benzo(a)anthracene	CN-SVOC	18-3:0-2cm	NC	mg/kgOC		18-3:0-10cm	11.54	mg/kgOC		NC	mg/kgOC	NC
bis(2-Ethylhexyl)phthalate	sVOCs	18-3:0-2cm	190	µg/kg		18-3:0-10cm	530	µg/kg		340	µg/kg	64.15%
Chrysene	sVOCs	18-3:0-2cm	320	µg/kg		18-3:0-10cm	410	µg/kg		90	µg/kg	21.95%
Carbon Normalized Chrysene	CN-SVOC	18-3:0-2cm	NC	mg/kgOC		18-3:0-10cm	17.52	mg/kgOC		NC	mg/kgOC	NC
Di-n-Octyl phthalate	sVOCs	18-3:0-2cm	59	µg/kg	U	18-3:0-10cm	58	µg/kg	U	NC	µg/kg	NC
Benzo(a)pyrene	sVOCs	18-3:0-2cm	220	µg/kg		18-3:0-10cm	300	µg/kg		80	µg/kg	26.67%
Carbon Normalized Benzo(a)pyrene	CN-SVOC	18-3:0-2cm	NC	mg/kgOC		18-3:0-10cm	12.82	mg/kgOC		NC	mg/kgOC	NC
Indeno(1,2,3-cd)pyrene	sVOCs	18-3:0-2cm	130	µg/kg		18-3:0-10cm	180	µg/kg		50	µg/kg	27.78%
Carbon Normalized Indeno(1,2,3-cd)pyrene	CN-SVOC	18-3:0-2cm	NC	mg/kgOC		18-3:0-10cm	7.69	mg/kgOC		NC	mg/kgOC	NC
Dibenzo(a,h)anthracene	sVOCs	18-3:0-2cm	32	µg/kg	J	18-3:0-10cm	70	µg/kg		38	µg/kg	54.29%
Carbon Normalized Dibenzo(a,h)anthracene	CN-SVOC	18-3:0-2cm	NC	mg/kgOC		18-3:0-10cm	2.99	mg/kgOC		NC	mg/kgOC	NC
Benzo(g,h,i)perylene	sVOCs	18-3:0-2cm	160	µg/kg		18-3:0-10cm	220	µg/kg		60	µg/kg	27.27%
Carbon Normalized Benzo(g,h,i)perylene	CN-SVOC	18-3:0-2cm	NC	mg/kgOC		18-3:0-10cm	9.40	mg/kgOC		NC	mg/kgOC	NC
1-Methylnaphthalene	sVOCs	18-3:0-2cm	59	µg/kg	U	18-3:0-10cm	58	µg/kg	U	NC	µg/kg	NC
Total Benzofluoranthenes	sVOCs	18-3:0-2cm	470	µg/kg		18-3:0-10cm	640	µg/kg		170	µg/kg	26.56%
Carbon Normalized Total Benzofluoranthenes	CN-SVOC	18-3:0-2cm	NC	mg/kgOC		18-3:0-10cm	27.35	mg/kgOC		NC	mg/kgOC	NC

*TOC value outside range normally accepted for use in carbon normalization.

Calculated value - not in the EDD

NC = not calculated. If analyltes are not detected, carbon normalized values and differences are not calculated. Also, if TOC value is outside the 0.5 to 3.5 range, carbon normalized values are not calculated.

Table A-6. Sample Locations 18A-1

Result Parameter Name	Sampling Category	Sample IDs								Difference from 0-2cm to 0-10cm	Unit	% difference relative to the 0-10cm value
		0-2cm Sample ID	Value	Unit	Result Data Qualifier	0-10cm Sample ID	Value	Unit	Result Data Qualifier			
Total Solids	TS	18A-1:0-2cm	74.99	%		18A-1:0-10cm	25.02	%		-49.97	%	199.72%
Total Organic Carbon	TOC	18A-1:0-2cm	1.24	%		18A-1:0-10cm	2.04	%		0.8	%	39.22%
Total PCBs	PCBs	18A-1:0-2cm	393.5	µg/kg		18A-1:0-10cm	417.4	µg/kg		23.9	%	5.73%
Carbon-normalized Total PCBs	CN-PCBs	18A-1:0-2cm	31.73	mg/kgOC		18A-1:0-10cm	20.46	mg/kgOC		-11.27	mg/kgOC	55.10%
Particle/Grain Size > 2mm (Gravel)	Grain Size	18A-1:0-2cm	6.3	%		18A-1:0-10cm	0.1	%		-6.2	%	6200.00%
Particle/Grain Size, 2mm - 1mm (Very Coarse Sand)	Grain Size	18A-1:0-2cm	12.2	%		18A-1:0-10cm	0.7	%		-11.5	%	1642.86%
Particle/Grain Size, 1mm - 0.5mm (Coarse Sand)	Grain Size	18A-1:0-2cm	35.6	%		18A-1:0-10cm	3.8	%		-31.8	%	836.84%
Particle/Grain Size, 0.5mm - 0.25mm (Medium Sand)	Grain Size	18A-1:0-2cm	32.6	%		18A-1:0-10cm	2.6	%		-30	%	1153.85%
Particle/Grain Size, 0.25mm - 0.125mm (Fine Sand)	Grain Size	18A-1:0-2cm	7.4	%		18A-1:0-10cm	2.3	%		-5.1	%	221.74%
Particle/Grain Size, 125µm - 63µm (Very Fine Sand)	Grain Size	18A-1:0-2cm	1.5	%		18A-1:0-10cm	3.1	%		1.6	%	51.61%
Particle/Grain Size, 63µm - 31µm (Silt)	Grain Size	18A-1:0-2cm	0.6	%		18A-1:0-10cm	4	%		3.4	%	85.00%
Particle/Grain Size, 31µm - 15.6µm (Silt)	Grain Size	18A-1:0-2cm	0.4	%		18A-1:0-10cm	25.4	%		25	%	98.43%
Particle/Grain Size, 15.6µm - 7.8µm (Silt)	Grain Size	18A-1:0-2cm	0.5	%		18A-1:0-10cm	20.8	%		20.3	%	97.60%
Particle/Grain Size, 7.8µm - 3.9µm (Silt)	Grain Size	18A-1:0-2cm	0.4	%		18A-1:0-10cm	6.8	%		6.4	%	94.12%
Particle/Grain Size, 3.9µm - 2.0µm (Clay)	Grain Size	18A-1:0-2cm	0.6	%		18A-1:0-10cm	5.7	%		5.1	%	89.47%
Particle/Grain Size, 2.0µm - 1.0µm (Clay)	Grain Size	18A-1:0-2cm	0.6	%		18A-1:0-10cm	8.1	%		7.5	%	92.59%
Particle/Grain Size < 1.0µm (Clay)	Grain Size	18A-1:0-2cm	1.3	%		18A-1:0-10cm	16.4	%		15.1	%	92.07%
Particle/Grain Size, Fines (Silt/Clay)	Grain Size	18A-1:0-2cm	4.4	%		18A-1:0-10cm	87.3	%		82.9	%	94.96%
Aluminum	Metals	18A-1:0-2cm	14400	mg/kg		18A-1:0-10cm	17100	mg/kg		2700	mg/kg	15.79%
Antimony	Metals	18A-1:0-2cm	9	mg/kg		18A-1:0-10cm	0.8	mg/kg	U	NC	mg/kg	NC
Arsenic	Metals	18A-1:0-2cm	502	mg/kg		18A-1:0-10cm	16.8	mg/kg		-485.2	mg/kg	2888.10%
Barium	Metals	18A-1:0-2cm	1120	mg/kg		18A-1:0-10cm	53	mg/kg		-1067	mg/kg	2013.21%
Beryllium	Metals	18A-1:0-2cm	1.5	mg/kg		18A-1:0-10cm	0.8	mg/kg	U	NC	mg/kg	NC
Cadmium	Metals	18A-1:0-2cm	1.4	mg/kg		18A-1:0-10cm	2.4	mg/kg		1	mg/kg	41.67%
Calcium	Metals	18A-1:0-2cm	60900	mg/kg		18A-1:0-10cm	11300	mg/kg		-49600	mg/kg	438.94%
Chromium	Metals	18A-1:0-2cm	134	mg/kg		18A-1:0-10cm	52	mg/kg		-82	mg/kg	157.69%
Cobalt	Metals	18A-1:0-2cm	53.4	mg/kg		18A-1:0-10cm	9.7	mg/kg		-43.7	mg/kg	450.52%
Copper	Metals	18A-1:0-2cm	2070	mg/kg		18A-1:0-10cm	270	mg/kg		-1800	mg/kg	666.67%
Iron	Metals	18A-1:0-2cm	96600	mg/kg		18A-1:0-10cm	27300	mg/kg		-69300	mg/kg	253.85%
Lead	Metals	18A-1:0-2cm	1050	mg/kg		18A-1:0-10cm	83.6	mg/kg		-966.4	mg/kg	1155.98%
Magnesium	Metals	18A-1:0-2cm	9550	mg/kg		18A-1:0-10cm	10500	mg/kg		950	mg/kg	9.05%
Manganese	Metals	18A-1:0-2cm	2680	mg/kg		18A-1:0-10cm	321	mg/kg		-2359	mg/kg	734.89%
Mercury	Mercury	18A-1:0-2cm	0.96	mg/kg		18A-1:0-10cm	1.01	mg/kg		0.05	mg/kg	4.95%
Nickel	Metals	18A-1:0-2cm	77.1	mg/kg		18A-1:0-10cm	47	mg/kg		-30.1	mg/kg	64.04%
Potassium	Metals	18A-1:0-2cm	3510	mg/kg		18A-1:0-10cm	3660	mg/kg		150	mg/kg	4.10%
Selenium	Metals	18A-1:0-2cm	2.3	mg/kg		18A-1:0-10cm	3	mg/kg		0.7	mg/kg	23.33%
Silver	Metals	18A-1:0-2cm	4	mg/kg		18A-1:0-10cm	0.8	mg/kg		-3.2	mg/kg	400.00%
Sodium	Metals	18A-1:0-2cm	4420	mg/kg		18A-1:0-10cm	30600	mg/kg		26180	mg/kg	85.56%
Thallium	Metals	18A-1:0-2cm	0.3	mg/kg		18A-1:0-10cm	0.8	mg/kg	U	NC	mg/kg	NC
Vanadium	Metals	18A-1:0-2cm	47.5	mg/kg		18A-1:0-10cm	51.1	mg/kg		3.6	mg/kg	7.05%
Zinc	Metals	18A-1:0-2cm	5450	mg/kg		18A-1:0-10cm	300	mg/kg		-5150	mg/kg	1716.67%
Phenol	sVOCs	18A-1:0-2cm	160	µg/kg		18A-1:0-10cm	68	µg/kg		-92	µg/kg	135.29%
Bis-(2-Chloroethyl) Ether	sVOCs	18A-1:0-2cm	20	µg/kg	U	18A-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
2-Chlorophenol	sVOCs	18A-1:0-2cm	20	µg/kg	U	18A-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
1,3-Dichlorobenzene	sVOCs	18A-1:0-2cm	20	µg/kg	U	18A-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC

Table A-6 (Continued). Sample Locations: 18A-1

Result Parameter Name	Sampling Category	Sample IDs								Difference from 0-2cm to 0-10cm	Unit	% difference relative to the 0-10cm value
		0-2cm Sample ID	Value	Unit	Result Data Qualifier	0-10cm Sample ID	Value	Unit	Result Data Qualifier			
1,4-Dichlorobenzene	sVOCs	18A-1:0-2cm	20	µg/kg	U	18A-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
Benzyl Alcohol	sVOCs	18A-1:0-2cm	20	µg/kg	U	18A-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
1,2-Dichlorobenzene	sVOCs	18A-1:0-2cm	20	µg/kg	U	18A-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
2-Methylphenol	sVOCs	18A-1:0-2cm	20	µg/kg	U	18A-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
2,2'-Oxybis(1-Chloropropane)	sVOCs	18A-1:0-2cm	20	µg/kg	U	18A-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
4-Methylphenol	sVOCs	18A-1:0-2cm	38	µg/kg		18A-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
N-Nitroso-Di-N-Propylamine	sVOCs	18A-1:0-2cm	20	µg/kg	U	18A-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
Hexachloroethane	sVOCs	18A-1:0-2cm	20	µg/kg	U	18A-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
Nitrobenzene	sVOCs	18A-1:0-2cm	20	µg/kg	U	18A-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
Isophorone	sVOCs	18A-1:0-2cm	20	µg/kg	U	18A-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
2-Nitrophenol	sVOCs	18A-1:0-2cm	20	µg/kg	U	18A-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
2,4-Dimethylphenol	sVOCs	18A-1:0-2cm	98	µg/kg	U	18A-1:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Benzoic Acid	sVOCs	18A-1:0-2cm	200	µg/kg	U	18A-1:0-10cm	260	µg/kg	J	60	µg/kg	23.08%
bis(2-Chloroethoxy) Methane	sVOCs	18A-1:0-2cm	20	µg/kg	U	18A-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
2,4-Dichlorophenol	sVOCs	18A-1:0-2cm	98	µg/kg	U	18A-1:0-10cm	300	µg/kg	U	NC	µg/kg	NC
1,2,4-Trichlorobenzene	sVOCs	18A-1:0-2cm	20	µg/kg	U	18A-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
Naphthalene	sVOCs	18A-1:0-2cm	47	µg/kg		18A-1:0-10cm	50	µg/kg	J	3	µg/kg	6.00%
Carbon Normalized Naphthalene	CN-SVOC	18A-1:0-2cm	3.79	mg/kgOC		18A-1:0-10cm	2.45	mg/kgOC	J	-1.34	mg/kgOC	54.65%
4-Chloroaniline	sVOCs	18A-1:0-2cm	98	µg/kg	U	18A-1:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Hexachlorobutadiene	sVOCs	18A-1:0-2cm	20	µg/kg	U	18A-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
4-Chloro-3-methylphenol	sVOCs	18A-1:0-2cm	98	µg/kg	U	18A-1:0-10cm	300	µg/kg	U	NC	µg/kg	NC
2-Methylnaphthalene	sVOCs	18A-1:0-2cm	23	µg/kg		18A-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
Hexachlorocyclopentadiene	sVOCs	18A-1:0-2cm	98	µg/kg	U	18A-1:0-10cm	300	µg/kg	U	NC	µg/kg	NC
2,4,6-Trichlorophenol	sVOCs	18A-1:0-2cm	98	µg/kg	U	18A-1:0-10cm	300	µg/kg	U	NC	µg/kg	NC
2,4,5-Trichlorophenol	sVOCs	18A-1:0-2cm	98	µg/kg	U	18A-1:0-10cm	300	µg/kg	U	NC	µg/kg	NC
2-Chloronaphthalene	sVOCs	18A-1:0-2cm	20	µg/kg	U	18A-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
2-Nitroaniline	sVOCs	18A-1:0-2cm	98	µg/kg	U	18A-1:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Dimethylphthalate	sVOCs	18A-1:0-2cm	20	µg/kg	U	18A-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
Acenaphthylene	sVOCs	18A-1:0-2cm	21	µg/kg		18A-1:0-10cm	38	µg/kg	J	17	µg/kg	44.74%
Carbon Normalized Acenaphthylene	CN-SVOC	18A-1:0-2cm	1.69	mg/kgOC		18A-1:0-10cm	1.86	mg/kgOC	J	0.17	mg/kgOC	9.08%
3-Nitroaniline	sVOCs	18A-1:0-2cm	98	µg/kg	U	18A-1:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Acenaphthene	sVOCs	18A-1:0-2cm	54	µg/kg		18A-1:0-10cm	97	µg/kg		43	µg/kg	44.33%
Carbon Normalized Acenaphthene	CN-SVOC	18A-1:0-2cm	4.35	mg/kgOC		18A-1:0-10cm	4.75	mg/kgOC		0.40	mg/kgOC	8.41%
2,4-Dinitrophenol	sVOCs	18A-1:0-2cm	200	µg/kg	U	18A-1:0-10cm	590	µg/kg	U	NC	µg/kg	NC
4-Nitrophenol	sVOCs	18A-1:0-2cm	98	µg/kg	U	18A-1:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Dibenzofuran	sVOCs	18A-1:0-2cm	26	µg/kg		18A-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
2,6-Dinitrotoluene	sVOCs	18A-1:0-2cm	98	µg/kg	U	18A-1:0-10cm	300	µg/kg	U	NC	µg/kg	NC
2,4-Dinitrotoluene	sVOCs	18A-1:0-2cm	98	µg/kg	U	18A-1:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Diethylphthalate	sVOCs	18A-1:0-2cm	20	µg/kg	U	18A-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
4-Chlorophenyl-phenylether	sVOCs	18A-1:0-2cm	20	µg/kg	U	18A-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
Fluorene	sVOCs	18A-1:0-2cm	45	µg/kg		18A-1:0-10cm	120	µg/kg		75	µg/kg	62.50%
Carbon Normalized Fluorene	CN-SVOC	18A-1:0-2cm	3.63	mg/kgOC		18A-1:0-10cm	5.88	mg/kgOC		2.25	mg/kgOC	38.31%
4-Nitroaniline	sVOCs	18A-1:0-2cm	98	µg/kg	U	18A-1:0-10cm	300	µg/kg	U	NC	µg/kg	NC
4,6-Dinitro-2-Methylphenol	sVOCs	18A-1:0-2cm	200	µg/kg	U	18A-1:0-10cm	590	µg/kg	U	NC	µg/kg	NC
N-Nitrosodiphenylamine	sVOCs	18A-1:0-2cm	20	µg/kg	U	18A-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC

Table A-6 (Continued). Sample Locations: 18A-1

Result Parameter Name	Sampling Category	Sample IDs								Difference from 0-2cm to 0-10cm	Unit	% difference relative to the 0-10cm value
		0-2cm Sample ID	Value	Unit	Result Data Qualifier	0-10cm Sample ID	Value	Unit	Result Data Qualifier			
4-Bromophenyl-phenylether	sVOCs	18A-1:0-2cm	20	µg/kg	U	18A-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
Hexachlorobenzene	sVOCs	18A-1:0-2cm	20	µg/kg	U	18A-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
Pentachlorophenol	sVOCs	18A-1:0-2cm	98	µg/kg	U	18A-1:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Phenanthrene	sVOCs	18A-1:0-2cm	490	µg/kg		18A-1:0-10cm	710	µg/kg		220	µg/kg	30.99%
Carbon Normalized Phenanthrene	CN-SVOC	18A-1:0-2cm	39.52	mg/kgOC		18A-1:0-10cm	34.8	mg/kgOC		-4.71	mg/kgOC	13.54%
Carbazole	sVOCs	18A-1:0-2cm	39	µg/kg	Q	18A-1:0-10cm	130	µg/kg	Q	91	µg/kg	70.00%
Anthracene	sVOCs	18A-1:0-2cm	110	µg/kg		18A-1:0-10cm	360	µg/kg		250	µg/kg	69.44%
Carbon Normalized Anthracene	CN-SVOC	18A-1:0-2cm	8.87	mg/kgOC		18A-1:0-10cm	17.65	mg/kgOC		8.78	mg/kgOC	49.73%
Di-n-Butylphthalate	sVOCs	18A-1:0-2cm	120	µg/kg		18A-1:0-10cm	210	µg/kg		90	µg/kg	42.86%
Fluoranthene	sVOCs	18A-1:0-2cm	840	µg/kg		18A-1:0-10cm	950	µg/kg		110.00	µg/kg	11.58%
Carbon Normalized Fluoranthene	CN-SVOC	18A-1:0-2cm	67.74	mg/kgOC		18A-1:0-10cm	46.57	mg/kgOC		-21.17	mg/kgOC	45.47%
Pyrene	sVOCs	18A-1:0-2cm	770	µg/kg		18A-1:0-10cm	850	µg/kg		80	µg/kg	9.41%
Carbon Normalized Pyrene	CN-SVOC	18A-1:0-2cm	62.10	mg/kgOC		18A-1:0-10cm	41.67	mg/kgOC		-20.43	mg/kgOC	49.03%
Butylbenzylphthalate	sVOCs	18A-1:0-2cm	20	µg/kg	U	18A-1:0-10cm	83	µg/kg		NC	µg/kg	NC
3,3'-Dichlorobenzidine	sVOCs	18A-1:0-2cm	98	µg/kg	U	18A-1:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Benzo(a)anthracene	sVOCs	18A-1:0-2cm	370	µg/kg		18A-1:0-10cm	350	µg/kg		-20	µg/kg	5.71%
Carbon Normalized Benzo(a)anthracene	CN-SVOC	18A-1:0-2cm	29.84	mg/kgOC		18A-1:0-10cm	17.16	mg/kgOC		-12.68	mg/kgOC	73.92%
bis(2-Ethylhexyl)phthalate	sVOCs	18A-1:0-2cm	340	µg/kg		18A-1:0-10cm	250	µg/kg		-90	µg/kg	36.00%
Chrysene	sVOCs	18A-1:0-2cm	470	µg/kg		18A-1:0-10cm	560	µg/kg		90	µg/kg	16.07%
Carbon Normalized Chrysene	CN-SVOC	18A-1:0-2cm	37.9	mg/kgOC		18A-1:0-10cm	27.45	mg/kgOC		-10.45	mg/kgOC	38.08%
Di-n-Octyl phthalate	sVOCs	18A-1:0-2cm	20	µg/kg	U	18A-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
Benzo(a)pyrene	sVOCs	18A-1:0-2cm	350	µg/kg		18A-1:0-10cm	470	µg/kg		120	µg/kg	25.53%
Carbon Normalized Benzo(a)pyrene	CN-SVOC	18A-1:0-2cm	28.23	mg/kgOC		18A-1:0-10cm	23.04	mg/kgOC		-5.19	mg/kgOC	22.51%
Indeno(1,2,3-cd)pyrene	sVOCs	18A-1:0-2cm	270	µg/kg		18A-1:0-10cm	290	µg/kg		20.00	µg/kg	6.90%
Carbon Normalized Indeno(1,2,3-cd)pyrene	CN-SVOC	18A-1:0-2cm	21.77	mg/kgOC		18A-1:0-10cm	14.22	mg/kgOC		-7.56	mg/kgOC	53.17%
Dibenzo(a,h)anthracene	sVOCs	18A-1:0-2cm	93	µg/kg		18A-1:0-10cm	94	µg/kg		1	µg/kg	1.06%
Carbon Normalized Dibenzo(a,h)anthracene	CN-SVOC	18A-1:0-2cm	7.5	mg/kgOC		18A-1:0-10cm	4.61	mg/kgOC		-2.89	mg/kgOC	62.77%
Benzo(g,h,i)perylene	sVOCs	18A-1:0-2cm	270	µg/kg		18A-1:0-10cm	360	µg/kg		90	µg/kg	25.00%
Carbon Normalized Benzo(g,h,i)perylene	CN-SVOC	18A-1:0-2cm	21.77	mg/kgOC		18A-1:0-10cm	17.65	mg/kgOC		-4.13	mg/kgOC	23.39%
1-Methylnaphthalene	sVOCs	18A-1:0-2cm	15	µg/kg	J	18A-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
Total Benzofluoranthenes	sVOCs	18A-1:0-2cm	660	µg/kg		18A-1:0-10cm	890	µg/kg		230	µg/kg	25.84%
Carbon Normalized Total Benzofluoranthenes	CN-SVOC	18A-1:0-2cm	53.23	mg/kgOC		18A-1:0-10cm	43.63	mg/kgOC		-9.60	mg/kgOC	22.00%

*TOC value outside range normally accepted for use in carbon normalization.

Calculated value - not in the EDD

NC = not calculated. If analyltes are not detected, carbon normalized values and differences are not calculated. Also, if TOC value is outside the 0.5 to 3.5 range, carbon normalized values are not calculated.

Table A-7. Sample Locations: 18A-2

Result Parameter Name	Sampling Category	Sample IDs								Difference from 0-2cm to 0-10cm	Unit	% difference relative to the 0-10cm value
		0-2cm Sample ID	Value	Unit	Result Data Qualifier	0-10cm Sample ID	Value	Unit	Result Data Qualifier			
Total Solids	TS	18A-2:0-2cm	74.74	%		18A-2:0-10cm	28.96	%		-45.78	%	158.08%
Total Organic Carbon	TOC	18A-2:0-2cm	0.98	%		18A-2:0-10cm	4.79	%	*	3.81	%	79.54%
Total PCBs	PCBs	18A-2:0-2cm	294.2	µg/kg		18A-2:0-10cm	694	µg/kg		399.8	%	57.61%
Carbon-normalized Total PCBs	CN-PCBs	18A-2:0-2cm	30.02	mg/kgOC		18A-2:0-10cm	NC	mg/kgOC		NC	mg/kgOC	NC
Particle/Grain Size > 2mm (Gravel)	Grain Size	18A-2:0-2cm	7.1	%		18A-2:0-10cm	7.3	%		0.2	%	2.74%
Particle/Grain Size, 2mm - 1mm (Very Coarse Sand)	Grain Size	18A-2:0-2cm	17.5	%		18A-2:0-10cm	11	%		-6.5	%	59.09%
Particle/Grain Size, 1mm - 0.5mm (Coarse Sand)	Grain Size	18A-2:0-2cm	41.7	%		18A-2:0-10cm	3.6	%		-38.1	%	1058.33%
Particle/Grain Size, 0.5mm - 0.25mm (Medium Sand)	Grain Size	18A-2:0-2cm	21.2	%		18A-2:0-10cm	1.7	%		-19.5	%	1147.06%
Particle/Grain Size, 0.25mm - 0.125mm (Fine Sand)	Grain Size	18A-2:0-2cm	5	%		18A-2:0-10cm	1.4	%		-3.6	%	257.14%
Particle/Grain Size, 125µm - 63µm (Very Fine Sand)	Grain Size	18A-2:0-2cm	1.7	%		18A-2:0-10cm	2.4	%		0.7	%	29.17%
Particle/Grain Size, 63µm - 31µm (Silt)	Grain Size	18A-2:0-2cm	0.8	%		18A-2:0-10cm	5.1	%		4.3	%	84.31%
Particle/Grain Size, 31µm - 15.6µm (Silt)	Grain Size	18A-2:0-2cm	0.8	%		18A-2:0-10cm	21.1	%		20.3	%	96.21%
Particle/Grain Size, 15.6µm - 7.8µm (Silt)	Grain Size	18A-2:0-2cm	1	%		18A-2:0-10cm	17.2	%		16.2	%	94.19%
Particle/Grain Size, 7.8µm - 3.9µm (Silt)	Grain Size	18A-2:0-2cm	0.5	%		18A-2:0-10cm	4.7	%		4.2	%	89.36%
Particle/Grain Size, 3.9µm - 2.0µm (Clay)	Grain Size	18A-2:0-2cm	0.7	%		18A-2:0-10cm	6.3	%		5.6	%	88.89%
Particle/Grain Size, 2.0µm - 1.0µm (Clay)	Grain Size	18A-2:0-2cm	0.6	%		18A-2:0-10cm	5.5	%		4.9	%	89.09%
Particle/Grain Size < 1.0µm (Clay)	Grain Size	18A-2:0-2cm	1.4	%		18A-2:0-10cm	12.9	%		11.5	%	89.15%
Particle/Grain Size, Fines (Silt/Clay)	Grain Size	18A-2:0-2cm	5.8	%		18A-2:0-10cm	72.7	%		66.9	%	92.02%
Aluminum	Metals	18A-2:0-2cm	16900	mg/kg		18A-2:0-10cm	19400	mg/kg		2500	mg/kg	12.89%
Antimony	Metals	18A-2:0-2cm	8	mg/kg		18A-2:0-10cm	0.7	mg/kg	U	NC	mg/kg	NC
Arsenic	Metals	18A-2:0-2cm	643	mg/kg		18A-2:0-10cm	18.2	mg/kg		-624.8	mg/kg	3432.97%
Barium	Metals	18A-2:0-2cm	1130	mg/kg		18A-2:0-10cm	54	mg/kg		-1076	mg/kg	1992.59%
Beryllium	Metals	18A-2:0-2cm	1.7	mg/kg		18A-2:0-10cm	0.7	mg/kg	U	NC	mg/kg	NC
Cadmium	Metals	18A-2:0-2cm	1.2	mg/kg		18A-2:0-10cm	2.5	mg/kg		1.3	mg/kg	52.00%
Calcium	Metals	18A-2:0-2cm	86100	mg/kg		18A-2:0-10cm	12700	mg/kg		-73400	mg/kg	577.95%
Chromium	Metals	18A-2:0-2cm	162	mg/kg		18A-2:0-10cm	54	mg/kg		-108	mg/kg	200.00%
Cobalt	Metals	18A-2:0-2cm	52.1	mg/kg		18A-2:0-10cm	10.2	mg/kg		-41.9	mg/kg	410.78%
Copper	Metals	18A-2:0-2cm	1380	mg/kg		18A-2:0-10cm	297	mg/kg		-1083	mg/kg	364.65%
Iron	Metals	18A-2:0-2cm	1E+05	mg/kg		18A-2:0-10cm	30000	mg/kg		-75000	mg/kg	250.00%
Lead	Metals	18A-2:0-2cm	992	mg/kg		18A-2:0-10cm	84.7	mg/kg		-907.3	mg/kg	1071.19%
Magnesium	Metals	18A-2:0-2cm	10900	mg/kg		18A-2:0-10cm	10800	mg/kg		-100	mg/kg	0.93%
Manganese	Metals	18A-2:0-2cm	2800	mg/kg		18A-2:0-10cm	329	mg/kg		-2471	mg/kg	751.06%
Mercury	Mercury	18A-2:0-2cm	0.35	mg/kg		18A-2:0-10cm	0.87	mg/kg		0.52	mg/kg	59.77%
Nickel	Metals	18A-2:0-2cm	58.7	mg/kg		18A-2:0-10cm	51	mg/kg		-7.7	mg/kg	15.10%
Potassium	Metals	18A-2:0-2cm	4390	mg/kg		18A-2:0-10cm	3820	mg/kg		-570	mg/kg	14.92%
Selenium	Metals	18A-2:0-2cm	2.3	mg/kg		18A-2:0-10cm	3	mg/kg		0.7	mg/kg	23.33%
Silver	Metals	18A-2:0-2cm	3	mg/kg		18A-2:0-10cm	0.9	mg/kg		-2.1	mg/kg	233.33%
Sodium	Metals	18A-2:0-2cm	6000	mg/kg		18A-2:0-10cm	27600	mg/kg		21600	mg/kg	78.26%
Thallium	Metals	18A-2:0-2cm	0.4	mg/kg		18A-2:0-10cm	0.7	mg/kg	U	NC	mg/kg	NC
Vanadium	Metals	18A-2:0-2cm	40.8	mg/kg		18A-2:0-10cm	54.2	mg/kg		13.4	mg/kg	24.72%
Zinc	Metals	18A-2:0-2cm	4970	mg/kg		18A-2:0-10cm	340	mg/kg		-4630	mg/kg	1361.76%
Phenol	sVOCs	18A-2:0-2cm	480	µg/kg		18A-2:0-10cm	54	µg/kg	J	-426	µg/kg	788.89%
Bis-(2-Chloroethyl) Ether	sVOCs	18A-2:0-2cm	19	µg/kg	U	18A-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
2-Chlorophenol	sVOCs	18A-2:0-2cm	19	µg/kg	U	18A-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
1,3-Dichlorobenzene	sVOCs	18A-2:0-2cm	19	µg/kg	U	18A-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC

Table A-7 (Continued). Sample Locations: 18A-2

Result Parameter Name	Sampling Category	Sample IDs								Difference from 0-2cm to 0-10cm	Unit	% difference relative to the 0-10cm value
		0-2cm Sample ID	Value	Unit	Result Data Qualifier	0-10cm Sample ID	Value	Unit	Result Data Qualifier			
1,4-Dichlorobenzene	sVOCs	18A-2:0-2cm	19	µg/kg	U	18A-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
Benzyl Alcohol	sVOCs	18A-2:0-2cm	19	µg/kg	U	18A-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
1,2-Dichlorobenzene	sVOCs	18A-2:0-2cm	18	µg/kg	J	18A-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
2-Methylphenol	sVOCs	18A-2:0-2cm	34	µg/kg		18A-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
2,2'-Oxybis(1-Chloropropane)	sVOCs	18A-2:0-2cm	19	µg/kg	U	18A-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
4-Methylphenol	sVOCs	18A-2:0-2cm	61	µg/kg		18A-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
N-Nitroso-Di-N-Propylamine	sVOCs	18A-2:0-2cm	19	µg/kg	U	18A-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
Hexachloroethane	sVOCs	18A-2:0-2cm	19	µg/kg	U	18A-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
Nitrobenzene	sVOCs	18A-2:0-2cm	19	µg/kg	U	18A-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
Isophorone	sVOCs	18A-2:0-2cm	19	µg/kg	U	18A-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
2-Nitrophenol	sVOCs	18A-2:0-2cm	19	µg/kg	U	18A-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
2,4-Dimethylphenol	sVOCs	18A-2:0-2cm	94	µg/kg	U	18A-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Benzoic Acid	sVOCs	18A-2:0-2cm	190	µg/kg	U	18A-2:0-10cm	600	µg/kg	U	NC	µg/kg	NC
bis(2-Chloroethoxy) Methane	sVOCs	18A-2:0-2cm	19	µg/kg	U	18A-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
2,4-Dichlorophenol	sVOCs	18A-2:0-2cm	94	µg/kg	U	18A-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
1,2,4-Trichlorobenzene	sVOCs	18A-2:0-2cm	19	µg/kg	U	18A-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
Naphthalene	sVOCs	18A-2:0-2cm	45	µg/kg		18A-2:0-10cm	42	µg/kg	J	-3	µg/kg	7.14%
Carbon Normalized Naphthalene	CN-SVOC	18A-2:0-2cm	4.59	mg/kgOC		18A-2:0-10cm	NC	mg/kgOC		NC	mg/kgOC	NC
4-Chloroaniline	sVOCs	18A-2:0-2cm	94	µg/kg	U	18A-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Hexachlorobutadiene	sVOCs	18A-2:0-2cm	19	µg/kg	U	18A-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
4-Chloro-3-methylphenol	sVOCs	18A-2:0-2cm	94	µg/kg	U	18A-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
2-Methylnaphthalene	sVOCs	18A-2:0-2cm	24	µg/kg		18A-2:0-10cm	33	µg/kg	J	9	µg/kg	27.27%
Hexachlorocyclopentadiene	sVOCs	18A-2:0-2cm	94	µg/kg	U	18A-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
2,4,6-Trichlorophenol	sVOCs	18A-2:0-2cm	94	µg/kg	U	18A-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
2,4,5-Trichlorophenol	sVOCs	18A-2:0-2cm	94	µg/kg	U	18A-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
2-Chloronaphthalene	sVOCs	18A-2:0-2cm	19	µg/kg	U	18A-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
2-Nitroaniline	sVOCs	18A-2:0-2cm	94	µg/kg	U	18A-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Dimethylphthalate	sVOCs	18A-2:0-2cm	19	µg/kg	U	18A-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
Acenaphthylene	sVOCs	18A-2:0-2cm	12	µg/kg	J	18A-2:0-10cm	45	µg/kg	J	33	µg/kg	73.33%
Carbon Normalized Acenaphthylene	CN-SVOC	18A-2:0-2cm	1.22	mg/kgOC		18A-2:0-10cm	NC	mg/kgOC		NC	mg/kgOC	NC
3-Nitroaniline	sVOCs	18A-2:0-2cm	94	µg/kg	U	18A-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Acenaphthene	sVOCs	18A-2:0-2cm	57	µg/kg		18A-2:0-10cm	99	µg/kg		42	µg/kg	42.42%
Carbon Normalized Acenaphthene	CN-SVOC	18A-2:0-2cm	5.82	mg/kgOC		18A-2:0-10cm	NC	mg/kgOC		NC	mg/kgOC	NC
2,4-Dinitrophenol	sVOCs	18A-2:0-2cm	190	µg/kg	U	18A-2:0-10cm	600	µg/kg	U	NC	µg/kg	NC
4-Nitrophenol	sVOCs	18A-2:0-2cm	94	µg/kg	U	18A-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Dibenzofuran	sVOCs	18A-2:0-2cm	32	µg/kg		18A-2:0-10cm	42	µg/kg	J	10	µg/kg	23.81%
2,6-Dinitrotoluene	sVOCs	18A-2:0-2cm	94	µg/kg	U	18A-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
2,4-Dinitrotoluene	sVOCs	18A-2:0-2cm	94	µg/kg	U	18A-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Diethylphthalate	sVOCs	18A-2:0-2cm	19	µg/kg	U	18A-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
4-Chlorophenyl-phenylether	sVOCs	18A-2:0-2cm	19	µg/kg	U	18A-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
Fluorene	sVOCs	18A-2:0-2cm	46	µg/kg		18A-2:0-10cm	84	µg/kg		38	µg/kg	45.24%
Carbon Normalized Fluorene	CN-SVOC	18A-2:0-2cm	4.69	mg/kgOC		18A-2:0-10cm	NC	mg/kgOC		NC	mg/kgOC	NC
4-Nitroaniline	sVOCs	18A-2:0-2cm	94	µg/kg	U	18A-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
4,6-Dinitro-2-Methylphenol	sVOCs	18A-2:0-2cm	190	µg/kg	U	18A-2:0-10cm	600	µg/kg	U	NC	µg/kg	NC
N-Nitrosodiphenylamine	sVOCs	18A-2:0-2cm	19	µg/kg	U	18A-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC

Table A-7 (Continued). Sample Locations: 18A-2

Result Parameter Name	Sampling Category	Sample IDs								Difference from 0-2cm to 0-10cm	Unit	% difference relative to the 0-10cm value
		0-2cm Sample ID	Value	Unit	Result Data Qualifier	0-10cm Sample ID	Value	Unit	Result Data Qualifier			
4-Bromophenyl-phenylether	sVOCs	18A-2:0-2cm	19	µg/kg	U	18A-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
Hexachlorobenzene	sVOCs	18A-2:0-2cm	19	µg/kg	U	18A-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
Pentachlorophenol	sVOCs	18A-2:0-2cm	94	µg/kg	U	18A-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Phenanthrene	sVOCs	18A-2:0-2cm	370	µg/kg		18A-2:0-10cm	540	µg/kg		170	µg/kg	31.48%
Carbon Normalized Phenanthrene	CN-SVOC	18A-2:0-2cm	37.76	mg/kgOC		18A-2:0-10cm	NC	mg/kgOC		NC	mg/kgOC	NC
Carbazole	sVOCs	18A-2:0-2cm	54	µg/kg	Q	18A-2:0-10cm	90	µg/kg	Q	36	µg/kg	40.00%
Anthracene	sVOCs	18A-2:0-2cm	94	µg/kg		18A-2:0-10cm	160	µg/kg		66	µg/kg	41.25%
Carbon Normalized Anthracene	CN-SVOC	18A-2:0-2cm	9.59	mg/kgOC		18A-2:0-10cm	NC	mg/kgOC		NC	mg/kgOC	NC
Di-n-Butylphthalate	sVOCs	18A-2:0-2cm	82	µg/kg		18A-2:0-10cm	530	µg/kg		448	µg/kg	84.53%
Fluoranthene	sVOCs	18A-2:0-2cm	1000	µg/kg		18A-2:0-10cm	880	µg/kg		-120	µg/kg	13.64%
Carbon Normalized Fluoranthene	CN-SVOC	18A-2:0-2cm	102	mg/kgOC		18A-2:0-10cm	NC	mg/kgOC		NC	mg/kgOC	NC
Pyrene	sVOCs	18A-2:0-2cm	890	µg/kg		18A-2:0-10cm	860	µg/kg		-30	µg/kg	3.49%
Carbon Normalized Pyrene	CN-SVOC	18A-2:0-2cm	90.82	mg/kgOC		18A-2:0-10cm	NC	mg/kgOC		NC	mg/kgOC	NC
Butylbenzylphthalate	sVOCs	18A-2:0-2cm	270	µg/kg		18A-2:0-10cm	250	µg/kg		-20	µg/kg	8.00%
3,3'-Dichlorobenzidine	sVOCs	18A-2:0-2cm	94	µg/kg	U	18A-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Benzo(a)anthracene	sVOCs	18A-2:0-2cm	260	µg/kg		18A-2:0-10cm	410	µg/kg		150	µg/kg	36.59%
Carbon Normalized Benzo(a)anthracene	CN-SVOC	18A-2:0-2cm	26.53	mg/kgOC		18A-2:0-10cm	NC	mg/kgOC		NC	mg/kgOC	NC
bis(2-Ethylhexyl)phthalate	sVOCs	18A-2:0-2cm	150	µg/kg		18A-2:0-10cm	400	µg/kg		250	µg/kg	62.50%
Chrysene	sVOCs	18A-2:0-2cm	310	µg/kg		18A-2:0-10cm	620	µg/kg		310	µg/kg	50.00%
Carbon Normalized Chrysene	CN-SVOC	18A-2:0-2cm	31.63	mg/kgOC		18A-2:0-10cm	NC	mg/kgOC		NC	mg/kgOC	NC
Di-n-Octyl phthalate	sVOCs	18A-2:0-2cm	19	µg/kg	U	18A-2:0-10cm	60	µg/kg	U	NC	µg/kg	NC
Benzo(a)pyrene	sVOCs	18A-2:0-2cm	160	µg/kg		18A-2:0-10cm	460	µg/kg		300	µg/kg	65.22%
Carbon Normalized Benzo(a)pyrene	CN-SVOC	18A-2:0-2cm	16.33	mg/kgOC		18A-2:0-10cm	NC	mg/kgOC		NC	mg/kgOC	NC
Indeno(1,2,3-cd)pyrene	sVOCs	18A-2:0-2cm	110	µg/kg		18A-2:0-10cm	260	µg/kg		150	µg/kg	57.69%
Carbon Normalized Indeno(1,2,3-cd)pyrene	CN-SVOC	18A-2:0-2cm	11.22	mg/kgOC		18A-2:0-10cm	NC	mg/kgOC		NC	mg/kgOC	NC
Dibenzo(a,h)anthracene	sVOCs	18A-2:0-2cm	39	µg/kg		18A-2:0-10cm	87	µg/kg		48	µg/kg	55.17%
Carbon Normalized Dibenzo(a,h)anthracene	CN-SVOC	18A-2:0-2cm	3.98	mg/kgOC		18A-2:0-10cm	NC	mg/kgOC		NC	mg/kgOC	NC
Benzo(g,h,i)perylene	sVOCs	18A-2:0-2cm	110	µg/kg		18A-2:0-10cm	300	µg/kg		190	µg/kg	63.33%
Carbon Normalized Benzo(g,h,i)perylene	CN-SVOC	18A-2:0-2cm	11.22	mg/kgOC		18A-2:0-10cm	NC	mg/kgOC		NC	mg/kgOC	NC
1-Methylnaphthalene	sVOCs	18A-2:0-2cm	16	µg/kg	J	18A-2:0-10cm	27	µg/kg	J	11	µg/kg	40.74%
Total Benzofluoranthenes	sVOCs	18A-2:0-2cm	330	µg/kg		18A-2:0-10cm	910	µg/kg		580	µg/kg	63.74%
Carbon Normalized Total Benzofluoranthenes	CN-SVOC	18A-2:0-2cm	33.67	mg/kgOC		18A-2:0-10cm	NC	mg/kgOC		NC	mg/kgOC	NC

*TOC value outside range normally accepted for use in carbon normalization.

Calculated value - not in the EDD

NC = not calculated. If analyltes are not detected, carbon normalized values and differences are not calculated. Also, if TOC value is outside the 0.5 to 3.5 range, carbon normalized values are not calculated.

Table A-8. Sample Locations: 18A-3

Result Parameter Name	Sampling Category	Sample IDs								Difference from 0-2cm to 0-10cm	Unit	% difference relative to the 0-10cm value
		0-2cm Sample ID	Value	Unit	Result Data Qualifier	0-10cm Sample ID	Value	Unit	Result Data Qualifier			
Total Solids	TS	18A-3:0-2cm	22.95	%		18A-3:0-10cm	79.42	%		56.47	%	71.10%
Total Organic Carbon	TOC	18A-3:0-2cm	2.66	%		18A-3:0-10cm	0.799	%		-1.861	%	232.92%
Total PCBs	PCBs	18A-3:0-2cm	377.8	µg/kg		18A-3:0-10cm	272	µg/kg		-105.8	%	38.90%
Carbon-normalized Total PCBs	CN-PCBs	18A-3:0-2cm	14.2	mg/kgOC		18A-3:0-10cm	34.04	mg/kgOC		19.84	mg/kgOC	58.28%
Particle/Grain Size > 2mm (Gravel)	Grain Size	18A-3:0-2cm	1.3	%		18A-3:0-10cm	8.8	%		7.5	%	85.23%
Particle/Grain Size, 2mm - 1mm (Very Coarse Sand)	Grain Size	18A-3:0-2cm	1.4	%		18A-3:0-10cm	7.5	%		6.1	%	81.33%
Particle/Grain Size, 1mm - 0.5mm (Coarse Sand)	Grain Size	18A-3:0-2cm	2.2	%		18A-3:0-10cm	29.7	%		27.5	%	92.59%
Particle/Grain Size, 0.5mm - 0.25mm (Medium Sand)	Grain Size	18A-3:0-2cm	1.5	%		18A-3:0-10cm	41.4	%		39.9	%	96.38%
Particle/Grain Size, 0.25mm - 0.125mm (Fine Sand)	Grain Size	18A-3:0-2cm	1.4	%		18A-3:0-10cm	7.3	%		5.9	%	80.82%
Particle/Grain Size, 125µm - 63µm (Very Fine Sand)	Grain Size	18A-3:0-2cm	2.2	%		18A-3:0-10cm	1.2	%		-1	%	83.33%
Particle/Grain Size, 63µm - 31µm (Silt)	Grain Size	18A-3:0-2cm	3.5	%		18A-3:0-10cm	4.1	%	U	0.6	%	14.63%
Particle/Grain Size, 31µm - 15.6µm (Silt)	Grain Size	18A-3:0-2cm	29.5	%		18A-3:0-10cm	4.1	%	U	-25.4	%	619.51%
Particle/Grain Size, 15.6µm - 7.8µm (Silt)	Grain Size	18A-3:0-2cm	19.5	%		18A-3:0-10cm	4.1	%	U	-15.4	%	375.61%
Particle/Grain Size, 7.8µm - 3.9µm (Silt)	Grain Size	18A-3:0-2cm	7.9	%		18A-3:0-10cm	4.1	%	U	-3.8	%	92.68%
Particle/Grain Size, 3.9µm - 2.0µm (Clay)	Grain Size	18A-3:0-2cm	6.3	%		18A-3:0-10cm	4.1	%	U	-2.2	%	53.66%
Particle/Grain Size, 2.0µm - 1.0µm (Clay)	Grain Size	18A-3:0-2cm	7.4	%		18A-3:0-10cm	4.1	%	U	-3.3	%	80.49%
Particle/Grain Size < 1.0µm (Clay)	Grain Size	18A-3:0-2cm	16	%		18A-3:0-10cm	4.1	%	U	-11.9	%	290.24%
Particle/Grain Size, Fines (Silt/Clay)	Grain Size	18A-3:0-2cm	90	%		18A-3:0-10cm	4.1	%		-85.9	%	2095.12%
Aluminum	Metals	18A-3:0-2cm	19600	mg/kg		18A-3:0-10cm	14000	mg/kg		-5600	mg/kg	40.00%
Antimony	Metals	18A-3:0-2cm	0.9	mg/kg	U	18A-3:0-10cm	3.7	mg/kg		NC	mg/kg	NC
Arsenic	Metals	18A-3:0-2cm	15.6	mg/kg		18A-3:0-10cm	290	mg/kg		274.4	mg/kg	94.62%
Barium	Metals	18A-3:0-2cm	56	mg/kg		18A-3:0-10cm	1090	mg/kg		1034	mg/kg	94.86%
Beryllium	Metals	18A-3:0-2cm	0.9	mg/kg	U	18A-3:0-10cm	0.9	mg/kg		NC	mg/kg	NC
Cadmium	Metals	18A-3:0-2cm	2.5	mg/kg		18A-3:0-10cm	0.5	mg/kg		-2	mg/kg	400.00%
Calcium	Metals	18A-3:0-2cm	9980	mg/kg		18A-3:0-10cm	53500	mg/kg		43520	mg/kg	81.35%
Chromium	Metals	18A-3:0-2cm	53	mg/kg		18A-3:0-10cm	93.6	mg/kg		40.6	mg/kg	43.38%
Cobalt	Metals	18A-3:0-2cm	10.2	mg/kg		18A-3:0-10cm	33.2	mg/kg		23	mg/kg	69.28%
Copper	Metals	18A-3:0-2cm	268	mg/kg		18A-3:0-10cm	1950	mg/kg		1682	mg/kg	86.26%
Iron	Metals	18A-3:0-2cm	30400	mg/kg		18A-3:0-10cm	97500	mg/kg		67100	mg/kg	68.82%
Lead	Metals	18A-3:0-2cm	77.5	mg/kg		18A-3:0-10cm	781	mg/kg		703.5	mg/kg	90.08%
Magnesium	Metals	18A-3:0-2cm	11900	mg/kg		18A-3:0-10cm	8850	mg/kg		-3050	mg/kg	34.46%
Manganese	Metals	18A-3:0-2cm	357	mg/kg		18A-3:0-10cm	1560	mg/kg		1203	mg/kg	77.12%
Mercury	Mercury	18A-3:0-2cm	1.06	mg/kg		18A-3:0-10cm	7	mg/kg		5.94	mg/kg	84.86%
Nickel	Metals	18A-3:0-2cm	48	mg/kg		18A-3:0-10cm	68.5	mg/kg		20.5	mg/kg	29.93%
Potassium	Metals	18A-3:0-2cm	4270	mg/kg		18A-3:0-10cm	2990	mg/kg		-1280	mg/kg	42.81%
Selenium	Metals	18A-3:0-2cm	2	mg/kg		18A-3:0-10cm	1.7	mg/kg		-0.3	mg/kg	17.65%
Silver	Metals	18A-3:0-2cm	0.9	mg/kg	U	18A-3:0-10cm	2.5	mg/kg		NC	mg/kg	NC
Sodium	Metals	18A-3:0-2cm	35700	mg/kg		18A-3:0-10cm	4370	mg/kg		-31330	mg/kg	716.93%
Thallium	Metals	18A-3:0-2cm	0.9	mg/kg	U	18A-3:0-10cm	0.2	mg/kg	U	NC	mg/kg	NC
Vanadium	Metals	18A-3:0-2cm	52.9	mg/kg		18A-3:0-10cm	50.9	mg/kg		-2	mg/kg	3.93%
Zinc	Metals	18A-3:0-2cm	300	mg/kg		18A-3:0-10cm	3770	mg/kg		3470	mg/kg	92.04%
Phenol	sVOCs	18A-3:0-2cm	32	µg/kg	J	18A-3:0-10cm	490	µg/kg		458	µg/kg	93.47%
Bis-(2-Chloroethyl) Ether	sVOCs	18A-3:0-2cm	59	µg/kg	U	18A-3:0-10cm	20	µg/kg	U	NC	µg/kg	NC
2-Chlorophenol	sVOCs	18A-3:0-2cm	59	µg/kg	U	18A-3:0-10cm	20	µg/kg	U	NC	µg/kg	NC

Table A-8 (Continued). Sample Locations: 18A-3

Result Parameter Name	Sampling Category	Sample IDs								Difference from 0-2cm to 0-10cm	Unit	% difference relative to the 0-10cm value
		0-2cm Sample ID	Value	Unit	Result Data Qualifier	0-10cm Sample ID	Value	Unit	Result Data Qualifier			
1,3-Dichlorobenzene	sVOCs	18A-3:0-2cm	59	µg/kg	U	18A-3:0-10cm	20	µg/kg	U	NC	µg/kg	NC
1,4-Dichlorobenzene	sVOCs	18A-3:0-2cm	59	µg/kg	U	18A-3:0-10cm	20	µg/kg	U	NC	µg/kg	NC
Benzyl Alcohol	sVOCs	18A-3:0-2cm	59	µg/kg	U	18A-3:0-10cm	20	µg/kg	U	NC	µg/kg	NC
1,2-Dichlorobenzene	sVOCs	18A-3:0-2cm	59	µg/kg	U	18A-3:0-10cm	20	µg/kg	U	NC	µg/kg	NC
2-Methylphenol	sVOCs	18A-3:0-2cm	59	µg/kg	U	18A-3:0-10cm	20	µg/kg	U	NC	µg/kg	NC
2,2'-Oxybis(1-Chloropropane)	sVOCs	18A-3:0-2cm	59	µg/kg	U	18A-3:0-10cm	20	µg/kg	U	NC	µg/kg	NC
4-Methylphenol	sVOCs	18A-3:0-2cm	59	µg/kg	U	18A-3:0-10cm	20	µg/kg	U	NC	µg/kg	NC
N-Nitroso-Di-N-Propylamine	sVOCs	18A-3:0-2cm	59	µg/kg	U	18A-3:0-10cm	20	µg/kg	U	NC	µg/kg	NC
Hexachloroethane	sVOCs	18A-3:0-2cm	59	µg/kg	U	18A-3:0-10cm	20	µg/kg	U	NC	µg/kg	NC
Nitrobenzene	sVOCs	18A-3:0-2cm	59	µg/kg	U	18A-3:0-10cm	20	µg/kg	U	NC	µg/kg	NC
Isophorone	sVOCs	18A-3:0-2cm	59	µg/kg	U	18A-3:0-10cm	20	µg/kg	U	NC	µg/kg	NC
2-Nitrophenol	sVOCs	18A-3:0-2cm	59	µg/kg	U	18A-3:0-10cm	20	µg/kg	U	NC	µg/kg	NC
2,4-Dimethylphenol	sVOCs	18A-3:0-2cm	300	µg/kg	U	18A-3:0-10cm	99	µg/kg	U	NC	µg/kg	NC
Benzoic Acid	sVOCs	18A-3:0-2cm	590	µg/kg	U	18A-3:0-10cm	200	µg/kg	U	NC	µg/kg	NC
bis(2-Chloroethoxy) Methane	sVOCs	18A-3:0-2cm	59	µg/kg	U	18A-3:0-10cm	20	µg/kg	U	NC	µg/kg	NC
2,4-Dichlorophenol	sVOCs	18A-3:0-2cm	300	µg/kg	U	18A-3:0-10cm	99	µg/kg	U	NC	µg/kg	NC
1,2,4-Trichlorobenzene	sVOCs	18A-3:0-2cm	59	µg/kg	U	18A-3:0-10cm	20	µg/kg	U	NC	µg/kg	NC
Naphthalene	sVOCs	18A-3:0-2cm	30	µg/kg	J	18A-3:0-10cm	17	µg/kg	J	-13	µg/kg	76.47%
Carbon Normalized Naphthalene	CN-SVOC	18A-3:0-2cm	1.13	mg/kgOC	J	18A-3:0-10cm	2.13	mg/kgOC	J	1.00	mg/kgOC	46.99%
4-Chloroaniline	sVOCs	18A-3:0-2cm	300	µg/kg	U	18A-3:0-10cm	99	µg/kg	U	NC	µg/kg	NC
Hexachlorobutadiene	sVOCs	18A-3:0-2cm	59	µg/kg	U	18A-3:0-10cm	20	µg/kg	U	NC	µg/kg	NC
4-Chloro-3-methylphenol	sVOCs	18A-3:0-2cm	300	µg/kg	U	18A-3:0-10cm	99	µg/kg	U	NC	µg/kg	NC
2-Methylnaphthalene	sVOCs	18A-3:0-2cm	59	µg/kg	U	18A-3:0-10cm	20	µg/kg	U	NC	µg/kg	NC
Hexachlorocyclopentadiene	sVOCs	18A-3:0-2cm	300	µg/kg	U	18A-3:0-10cm	99	µg/kg	U	NC	µg/kg	NC
2,4,6-Trichlorophenol	sVOCs	18A-3:0-2cm	300	µg/kg	U	18A-3:0-10cm	99	µg/kg	U	NC	µg/kg	NC
2,4,5-Trichlorophenol	sVOCs	18A-3:0-2cm	300	µg/kg	U	18A-3:0-10cm	99	µg/kg	U	NC	µg/kg	NC
2-Chloronaphthalene	sVOCs	18A-3:0-2cm	59	µg/kg	U	18A-3:0-10cm	20	µg/kg	U	NC	µg/kg	NC
2-Nitroaniline	sVOCs	18A-3:0-2cm	300	µg/kg	U	18A-3:0-10cm	99	µg/kg	U	NC	µg/kg	NC
Dimethylphthalate	sVOCs	18A-3:0-2cm	59	µg/kg	U	18A-3:0-10cm	20	µg/kg	U	NC	µg/kg	NC
Acenaphthylene	sVOCs	18A-3:0-2cm	32	µg/kg	J	18A-3:0-10cm	12	µg/kg	J	-20	µg/kg	166.67%
Carbon Normalized Acenaphthylene	CN-SVOC	18A-3:0-2cm	1.20	mg/kgOC	J	18A-3:0-10cm	1.50	mg/kgOC	J	0.30	mg/kgOC	19.90%
3-Nitroaniline	sVOCs	18A-3:0-2cm	300	µg/kg	U	18A-3:0-10cm	99	µg/kg	U	NC	µg/kg	NC
Acenaphthene	sVOCs	18A-3:0-2cm	27	µg/kg	J	18A-3:0-10cm	20	µg/kg		-7	µg/kg	35.00%
Carbon Normalized Acenaphthene	CN-SVOC	18A-3:0-2cm	1.02	mg/kgOC	J	18A-3:0-10cm	2.50	mg/kgOC		1.49	mg/kgOC	59.45%
2,4-Dinitrophenol	sVOCs	18A-3:0-2cm	590	µg/kg	U	18A-3:0-10cm	200	µg/kg	U	NC	µg/kg	NC
4-Nitrophenol	sVOCs	18A-3:0-2cm	300	µg/kg	U	18A-3:0-10cm	99	µg/kg	U	NC	µg/kg	NC
Dibenzofuran	sVOCs	18A-3:0-2cm	18	µg/kg	J	18A-3:0-10cm	12	µg/kg	J	-6	µg/kg	50.00%
2,6-Dinitrotoluene	sVOCs	18A-3:0-2cm	300	µg/kg	U	18A-3:0-10cm	99	µg/kg	U	NC	µg/kg	NC
2,4-Dinitrotoluene	sVOCs	18A-3:0-2cm	300	µg/kg	U	18A-3:0-10cm	99	µg/kg	U	NC	µg/kg	NC
Diethylphthalate	sVOCs	18A-3:0-2cm	59	µg/kg	U	18A-3:0-10cm	20	µg/kg	U	NC	µg/kg	NC
4-Chlorophenyl-phenylether	sVOCs	18A-3:0-2cm	59	µg/kg	U	18A-3:0-10cm	20	µg/kg	U	NC	µg/kg	NC
Fluorene	sVOCs	18A-3:0-2cm	32	µg/kg	J	18A-3:0-10cm	22	µg/kg		-10	µg/kg	45.45%
Carbon Normalized Fluorene	CN-SVOC	18A-3:0-2cm	1.20	mg/kgOC	J	18A-3:0-10cm	2.75	mg/kgOC		1.55	mg/kgOC	56.31%
4-Nitroaniline	sVOCs	18A-3:0-2cm	300	µg/kg	U	18A-3:0-10cm	99	µg/kg	U	NC	µg/kg	NC

Table A-8 (Continued). Sample Locations: 18A-3

Result Parameter Name	Sampling Category	Sample IDs								Difference from 0-2cm to 0-10cm	Unit	% difference relative to the 0-10cm value
		0-2cm Sample ID	Value	Unit	Result Data Qualifier	0-10cm Sample ID	Value	Unit	Result Data Qualifier			
4,6-Dinitro-2-Methylphenol	sVOCs	18A-3:0-2cm	590	µg/kg	U	18A-3:0-10cm	200	µg/kg	U	NC	µg/kg	NC
N-Nitrosodiphenylamine	sVOCs	18A-3:0-2cm	59	µg/kg	U	18A-3:0-10cm	20	µg/kg	U	NC	µg/kg	NC
4-Bromophenyl-phenylether	sVOCs	18A-3:0-2cm	59	µg/kg	U	18A-3:0-10cm	20	µg/kg	U	NC	µg/kg	NC
Hexachlorobenzene	sVOCs	18A-3:0-2cm	59	µg/kg	U	18A-3:0-10cm	20	µg/kg	U	NC	µg/kg	NC
Pentachlorophenol	sVOCs	18A-3:0-2cm	300	µg/kg	U	18A-3:0-10cm	99	µg/kg	U	NC	µg/kg	NC
Phenanthrene	sVOCs	18A-3:0-2cm	180	µg/kg		18A-3:0-10cm	240	µg/kg		60	µg/kg	25.00%
Carbon Normalized Phenanthrene	CN-SVOC	18A-3:0-2cm	6.77	mg/kgOC		18A-3:0-10cm	30.04	mg/kgOC		23.27	mg/kgOC	77.47%
Carbazole	sVOCs	18A-3:0-2cm	36	µg/kg	QJ	18A-3:0-10cm	31	µg/kg	Q	-5	µg/kg	16.13%
Anthracene	sVOCs	18A-3:0-2cm	86	µg/kg		18A-3:0-10cm	63	µg/kg		-23	µg/kg	36.51%
Carbon Normalized Anthracene	CN-SVOC	18A-3:0-2cm	3.23	mg/kgOC		18A-3:0-10cm	7.88	mg/kgOC		4.65	mg/kgOC	59.00%
Di-n-Butylphthalate	sVOCs	18A-3:0-2cm	65	µg/kg		18A-3:0-10cm	42	µg/kg		-23	µg/kg	54.76%
Fluoranthene	sVOCs	18A-3:0-2cm	380	µg/kg		18A-3:0-10cm	530	µg/kg		150	µg/kg	28.30%
Carbon Normalized Fluoranthene	CN-SVOC	18A-3:0-2cm	14.29	mg/kgOC		18A-3:0-10cm	66.33	mg/kgOC		52.05	mg/kgOC	78.46%
Pyrene	sVOCs	18A-3:0-2cm	350	µg/kg		18A-3:0-10cm	410	µg/kg		60	µg/kg	14.63%
Carbon Normalized Pyrene	CN-SVOC	18A-3:0-2cm	13.16	mg/kgOC		18A-3:0-10cm	51.31	mg/kgOC		38.16	mg/kgOC	74.36%
Butylbenzylphthalate	sVOCs	18A-3:0-2cm	47	µg/kg	J	18A-3:0-10cm	30	µg/kg		-17	µg/kg	56.67%
3,3'-Dichlorobenzidine	sVOCs	18A-3:0-2cm	300	µg/kg	U	18A-3:0-10cm	99	µg/kg	U	NC	µg/kg	NC
Benzo(a)anthracene	sVOCs	18A-3:0-2cm	170	µg/kg		18A-3:0-10cm	250	µg/kg		80	µg/kg	32.00%
Carbon Normalized Benzo(a)anthracene	CN-SVOC	18A-3:0-2cm	6.39	mg/kgOC		18A-3:0-10cm	31.29	mg/kgOC		24.90	mg/kgOC	79.57%
bis(2-Ethylhexyl)phthalate	sVOCs	18A-3:0-2cm	190	µg/kg		18A-3:0-10cm	200	µg/kg		10	µg/kg	5.00%
Chrysene	sVOCs	18A-3:0-2cm	340	µg/kg		18A-3:0-10cm	340	µg/kg		0	µg/kg	0.00%
Carbon Normalized Chrysene	CN-SVOC	18A-3:0-2cm	12.78	mg/kgOC		18A-3:0-10cm	42.55	mg/kgOC		29.77	mg/kgOC	69.96%
Di-n-Octyl phthalate	sVOCs	18A-3:0-2cm	59	µg/kg	U	18A-3:0-10cm	20	µg/kg	U	NC	µg/kg	NC
Benzo(a)pyrene	sVOCs	18A-3:0-2cm	210	µg/kg		18A-3:0-10cm	220	µg/kg		10	µg/kg	4.55%
Carbon Normalized Benzo(a)pyrene	CN-SVOC	18A-3:0-2cm	7.89	mg/kgOC		18A-3:0-10cm	27.53	mg/kgOC		19.64	mg/kgOC	71.33%
Indeno(1,2,3-cd)pyrene	sVOCs	18A-3:0-2cm	120	µg/kg		18A-3:0-10cm	170	µg/kg		50	µg/kg	29.41%
Carbon Normalized Indeno(1,2,3-cd)pyrene	CN-SVOC	18A-3:0-2cm	4.51	mg/kgOC		18A-3:0-10cm	21.28	mg/kgOC		16.77	mg/kgOC	78.80%
Dibenzo(a,h)anthracene	sVOCs	18A-3:0-2cm	44	µg/kg	J	18A-3:0-10cm	63	µg/kg		19	µg/kg	30.16%
Carbon Normalized Dibenzo(a,h)anthracene	CN-SVOC	18A-3:0-2cm	1.65	mg/kgOC		18A-3:0-10cm	7.88	mg/kgOC		6.23	mg/kgOC	79.02%
Benzo(g,h,i)perylene	sVOCs	18A-3:0-2cm	160	µg/kg		18A-3:0-10cm	160	µg/kg		0	µg/kg	0.00%
Carbon Normalized Benzo(g,h,i)perylene	CN-SVOC	18A-3:0-2cm	6.02	mg/kgOC		18A-3:0-10cm	20.03	mg/kgOC		14.01	mg/kgOC	69.96%
1-Methylnaphthalene	sVOCs	18A-3:0-2cm	59	µg/kg	U	18A-3:0-10cm	20	µg/kg	U	NC	µg/kg	NC
Total Benzofluoranthenes	sVOCs	18A-3:0-2cm	470	µg/kg		18A-3:0-10cm	470	µg/kg		0	µg/kg	0.00%
Carbon Normalized Total Benzofluoranthenes	CN-SVOC	18A-3:0-2cm	17.67	mg/kgOC		18A-3:0-10cm	58.82	mg/kgOC		41.15	mg/kgOC	69.96%

*TOC value outside range normally accepted for use in carbon normalization.

Calculated value - not in the EDD

NC = not calculated. If analyltes are not detected, carbon normalized values and differences are not calculated. Also, if TOC value is outside the 0.5 to 3.5 range, carbon normalized values are not calculated.

Table A-9. Sample Locations: 98-99-1

Result Parameter Name	Sampling Category	Sample IDs								Difference from 0-2cm to 0-10cm	Unit	% difference relative to the 0-10cm value
		0-2cm Sample ID	Value	Unit	Result Data Qualifier	0-10cm Sample ID	Value	Unit	Result Data Qualifier			
Total Solids	TS	98/99-1:0-2cm	64.67	%		98/99-1:0-10cm	56.34	%		-8.33	%	14.79%
Total Organic Carbon	TOC	98/99-1:0-2cm	2.79	%		98/99-1:0-10cm	2.32	%		-0.47	%	20.26%
Total PCBs	PCBs	98/99-1:0-2cm	1114	µg/kg		98/99-1:0-10cm	2028	µg/kg		914	%	45.06%
Carbon-normalized Total PCBs	CN-PCBs	98/99-1:0-2cm	39.94	mg/kgOC		98/99-1:0-10cm	87.42	mg/kgOC		47.49	mg/kgOC	54.32%
Particle/Grain Size > 2mm (Gravel)	Grain Size	98/99-1:0-2cm	56.7	%		98/99-1:0-10cm	64.4	%		7.7	%	11.96%
Particle/Grain Size, 2mm - 1mm (Very Coarse Sand)	Grain Size	98/99-1:0-2cm	12	%		98/99-1:0-10cm	8.6	%		-3.4	%	39.53%
Particle/Grain Size, 1mm - 0.5mm (Coarse Sand)	Grain Size	98/99-1:0-2cm	4.3	%		98/99-1:0-10cm	5.7	%		1.4	%	24.56%
Particle/Grain Size, 0.5mm - 0.25mm (Medium Sand)	Grain Size	98/99-1:0-2cm	1	%		98/99-1:0-10cm	2.5	%		1.5	%	60.00%
Particle/Grain Size, 0.25mm - 0.125mm (Fine Sand)	Grain Size	98/99-1:0-2cm	4.3	%		98/99-1:0-10cm	2	%		-2.3	%	115.00%
Particle/Grain Size, 125µm - 63µm (Very Fine Sand)	Grain Size	98/99-1:0-2cm	1.8	%		98/99-1:0-10cm	1.6	%		-0.2	%	12.50%
Particle/Grain Size, 63µm - 31µm (Silt)	Grain Size	98/99-1:0-2cm	3.4	%		98/99-1:0-10cm	1.3	%		-2.1	%	161.54%
Particle/Grain Size, 31µm - 15.6µm (Silt)	Grain Size	98/99-1:0-2cm	8.8	%		98/99-1:0-10cm	4.4	%		-4.4	%	100.00%
Particle/Grain Size, 15.6µm - 7.8µm (Silt)	Grain Size	98/99-1:0-2cm	1.6	%		98/99-1:0-10cm	2.8	%		1.2	%	42.86%
Particle/Grain Size, 7.8µm - 3.9µm (Silt)	Grain Size	98/99-1:0-2cm	0.7	%		98/99-1:0-10cm	1.3	%		0.6	%	46.15%
Particle/Grain Size, 3.9µm - 2.0µm (Clay)	Grain Size	98/99-1:0-2cm	1.3	%		98/99-1:0-10cm	1.6	%		0.3	%	18.75%
Particle/Grain Size, 2.0µm - 1.0µm (Clay)	Grain Size	98/99-1:0-2cm	1.1	%		98/99-1:0-10cm	1.3	%		0.2	%	15.38%
Particle/Grain Size < 1.0µm (Clay)	Grain Size	98/99-1:0-2cm	2.8	%		98/99-1:0-10cm	2.6	%		-0.2	%	7.69%
Particle/Grain Size, Fines (Silt/Clay)	Grain Size	98/99-1:0-2cm	19.7	%		98/99-1:0-10cm	15.3	%		-4.4	%	28.76%
Aluminum	Metals	98/99-1:0-2cm	4840	mg/kg		98/99-1:0-10cm	4720	mg/kg		-120	mg/kg	2.54%
Antimony	Metals	98/99-1:0-2cm	0.9	mg/kg		98/99-1:0-10cm	0.4	mg/kg		-0.5	mg/kg	125.00%
Arsenic	Metals	98/99-1:0-2cm	12.7	mg/kg		98/99-1:0-10cm	9.5	mg/kg		-3.2	mg/kg	33.68%
Barium	Metals	98/99-1:0-2cm	43.3	mg/kg		98/99-1:0-10cm	28	mg/kg		-15.3	mg/kg	54.64%
Beryllium	Metals	98/99-1:0-2cm	0.3	mg/kg	U	98/99-1:0-10cm	0.3	mg/kg	U	NC	mg/kg	NC
Cadmium	Metals	98/99-1:0-2cm	0.9	mg/kg		98/99-1:0-10cm	0.9	mg/kg		0	mg/kg	0.00%
Calcium	Metals	98/99-1:0-2cm	3E+05	mg/kg		98/99-1:0-10cm	3E+05	mg/kg		14000	mg/kg	5.02%
Chromium	Metals	98/99-1:0-2cm	34.7	mg/kg		98/99-1:0-10cm	21	mg/kg		-13.7	mg/kg	65.24%
Cobalt	Metals	98/99-1:0-2cm	3.4	mg/kg		98/99-1:0-10cm	2.8	mg/kg		-0.6	mg/kg	21.43%
Copper	Metals	98/99-1:0-2cm	118	mg/kg		98/99-1:0-10cm	106	mg/kg		-12	mg/kg	11.32%
Iron	Metals	98/99-1:0-2cm	18300	mg/kg		98/99-1:0-10cm	9210	mg/kg		-9090	mg/kg	98.70%
Lead	Metals	98/99-1:0-2cm	51.1	mg/kg		98/99-1:0-10cm	41.9	mg/kg		-9.2	mg/kg	21.96%
Magnesium	Metals	98/99-1:0-2cm	4960	mg/kg		98/99-1:0-10cm	5060	mg/kg		100	mg/kg	1.98%
Manganese	Metals	98/99-1:0-2cm	271	mg/kg		98/99-1:0-10cm	217	mg/kg		-54	mg/kg	24.88%
Mercury	Mercury	98/99-1:0-2cm	0.37	mg/kg		98/99-1:0-10cm	0.26	mg/kg		-0.11	mg/kg	42.31%
Nickel	Metals	98/99-1:0-2cm	16.6	mg/kg		98/99-1:0-10cm	14.9	mg/kg		-1.7	mg/kg	11.41%
Potassium	Metals	98/99-1:0-2cm	1080	mg/kg		98/99-1:0-10cm	1140	mg/kg		60	mg/kg	5.26%
Selenium	Metals	98/99-1:0-2cm	0.8	mg/kg		98/99-1:0-10cm	0.8	mg/kg	U	NC	mg/kg	NC
Silver	Metals	98/99-1:0-2cm	0.4	mg/kg		98/99-1:0-10cm	0.8	mg/kg		0.4	mg/kg	50.00%
Sodium	Metals	98/99-1:0-2cm	9980	mg/kg		98/99-1:0-10cm	10500	mg/kg		520	mg/kg	4.95%
Thallium	Metals	98/99-1:0-2cm	0.3	mg/kg	U	98/99-1:0-10cm	0.3	mg/kg	U	NC	mg/kg	NC
Vanadium	Metals	98/99-1:0-2cm	15.5	mg/kg		98/99-1:0-10cm	15.5	mg/kg		0	mg/kg	0.00%
Zinc	Metals	98/99-1:0-2cm	220	mg/kg		98/99-1:0-10cm	149	mg/kg		-71	mg/kg	47.65%
Phenol	sVOCs	98/99-1:0-2cm	32	µg/kg		98/99-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
Bis-(2-Chloroethyl) Ether	sVOCs	98/99-1:0-2cm	20	µg/kg	U	98/99-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
2-Chlorophenol	sVOCs	98/99-1:0-2cm	20	µg/kg	U	98/99-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC

Table A-9 (Continued). Sample Locations: 98/99-1

Result Parameter Name	Sampling Category	Sample IDs								Difference from 0-2cm to 0-10cm	Unit	% difference relative to the 0-10cm value
		0-2cm Sample ID	Value	Unit	Result Data Qualifier	0-10cm Sample ID	Value	Unit	Result Data Qualifier			
1,3-Dichlorobenzene	sVOCs	98/99-1:0-2cm	20	µg/kg	U	98/99-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
1,4-Dichlorobenzene	sVOCs	98/99-1:0-2cm	20	µg/kg	U	98/99-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
Benzyl Alcohol	sVOCs	98/99-1:0-2cm	20	µg/kg	U	98/99-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
1,2-Dichlorobenzene	sVOCs	98/99-1:0-2cm	20	µg/kg	U	98/99-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
2-Methylphenol	sVOCs	98/99-1:0-2cm	20	µg/kg	U	98/99-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
2,2'-Oxybis(1-Chloropropane)	sVOCs	98/99-1:0-2cm	20	µg/kg	U	98/99-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
4-Methylphenol	sVOCs	98/99-1:0-2cm	22	µg/kg		98/99-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
N-Nitroso-Di-N-Propylamine	sVOCs	98/99-1:0-2cm	20	µg/kg	U	98/99-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
Hexachloroethane	sVOCs	98/99-1:0-2cm	20	µg/kg	U	98/99-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
Nitrobenzene	sVOCs	98/99-1:0-2cm	20	µg/kg	U	98/99-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
Isophorone	sVOCs	98/99-1:0-2cm	20	µg/kg	U	98/99-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
2-Nitrophenol	sVOCs	98/99-1:0-2cm	20	µg/kg	U	98/99-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
2,4-Dimethylphenol	sVOCs	98/99-1:0-2cm	99	µg/kg	U	98/99-1:0-10cm	290	µg/kg	U	NC	µg/kg	NC
Benzoic Acid	sVOCs	98/99-1:0-2cm	200	µg/kg	U	98/99-1:0-10cm	590	µg/kg	U	NC	µg/kg	NC
bis(2-Chloroethoxy) Methane	sVOCs	98/99-1:0-2cm	20	µg/kg	U	98/99-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
2,4-Dichlorophenol	sVOCs	98/99-1:0-2cm	99	µg/kg	U	98/99-1:0-10cm	290	µg/kg	U	NC	µg/kg	NC
1,2,4-Trichlorobenzene	sVOCs	98/99-1:0-2cm	20	µg/kg	U	98/99-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
Naphthalene	sVOCs	98/99-1:0-2cm	18	µg/kg	J	98/99-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
Carbon Normalized Naphthalene	CN-SVOC	98/99-1:0-2cm	0.65	mg/kgOC	J	98/99-1:0-10cm	NC	mg/kgOC		NC	mg/kgOC	NC
4-Chloroaniline	sVOCs	98/99-1:0-2cm	99	µg/kg	U	98/99-1:0-10cm	290	µg/kg	U	NC	µg/kg	NC
Hexachlorobutadiene	sVOCs	98/99-1:0-2cm	20	µg/kg	U	98/99-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
4-Chloro-3-methylphenol	sVOCs	98/99-1:0-2cm	99	µg/kg	U	98/99-1:0-10cm	290	µg/kg	U	NC	µg/kg	NC
2-Methylnaphthalene	sVOCs	98/99-1:0-2cm	20	µg/kg	U	98/99-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
Hexachlorocyclopentadiene	sVOCs	98/99-1:0-2cm	99	µg/kg	U	98/99-1:0-10cm	290	µg/kg	U	NC	µg/kg	NC
2,4,6-Trichlorophenol	sVOCs	98/99-1:0-2cm	99	µg/kg	U	98/99-1:0-10cm	290	µg/kg	U	NC	µg/kg	NC
2,4,5-Trichlorophenol	sVOCs	98/99-1:0-2cm	99	µg/kg	U	98/99-1:0-10cm	290	µg/kg	U	NC	µg/kg	NC
2-Chloronaphthalene	sVOCs	98/99-1:0-2cm	20	µg/kg	U	98/99-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
2-Nitroaniline	sVOCs	98/99-1:0-2cm	99	µg/kg	U	98/99-1:0-10cm	290	µg/kg	U	NC	µg/kg	NC
Dimethylphthalate	sVOCs	98/99-1:0-2cm	20	µg/kg	U	98/99-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
Acenaphthylene	sVOCs	98/99-1:0-2cm	43	µg/kg		98/99-1:0-10cm	35	µg/kg	J	-8	µg/kg	22.86%
Carbon Normalized Acenaphthylene	CN-SVOC	98/99-1:0-2cm	1.54	mg/kgOC		98/99-1:0-10cm	1.51	mg/kgOC	J	-0.03	mg/kgOC	2.16%
3-Nitroaniline	sVOCs	98/99-1:0-2cm	99	µg/kg	U	98/99-1:0-10cm	290	µg/kg	U	191	µg/kg	65.86%
Acenaphthene	sVOCs	98/99-1:0-2cm	31	µg/kg		98/99-1:0-10cm	47	µg/kg	J	16	µg/kg	34.04%
Carbon Normalized Acenaphthene	CN-SVOC	98/99-1:0-2cm	1.11	mg/kgOC		98/99-1:0-10cm	2.03	mg/kgOC	J	0.91	mg/kgOC	45.15%
2,4-Dinitrophenol	sVOCs	98/99-1:0-2cm	200	µg/kg	U	98/99-1:0-10cm	590	µg/kg	U	NC	µg/kg	NC
4-Nitrophenol	sVOCs	98/99-1:0-2cm	99	µg/kg	U	98/99-1:0-10cm	290	µg/kg	U	NC	µg/kg	NC
Dibenzofuran	sVOCs	98/99-1:0-2cm	16	µg/kg	J	98/99-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
2,6-Dinitrotoluene	sVOCs	98/99-1:0-2cm	99	µg/kg	U	98/99-1:0-10cm	290	µg/kg	U	NC	µg/kg	NC
2,4-Dinitrotoluene	sVOCs	98/99-1:0-2cm	99	µg/kg	U	98/99-1:0-10cm	290	µg/kg	U	NC	µg/kg	NC
Diethylphthalate	sVOCs	98/99-1:0-2cm	20	µg/kg	U	98/99-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
4-Chlorophenyl-phenylether	sVOCs	98/99-1:0-2cm	20	µg/kg	U	98/99-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
Fluorene	sVOCs	98/99-1:0-2cm	28	µg/kg		98/99-1:0-10cm	44	µg/kg	J	16	µg/kg	36.36%
Carbon Normalized Fluorene	CN-SVOC	98/99-1:0-2cm	1.00	mg/kgOC		98/99-1:0-10cm	1.90	mg/kgOC	J	0.89	mg/kgOC	47.08%
4-Nitroaniline	sVOCs	98/99-1:0-2cm	99	µg/kg	U	98/99-1:0-10cm	290	µg/kg	U	NC	µg/kg	NC

Table A-9 (Continued). Sample Locations: 98/99-1

Result Parameter Name	Sampling Category	Sample IDs								Difference from 0-2cm to 0-10cm	Unit	% difference relative to the 0-10cm value
		0-2cm Sample ID	Value	Unit	Result Data Qualifier	0-10cm Sample ID	Value	Unit	Result Data Qualifier			
4,6-Dinitro-2-Methylphenol	sVOCs	98/99-1:0-2cm	200	µg/kg	U	98/99-1:0-10cm	590	µg/kg	U	NC	µg/kg	NC
N-Nitrosodiphenylamine	sVOCs	98/99-1:0-2cm	20	µg/kg	U	98/99-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
4-Bromophenyl-phenylether	sVOCs	98/99-1:0-2cm	20	µg/kg	U	98/99-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
Hexachlorobenzene	sVOCs	98/99-1:0-2cm	20	µg/kg	U	98/99-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
Pentachlorophenol	sVOCs	98/99-1:0-2cm	99	µg/kg	U	98/99-1:0-10cm	290	µg/kg	U	NC	µg/kg	NC
Phenanthrene	sVOCs	98/99-1:0-2cm	300	µg/kg		98/99-1:0-10cm	380	µg/kg		80	µg/kg	21.05%
Carbon Normalized Phenanthrene	CN-SVOC	98/99-1:0-2cm	10.75	mg/kgOC		98/99-1:0-10cm	16.38	mg/kgOC		5.63	mg/kgOC	34.35%
Carbazole	sVOCs	98/99-1:0-2cm	68	µg/kg	Q	98/99-1:0-10cm	76	µg/kg		8	µg/kg	10.53%
Anthracene	sVOCs	98/99-1:0-2cm	90	µg/kg		98/99-1:0-10cm	160	µg/kg		70	µg/kg	43.75%
Carbon Normalized Anthracene	CN-SVOC	98/99-1:0-2cm	3.23	mg/kgOC		98/99-1:0-10cm	6.90	mg/kgOC		3.67	mg/kgOC	53.23%
Di-n-Butylphthalate	sVOCs	98/99-1:0-2cm	60	µg/kg		98/99-1:0-10cm	70	µg/kg		10	µg/kg	14.29%
Fluoranthene	sVOCs	98/99-1:0-2cm	750	µg/kg		98/99-1:0-10cm	2000	µg/kg		1250	µg/kg	62.50%
Carbon Normalized Fluoranthene	CN-SVOC	98/99-1:0-2cm	26.88	mg/kgOC		98/99-1:0-10cm	86.21	mg/kgOC		59.33	mg/kgOC	68.82%
Pyrene	sVOCs	98/99-1:0-2cm	910	µg/kg		98/99-1:0-10cm	2300	µg/kg		1390	µg/kg	60.43%
Carbon Normalized Pyrene	CN-SVOC	98/99-1:0-2cm	32.62	mg/kgOC		98/99-1:0-10cm	99.14	mg/kgOC		66.52	mg/kgOC	67.10%
Butylbenzylphthalate	sVOCs	98/99-1:0-2cm	20	µg/kg	U	98/99-1:0-10cm	79	µg/kg		NC	µg/kg	NC
3,3'-Dichlorobenzidine	sVOCs	98/99-1:0-2cm	99	µg/kg	U	98/99-1:0-10cm	290	µg/kg	U	NC	µg/kg	NC
Benzo(a)anthracene	sVOCs	98/99-1:0-2cm	270	µg/kg		98/99-1:0-10cm	450	µg/kg		180	µg/kg	40.00%
Carbon Normalized Benzo(a)anthracene	CN-SVOC	98/99-1:0-2cm	9.68	mg/kgOC		98/99-1:0-10cm	19.40	mg/kgOC		9.72	mg/kgOC	50.11%
bis(2-Ethylhexyl)phthalate	sVOCs	98/99-1:0-2cm	220	µg/kg		98/99-1:0-10cm	390	µg/kg		170	µg/kg	43.59%
Chrysene	sVOCs	98/99-1:0-2cm	590	µg/kg		98/99-1:0-10cm	1100	µg/kg		510	µg/kg	46.36%
Carbon Normalized Chrysene	CN-SVOC	98/99-1:0-2cm	21.15	mg/kgOC		98/99-1:0-10cm	47.41	mg/kgOC		26.27	mg/kgOC	55.40%
Di-n-Octyl phthalate	sVOCs	98/99-1:0-2cm	20	µg/kg	U	98/99-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
Benzo(a)pyrene	sVOCs	98/99-1:0-2cm	280	µg/kg		98/99-1:0-10cm	440	µg/kg		160	µg/kg	36.36%
Carbon Normalized Benzo(a)pyrene	CN-SVOC	98/99-1:0-2cm	10.04	mg/kgOC		98/99-1:0-10cm	18.97	mg/kgOC		8.93	mg/kgOC	47.08%
Indeno(1,2,3-cd)pyrene	sVOCs	98/99-1:0-2cm	140	µg/kg		98/99-1:0-10cm	260	µg/kg		120	µg/kg	46.15%
Carbon Normalized Indeno(1,2,3-cd)pyrene	CN-SVOC	98/99-1:0-2cm	5.02	mg/kgOC		98/99-1:0-10cm	11.21	mg/kgOC		6.19	mg/kgOC	55.22%
Dibenzo(a,h)anthracene	sVOCs	98/99-1:0-2cm	50	µg/kg		98/99-1:0-10cm	110	µg/kg		60	µg/kg	54.55%
Carbon Normalized Dibenzo(a,h)anthracene	CN-SVOC	98/99-1:0-2cm	1.79	mg/kgOC		98/99-1:0-10cm	4.74	mg/kgOC		2.95	mg/kgOC	62.20%
Benzo(g,h,i)perylene	sVOCs	98/99-1:0-2cm	130	µg/kg		98/99-1:0-10cm	280	µg/kg		150	µg/kg	53.57%
Carbon Normalized Benzo(g,h,i)perylene	CN-SVOC	98/99-1:0-2cm	4.66	mg/kgOC		98/99-1:0-10cm	12.07	mg/kgOC		7.41	mg/kgOC	61.39%
1-Methylnaphthalene	sVOCs	98/99-1:0-2cm	7.9	µg/kg	J	98/99-1:0-10cm	59	µg/kg	U	NC	µg/kg	NC
Total Benzofluoranthenes	sVOCs	98/99-1:0-2cm	830	µg/kg		98/99-1:0-10cm	1100	µg/kg		270	µg/kg	24.55%
Carbon Normalized Total Benzofluoranthenes	CN-SVOC	98/99-1:0-2cm	29.75	mg/kgOC		98/99-1:0-10cm	47.41	mg/kgOC		17.66	mg/kgOC	37.26%

*TOC value outside range normally accepted for use in carbon normalization.

Calculated value - not in the EDD

NA = Not applicable

NC = not calculated. If analyltes are not detected, carbon normalized values and differences are not calculated.

Table A-10. Sample Locations: 98/99-2

Result Parameter Name	Sampling Category	Sample IDs								Difference from 0-2cm to 0-10cm	Unit	% difference relative to the 0-10cm value
		0-2cm Sample ID	Value	Unit	Result Data Qualifier	0-10cm Sample ID	Value	Unit	Result Data Qualifier			
Total Solids	TS	98/99-2:0-2cm	37.92	%		98/99-2:0-10cm	34.81	%		-3.11	%	8.93%
Total Organic Carbon	TOC	98/99-2:0-2cm	3.23	%		98/99-2:0-10cm	2.69	%		-0.54	%	20.07%
Total PCBs	PCBs	98/99-2:0-2cm	915.8	µg/kg		98/99-2:0-10cm	767	µg/kg		-148.8	%	19.40%
Carbon-normalized Total PCBs	CN-PCBs	98/99-2:0-2cm	28.35	mg/kgOC		98/99-2:0-10cm	28.51	mg/kgOC		0.16	mg/kgOC	0.56%
Particle/Grain Size > 2mm (Gravel)	Grain Size	98/99-2:0-2cm	26.5	%		98/99-2:0-10cm	7.7	%		-18.8	%	244.16%
Particle/Grain Size, 2mm - 1mm (Very Coarse SaNC)	Grain Size	98/99-2:0-2cm	4	%		98/99-2:0-10cm	3.2	%		-0.8	%	25.00%
Particle/Grain Size, 1mm - 0.5mm (Coarse SaNC)	Grain Size	98/99-2:0-2cm	2.9	%		98/99-2:0-10cm	2.9	%		0	%	0.00%
Particle/Grain Size, 0.5mm - 0.25mm (Medium SaNC)	Grain Size	98/99-2:0-2cm	2.9	%		98/99-2:0-10cm	2.9	%		0	%	0.00%
Particle/Grain Size, 0.25mm - 0.125mm (Fine SaNC)	Grain Size	98/99-2:0-2cm	2.8	%		98/99-2:0-10cm	2.5	%		-0.3	%	12.00%
Particle/Grain Size, 125µm - 63µm (Very Fine SaNC)	Grain Size	98/99-2:0-2cm	4	%		98/99-2:0-10cm	2.7	%		-1.3	%	48.15%
Particle/Grain Size, 63µm - 31µm (Silt)	Grain Size	98/99-2:0-2cm	7.5	%		98/99-2:0-10cm	7.1	%		-0.4	%	5.63%
Particle/Grain Size, 31µm - 15.6µm (Silt)	Grain Size	98/99-2:0-2cm	18.5	%		98/99-2:0-10cm	9.7	%		-8.8	%	90.72%
Particle/Grain Size, 15.6µm - 7.8µm (Silt)	Grain Size	98/99-2:0-2cm	10	%		98/99-2:0-10cm	18.5	%		8.5	%	45.95%
Particle/Grain Size, 7.8µm - 3.9µm (Silt)	Grain Size	98/99-2:0-2cm	3.7	%		98/99-2:0-10cm	10.2	%		6.5	%	63.73%
Particle/Grain Size, 3.9µm - 2.0µm (Clay)	Grain Size	98/99-2:0-2cm	3.8	%		98/99-2:0-10cm	8.7	%		4.9	%	56.32%
Particle/Grain Size, 2.0µm - 1.0µm (Clay)	Grain Size	98/99-2:0-2cm	4.2	%		98/99-2:0-10cm	8.4	%		4.2	%	50.00%
Particle/Grain Size < 1.0µm (Clay)	Grain Size	98/99-2:0-2cm	9.2	%		98/99-2:0-10cm	15.5	%		6.3	%	40.65%
Particle/Grain Size, Fines (Silt/Clay)	Grain Size	98/99-2:0-2cm	56.9	%		98/99-2:0-10cm	78.1	%		21.2	%	27.14%
Aluminum	Metals	98/99-2:0-2cm	16400	mg/kg		98/99-2:0-10cm	18400	mg/kg		2000	mg/kg	10.87%
Antimony	Metals	98/99-2:0-2cm	2	mg/kg		98/99-2:0-10cm	0.9	mg/kg		-1.1	mg/kg	122.22%
Arsenic	Metals	98/99-2:0-2cm	91.6	mg/kg		98/99-2:0-10cm	58.8	mg/kg		-32.8	mg/kg	55.78%
Barium	Metals	98/99-2:0-2cm	193	mg/kg		98/99-2:0-10cm	100	mg/kg		-93	mg/kg	93.00%
Beryllium	Metals	98/99-2:0-2cm	0.6	mg/kg	U	98/99-2:0-10cm	0.6	mg/kg	U	NC	mg/kg	NC
Cadmium	Metals	98/99-2:0-2cm	1.5	mg/kg		98/99-2:0-10cm	1.4	mg/kg		-0.1	mg/kg	7.14%
Calcium	Metals	98/99-2:0-2cm	32300	mg/kg		98/99-2:0-10cm	35000	mg/kg		2700	mg/kg	7.71%
Chromium	Metals	98/99-2:0-2cm	76	mg/kg		98/99-2:0-10cm	69	mg/kg		-7	mg/kg	10.14%
Cobalt	Metals	98/99-2:0-2cm	13.8	mg/kg		98/99-2:0-10cm	13.8	mg/kg		0	mg/kg	0.00%
Copper	Metals	98/99-2:0-2cm	641	mg/kg		98/99-2:0-10cm	588	mg/kg		-53	mg/kg	9.01%
Iron	Metals	98/99-2:0-2cm	32200	mg/kg		98/99-2:0-10cm	32500	mg/kg		300	mg/kg	0.92%
Lead	Metals	98/99-2:0-2cm	178	mg/kg		98/99-2:0-10cm	149	mg/kg		-29	mg/kg	19.46%
Magnesium	Metals	98/99-2:0-2cm	9260	mg/kg		98/99-2:0-10cm	9930	mg/kg		670	mg/kg	6.75%
Manganese	Metals	98/99-2:0-2cm	500	mg/kg		98/99-2:0-10cm	476	mg/kg		-24	mg/kg	5.04%
Mercury	Mercury	98/99-2:0-2cm	1.38	mg/kg		98/99-2:0-10cm	2.25	mg/kg		0.87	mg/kg	38.67%
Nickel	Metals	98/99-2:0-2cm	50	mg/kg		98/99-2:0-10cm	75	mg/kg		25	mg/kg	33.33%
Potassium	Metals	98/99-2:0-2cm	3320	mg/kg		98/99-2:0-10cm	3530	mg/kg		210	mg/kg	5.95%
Selenium	Metals	98/99-2:0-2cm	2	mg/kg		98/99-2:0-10cm	2	mg/kg		0	mg/kg	0.00%
Silver	Metals	98/99-2:0-2cm	1.5	mg/kg		98/99-2:0-10cm	1.6	mg/kg		0.1	mg/kg	6.25%
Sodium	Metals	98/99-2:0-2cm	21400	mg/kg		98/99-2:0-10cm	21600	mg/kg		200	mg/kg	0.93%
Thallium	Metals	98/99-2:0-2cm	0.6	mg/kg	U	98/99-2:0-10cm	0.6	mg/kg	U	NC	mg/kg	NC
Vanadium	Metals	98/99-2:0-2cm	48	mg/kg		98/99-2:0-10cm	54.2	mg/kg		6.2	mg/kg	11.44%
Zinc	Metals	98/99-2:0-2cm	610	mg/kg		98/99-2:0-10cm	460	mg/kg		-150	mg/kg	32.61%
Phenol	sVOCs	98/99-2:0-2cm	41	µg/kg	J	98/99-2:0-10cm	230	µg/kg		189	µg/kg	82.17%
Bis-(2-Chloroethyl) Ether	sVOCs	98/99-2:0-2cm	82	µg/kg	U	98/99-2:0-10cm	59	µg/kg	U	NC	µg/kg	NC
2-Chlorophenol	sVOCs	98/99-2:0-2cm	82	µg/kg	U	98/99-2:0-10cm	59	µg/kg	U	NC	µg/kg	NC

Table A-10 (Continued). Sample Locations: 98/99-2

Result Parameter Name	Sampling Category	Sample IDs								Difference from 0-2cm to 0-10cm	Unit	% difference relative to the 0-10cm value
		0-2cm Sample ID	Value	Unit	Result Data Qualifier	0-10cm Sample ID	Value	Unit	Result Data Qualifier			
1,3-Dichlorobenzene	sVOCs	98/99-2:0-2cm	82	µg/kg	U	98/99-2:0-10cm	59	µg/kg	U	NC	µg/kg	NC
1,4-Dichlorobenzene	sVOCs	98/99-2:0-2cm	82	µg/kg	U	98/99-2:0-10cm	59	µg/kg	U	NC	µg/kg	NC
Benzyl Alcohol	sVOCs	98/99-2:0-2cm	82	µg/kg	U	98/99-2:0-10cm	59	µg/kg	U	NC	µg/kg	NC
1,2-Dichlorobenzene	sVOCs	98/99-2:0-2cm	82	µg/kg	U	98/99-2:0-10cm	59	µg/kg	U	NC	µg/kg	NC
2-Methylphenol	sVOCs	98/99-2:0-2cm	82	µg/kg	U	98/99-2:0-10cm	59	µg/kg	U	NC	µg/kg	NC
2,2'-Oxybis(1-Chloropropane)	sVOCs	98/99-2:0-2cm	82	µg/kg	U	98/99-2:0-10cm	59	µg/kg	U	NC	µg/kg	NC
4-Methylphenol	sVOCs	98/99-2:0-2cm	78	µg/kg	J	98/99-2:0-10cm	810	µg/kg		732	µg/kg	90.37%
N-Nitroso-Di-N-Propylamine	sVOCs	98/99-2:0-2cm	82	µg/kg	U	98/99-2:0-10cm	59	µg/kg	U	NC	µg/kg	NC
Hexachloroethane	sVOCs	98/99-2:0-2cm	82	µg/kg	U	98/99-2:0-10cm	59	µg/kg	U	NC	µg/kg	NC
Nitrobenzene	sVOCs	98/99-2:0-2cm	82	µg/kg	U	98/99-2:0-10cm	59	µg/kg	U	NC	µg/kg	NC
Isophorone	sVOCs	98/99-2:0-2cm	82	µg/kg	U	98/99-2:0-10cm	59	µg/kg	U	NC	µg/kg	NC
2-Nitrophenol	sVOCs	98/99-2:0-2cm	82	µg/kg	U	98/99-2:0-10cm	59	µg/kg	U	NC	µg/kg	NC
2,4-Dimethylphenol	sVOCs	98/99-2:0-2cm	410	µg/kg	U	98/99-2:0-10cm	2000	µg/kg		NC	µg/kg	NC
Benzoic Acid	sVOCs	98/99-2:0-2cm	820	µg/kg	U	98/99-2:0-10cm	590	µg/kg	U	NC	µg/kg	NC
bis(2-Chloroethoxy) Methane	sVOCs	98/99-2:0-2cm	82	µg/kg	U	98/99-2:0-10cm	59	µg/kg	U	NC	µg/kg	NC
2,4-Dichlorophenol	sVOCs	98/99-2:0-2cm	410	µg/kg	U	98/99-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
1,2,4-Trichlorobenzene	sVOCs	98/99-2:0-2cm	82	µg/kg	U	98/99-2:0-10cm	59	µg/kg	U	NC	µg/kg	NC
Naphthalene	sVOCs	98/99-2:0-2cm	41	µg/kg	J	98/99-2:0-10cm	68	µg/kg		27	µg/kg	39.71%
Carbon-normalized Naphthalene	CN-SVOC	98/99-2:0-2cm	1.27	mg/kgOC	J	98/99-2:0-10cm	2.53	mg/kgOC		1.26	mg/kgOC	49.79%
4-Chloroaniline	sVOCs	98/99-2:0-2cm	410	µg/kg	U	98/99-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Hexachlorobutadiene	sVOCs	98/99-2:0-2cm	82	µg/kg	U	98/99-2:0-10cm	59	µg/kg	U	NC	µg/kg	NC
4-Chloro-3-methylphenol	sVOCs	98/99-2:0-2cm	410	µg/kg	U	98/99-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
2-Methylnaphthalene	sVOCs	98/99-2:0-2cm	82	µg/kg	U	98/99-2:0-10cm	44	µg/kg	J	NC	µg/kg	NC
Hexachlorocyclopentadiene	sVOCs	98/99-2:0-2cm	410	µg/kg	U	98/99-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
2,4,6-Trichlorophenol	sVOCs	98/99-2:0-2cm	410	µg/kg	U	98/99-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
2,4,5-Trichlorophenol	sVOCs	98/99-2:0-2cm	410	µg/kg	U	98/99-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
2-Chloronaphthalene	sVOCs	98/99-2:0-2cm	82	µg/kg	U	98/99-2:0-10cm	59	µg/kg	U	NC	µg/kg	NC
2-Nitroaniline	sVOCs	98/99-2:0-2cm	410	µg/kg	U	98/99-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Dimethylphthalate	sVOCs	98/99-2:0-2cm	82	µg/kg	U	98/99-2:0-10cm	62	µg/kg		NC	µg/kg	NC
Acenaphthylene	sVOCs	98/99-2:0-2cm	37	µg/kg	J	98/99-2:0-10cm	44	µg/kg	J	7	µg/kg	15.91%
Carbon-normalized Acenaphthylene	CN-SVOC	98/99-2:0-2cm	1.15	mg/kgOC	J	98/99-2:0-10cm	1.64	mg/kgOC	J	0.49	mg/kgOC	29.97%
3-Nitroaniline	sVOCs	98/99-2:0-2cm	410	µg/kg	U	98/99-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Acenaphthene	sVOCs	98/99-2:0-2cm	45	µg/kg	J	98/99-2:0-10cm	44	µg/kg	J	-1	µg/kg	2.27%
Carbon-normalized Acenaphthene	CN-SVOC	98/99-2:0-2cm	1.39	mg/kgOC	J	98/99-2:0-10cm	1.64	mg/kgOC	J	0.24	mg/kgOC	14.83%
2,4-Dinitrophenol	sVOCs	98/99-2:0-2cm	820	µg/kg	U	98/99-2:0-10cm	590	µg/kg	U	NC	µg/kg	NC
4-Nitrophenol	sVOCs	98/99-2:0-2cm	410	µg/kg	U	98/99-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Dibenzofuran	sVOCs	98/99-2:0-2cm	29	µg/kg	J	98/99-2:0-10cm	30	µg/kg	J	1	µg/kg	3.33%
2,6-Dinitrotoluene	sVOCs	98/99-2:0-2cm	410	µg/kg	U	98/99-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
2,4-Dinitrotoluene	sVOCs	98/99-2:0-2cm	410	µg/kg	U	98/99-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Diethylphthalate	sVOCs	98/99-2:0-2cm	82	µg/kg	U	98/99-2:0-10cm	59	µg/kg	U	NC	µg/kg	NC
4-Chlorophenyl-phenylether	sVOCs	98/99-2:0-2cm	82	µg/kg	U	98/99-2:0-10cm	59	µg/kg	U	NC	µg/kg	NC
Fluorene	sVOCs	98/99-2:0-2cm	41	µg/kg	J	98/99-2:0-10cm	50	µg/kg	J	9	µg/kg	18.00%
Carbon-normalized Fluorene	CN-SVOC	98/99-2:0-2cm	1.27	mg/kgOC	J	98/99-2:0-10cm	1.86	mg/kgOC	J	0.59	mg/kgOC	31.71%
4-Nitroaniline	sVOCs	98/99-2:0-2cm	410	µg/kg	U	98/99-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC

Table A-10 (Continued). Sample Locations: 98/99-2

Result Parameter Name	Sampling Category	Sample IDs								Difference from 0-2cm to 0-10cm	Unit	% difference relative to the 0-10cm value
		0-2cm Sample ID	Value	Unit	Result Data Qualifier	0-10cm Sample ID	Value	Unit	Result Data Qualifier			
4,6-Dinitro-2-Methylphenol	sVOCs	98/99-2:0-2cm	820	µg/kg	U	98/99-2:0-10cm	590	µg/kg	U	NC	µg/kg	NC
N-Nitrosodiphenylamine	sVOCs	98/99-2:0-2cm	82	µg/kg	U	98/99-2:0-10cm	59	µg/kg	U	NC	µg/kg	NC
4-Bromophenyl-phenylether	sVOCs	98/99-2:0-2cm	82	µg/kg	U	98/99-2:0-10cm	59	µg/kg	U	NC	µg/kg	NC
Hexachlorobenzene	sVOCs	98/99-2:0-2cm	82	µg/kg	U	98/99-2:0-10cm	59	µg/kg	U	NC	µg/kg	NC
Pentachlorophenol	sVOCs	98/99-2:0-2cm	410	µg/kg	U	98/99-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Phenanthrene	sVOCs	98/99-2:0-2cm	420	µg/kg		98/99-2:0-10cm	320	µg/kg		-100	µg/kg	31.25%
Carbon-normalized Phenanthrene	CN-SVOC	98/99-2:0-2cm	13	mg/kgOC		98/99-2:0-10cm	11.9	mg/kgOC		-1.11	mg/kgOC	9.31%
Carbazole	sVOCs	98/99-2:0-2cm	57	µg/kg	J	98/99-2:0-10cm	86	µg/kg		29	µg/kg	33.72%
Anthracene	sVOCs	98/99-2:0-2cm	110	µg/kg		98/99-2:0-10cm	140	µg/kg		30	µg/kg	21.43%
Carbon-normalized Anthracene	CN-SVOC	98/99-2:0-2cm	3.41	mg/kgOC		98/99-2:0-10cm	5.20	mg/kgOC		1.80	mg/kgOC	34.56%
Di-n-Butylphthalate	sVOCs	98/99-2:0-2cm	720	µg/kg		98/99-2:0-10cm	660	µg/kg		-60	µg/kg	9.09%
Fluoranthene	sVOCs	98/99-2:0-2cm	690	µg/kg		98/99-2:0-10cm	690	µg/kg		0	µg/kg	0.00%
Carbon-normalized Fluoranthene	CN-SVOC	98/99-2:0-2cm	21.36	mg/kgOC		98/99-2:0-10cm	25.65	mg/kgOC		4.29	mg/kgOC	16.72%
Pyrene	sVOCs	98/99-2:0-2cm	1600	µg/kg		98/99-2:0-10cm	1200	µg/kg		-400	µg/kg	33.33%
Carbon-normalized Pyrene	CN-SVOC	98/99-2:0-2cm	49.54	mg/kgOC		98/99-2:0-10cm	44.61	mg/kgOC		-4.93	mg/kgOC	11.04%
Butylbenzylphthalate	sVOCs	98/99-2:0-2cm	180	µg/kg		98/99-2:0-10cm	1500	µg/kg		1320	µg/kg	88.00%
3,3'-Dichlorobenzidine	sVOCs	98/99-2:0-2cm	410	µg/kg	U	98/99-2:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Benzo(a)anthracene	sVOCs	98/99-2:0-2cm	260	µg/kg		98/99-2:0-10cm	350	µg/kg		90	µg/kg	25.71%
Carbon-normalized Benzo(a)anthracene	CN-SVOC	98/99-2:0-2cm	8.05	mg/kgOC		98/99-2:0-10cm	13.01	mg/kgOC		4.96	mg/kgOC	38.13%
bis(2-Ethylhexyl)phthalate	sVOCs	98/99-2:0-2cm	1200	µg/kg		98/99-2:0-10cm	14000	µg/kg		12800	µg/kg	91.43%
Chrysene	sVOCs	98/99-2:0-2cm	520	µg/kg		98/99-2:0-10cm	710	µg/kg		190	µg/kg	26.76%
Carbon-normalized Chrysene	CN-SVOC	98/99-2:0-2cm	16.1	mg/kgOC		98/99-2:0-10cm	26.39	mg/kgOC		10.29	mg/kgOC	39.00%
Di-n-Octyl phthalate	sVOCs	98/99-2:0-2cm	82	µg/kg	U	98/99-2:0-10cm	59	µg/kg	U	NC	µg/kg	NC
Benzo(a)pyrene	sVOCs	98/99-2:0-2cm	380	µg/kg		98/99-2:0-10cm	490	µg/kg		110	µg/kg	22.45%
Carbon-normalized Benzo(a)pyrene	CN-SVOC	98/99-2:0-2cm	11.76	mg/kgOC		98/99-2:0-10cm	18.22	mg/kgOC		6.45	mg/kgOC	35.41%
INCeno(1,2,3-cd)pyrene	sVOCs	98/99-2:0-2cm	230	µg/kg		98/99-2:0-10cm	320	µg/kg		90	µg/kg	28.13%
Carbon-normalized INCeno(1,2,3-cd)pyrene	CN-SVOC	98/99-2:0-2cm	7.12	mg/kgOC		98/99-2:0-10cm	11.90	mg/kgOC		4.78	mg/kgOC	40.14%
Dibenzo(a,h)anthracene	sVOCs	98/99-2:0-2cm	120	µg/kg		98/99-2:0-10cm	120	µg/kg		0	µg/kg	0.00%
Carbon-normalized Dibenzo(a,h)anthracene	CN-SVOC	98/99-2:0-2cm	3.72	mg/kgOC		98/99-2:0-10cm	4.46	mg/kgOC		0.75	mg/kgOC	16.72%
Benzo(g,h,i)perylene	sVOCs	98/99-2:0-2cm	320	µg/kg		98/99-2:0-10cm	390	µg/kg		70	µg/kg	17.95%
Carbon-normalized Benzo(g,h,i)perylene	CN-SVOC	98/99-2:0-2cm	9.91	mg/kgOC		98/99-2:0-10cm	14.50	mg/kgOC		4.59	mg/kgOC	31.67%
1-Methylnaphthalene	sVOCs	98/99-2:0-2cm	82	µg/kg	U	98/99-2:0-10cm	27	µg/kg	J	NC	µg/kg	NC
Total Benzofluoranthenes	sVOCs	98/99-2:0-2cm	880	µg/kg		98/99-2:0-10cm	1300	µg/kg		420	µg/kg	32.31%
Carbon-normalized Total Benzofluoranthenes	CN-SVOC	98/99-2:0-2cm	27.24	mg/kgOC		98/99-2:0-10cm	48.33	mg/kgOC		21.08	mg/kgOC	43.62%

*TOC value outside range normally accepted for use in carbon normalization.

Calculated value - not in the EDD

NA = Not applicable

NC = not calculated. If analyltes are not detected, carbon normalized values and differences are not calculated.

Table A-11. Sample Locations: 98/99-3

Result Parameter Name	Sampling Category	Sample IDs								Difference from 0-2cm to 0-10cm	Unit	% difference relative to the 0-10cm value
		0-2cm Sample ID	Value	Unit	Result Data Qualifier	0-10cm Sample ID	Value	Unit	Result Data Qualifier			
Total Solids	TS	98/99-3:0-2cm	25.43	%		98/99-3:0-10cm	31.34	%		5.91	%	18.86%
Total Organic Carbon	TOC	98/99-3:0-2cm	2.5	%		98/99-3:0-10cm	2.72	%		0.22	%	8.09%
Total PCBs	PCBs	98/99-3:0-2cm	478.5	µg/kg		98/99-3:0-10cm	631.8	µg/kg		153.3	%	24.26%
Carbon-normalized Total PCBs	CN-PCBs	98/99-3:0-2cm	19.14	mg/kgOC		98/99-3:0-10cm	23.23	mg/kgOC		4.09	mg/kgOC	17.60%
Particle/Grain Size > 2mm (Gravel)	Grain Size	98/99-3:0-2cm	2.8	%		98/99-3:0-10cm	0.4	%		-2.4	%	600.00%
Particle/Grain Size, 2mm - 1mm (Very Coarse Sand)	Grain Size	98/99-3:0-2cm	1.4	%		98/99-3:0-10cm	6.3	%		4.9	%	77.78%
Particle/Grain Size, 1mm - 0.5mm (Coarse Sand)	Grain Size	98/99-3:0-2cm	4.1	%		98/99-3:0-10cm	3.2	%		-0.9	%	28.13%
Particle/Grain Size, 0.5mm - 0.25mm (Medium Sand)	Grain Size	98/99-3:0-2cm	2.3	%		98/99-3:0-10cm	1.8	%		-0.5	%	27.78%
Particle/Grain Size, 0.25mm - 0.125mm (Fine Sand)	Grain Size	98/99-3:0-2cm	1.6	%		98/99-3:0-10cm	1.9	%		0.3	%	15.79%
Particle/Grain Size, 125µm - 63µm (Very Fine Sand)	Grain Size	98/99-3:0-2cm	2.7	%		98/99-3:0-10cm	3.8	%		1.1	%	28.95%
Particle/Grain Size, 63µm - 31µm (Silt)	Grain Size	98/99-3:0-2cm	6.5	%		98/99-3:0-10cm	7.9	%		1.4	%	17.72%
Particle/Grain Size, 31µm - 15.6µm (Silt)	Grain Size	98/99-3:0-2cm	19.1	%		98/99-3:0-10cm	17.5	%		-1.6	%	9.14%
Particle/Grain Size, 15.6µm - 7.8µm (Silt)	Grain Size	98/99-3:0-2cm	18.9	%		98/99-3:0-10cm	15.5	%		-3.4	%	21.94%
Particle/Grain Size, 7.8µm - 3.9µm (Silt)	Grain Size	98/99-3:0-2cm	9.9	%		98/99-3:0-10cm	9.8	%		-0.1	%	1.02%
Particle/Grain Size, 3.9µm - 2.0µm (Clay)	Grain Size	98/99-3:0-2cm	7.8	%		98/99-3:0-10cm	9.5	%		1.7	%	17.89%
Particle/Grain Size, 2.0µm - 1.0µm (Clay)	Grain Size	98/99-3:0-2cm	6.8	%		98/99-3:0-10cm	7.9	%		1.1	%	13.92%
Particle/Grain Size < 1.0µm (Clay)	Grain Size	98/99-3:0-2cm	16.1	%		98/99-3:0-10cm	14.5	%		-1.6	%	11.03%
Particle/Grain Size, Fines (Silt/Clay)	Grain Size	98/99-3:0-2cm	85.1	%		98/99-3:0-10cm	82.7	%		-2.4	%	2.90%
Aluminum	Metals	98/99-3:0-2cm	19200	mg/kg		98/99-3:0-10cm	18700	mg/kg		-500	mg/kg	2.67%
Antimony	Metals	98/99-3:0-2cm	0.7	mg/kg	U	98/99-3:0-10cm	1	mg/kg		0.3	mg/kg	30.00%
Arsenic	Metals	98/99-3:0-2cm	19.7	mg/kg		98/99-3:0-10cm	26.5	mg/kg		6.8	mg/kg	25.66%
Barium	Metals	98/99-3:0-2cm	56	mg/kg		98/99-3:0-10cm	76	mg/kg		20	mg/kg	26.32%
Beryllium	Metals	98/99-3:0-2cm	0.7	mg/kg	U	98/99-3:0-10cm	0.6	mg/kg	U	-0.1	mg/kg	16.67%
Cadmium	Metals	98/99-3:0-2cm	2	mg/kg		98/99-3:0-10cm	1.7	mg/kg		-0.3	mg/kg	17.65%
Calcium	Metals	98/99-3:0-2cm	9840	mg/kg		98/99-3:0-10cm	16600	mg/kg		6760	mg/kg	40.72%
Chromium	Metals	98/99-3:0-2cm	58	mg/kg		98/99-3:0-10cm	59	mg/kg		1	mg/kg	1.69%
Cobalt	Metals	98/99-3:0-2cm	10.2	mg/kg		98/99-3:0-10cm	11.5	mg/kg		1.3	mg/kg	11.30%
Copper	Metals	98/99-3:0-2cm	298	mg/kg		98/99-3:0-10cm	424	mg/kg		126	mg/kg	29.72%
Iron	Metals	98/99-3:0-2cm	29600	mg/kg		98/99-3:0-10cm	30600	mg/kg		1000	mg/kg	3.27%
Lead	Metals	98/99-3:0-2cm	97.1	mg/kg		98/99-3:0-10cm	124	mg/kg		26.9	mg/kg	21.69%
Magnesium	Metals	98/99-3:0-2cm	11000	mg/kg		98/99-3:0-10cm	10300	mg/kg		-700	mg/kg	6.80%
Manganese	Metals	98/99-3:0-2cm	385	mg/kg		98/99-3:0-10cm	395	mg/kg		10	mg/kg	2.53%
Mercury	Mercury	98/99-3:0-2cm	0.82	mg/kg		98/99-3:0-10cm	1.36	mg/kg		0.54	mg/kg	39.71%
Nickel	Metals	98/99-3:0-2cm	47	mg/kg		98/99-3:0-10cm	51	mg/kg		4	mg/kg	7.84%
Potassium	Metals	98/99-3:0-2cm	3950	mg/kg		98/99-3:0-10cm	3610	mg/kg		-340	mg/kg	9.42%
Selenium	Metals	98/99-3:0-2cm	3	mg/kg		98/99-3:0-10cm	2	mg/kg		-1	mg/kg	50.00%
Silver	Metals	98/99-3:0-2cm	0.9	mg/kg		98/99-3:0-10cm	1.1	mg/kg		0.2	mg/kg	18.18%
Sodium	Metals	98/99-3:0-2cm	29200	mg/kg		98/99-3:0-10cm	24700	mg/kg		-4500	mg/kg	18.22%
Thallium	Metals	98/99-3:0-2cm	0.7	mg/kg	U	98/99-3:0-10cm	0.6	mg/kg	U	NC	mg/kg	NC
Vanadium	Metals	98/99-3:0-2cm	53.9	mg/kg		98/99-3:0-10cm	54.5	mg/kg		0.6	mg/kg	1.10%
Zinc	Metals	98/99-3:0-2cm	280	mg/kg		98/99-3:0-10cm	380	mg/kg		100	mg/kg	26.32%
Phenol	sVOCs	98/99-3:0-2cm	59	µg/kg	U	98/99-3:0-10cm	45	µg/kg	J	NC	µg/kg	NC
Bis-(2-Chloroethyl) Ether	sVOCs	98/99-3:0-2cm	59	µg/kg	U	98/99-3:0-10cm	60	µg/kg	U	NC	µg/kg	NC
2-Chlorophenol	sVOCs	98/99-3:0-2cm	59	µg/kg	U	98/99-3:0-10cm	60	µg/kg	U	NC	µg/kg	NC

Table A-11 (Continued). Sample Locations: 98/99-3

Result Parameter Name	Sampling Category	Sample IDs								Difference from 0-2cm to 0-10cm	Unit	% difference relative to the 0-10cm value
		0-2cm Sample ID	Value	Unit	Result Data Qualifier	0-10cm Sample ID	Value	Unit	Result Data Qualifier			
1,3-Dichlorobenzene	sVOCs	98/99-3:0-2cm	59	µg/kg	U	98/99-3:0-10cm	60	µg/kg	U	NC	µg/kg	NC
1,4-Dichlorobenzene	sVOCs	98/99-3:0-2cm	59	µg/kg	U	98/99-3:0-10cm	60	µg/kg	U	NC	µg/kg	NC
Benzyl Alcohol	sVOCs	98/99-3:0-2cm	59	µg/kg	U	98/99-3:0-10cm	60	µg/kg	U	NC	µg/kg	NC
1,2-Dichlorobenzene	sVOCs	98/99-3:0-2cm	59	µg/kg	U	98/99-3:0-10cm	60	µg/kg	U	NC	µg/kg	NC
2-Methylphenol	sVOCs	98/99-3:0-2cm	59	µg/kg	U	98/99-3:0-10cm	60	µg/kg	U	NC	µg/kg	NC
2,2'-Oxybis(1-Chloropropane)	sVOCs	98/99-3:0-2cm	59	µg/kg	U	98/99-3:0-10cm	60	µg/kg	U	NC	µg/kg	NC
4-Methylphenol	sVOCs	98/99-3:0-2cm	45	µg/kg	J	98/99-3:0-10cm	60	µg/kg	U	NC	µg/kg	NC
N-Nitroso-Di-N-Propylamine	sVOCs	98/99-3:0-2cm	59	µg/kg	U	98/99-3:0-10cm	60	µg/kg	U	NC	µg/kg	NC
Hexachloroethane	sVOCs	98/99-3:0-2cm	59	µg/kg	U	98/99-3:0-10cm	60	µg/kg	U	NC	µg/kg	NC
Nitrobenzene	sVOCs	98/99-3:0-2cm	59	µg/kg	U	98/99-3:0-10cm	60	µg/kg	U	NC	µg/kg	NC
Isophorone	sVOCs	98/99-3:0-2cm	59	µg/kg	U	98/99-3:0-10cm	60	µg/kg	U	NC	µg/kg	NC
2-Nitrophenol	sVOCs	98/99-3:0-2cm	59	µg/kg	U	98/99-3:0-10cm	60	µg/kg	U	NC	µg/kg	NC
2,4-Dimethylphenol	sVOCs	98/99-3:0-2cm	300	µg/kg	U	98/99-3:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Benzoic Acid	sVOCs	98/99-3:0-2cm	590	µg/kg	U	98/99-3:0-10cm	600	µg/kg	U	NC	µg/kg	NC
bis(2-Chloroethoxy) Methane	sVOCs	98/99-3:0-2cm	59	µg/kg	U	98/99-3:0-10cm	60	µg/kg	U	NC	µg/kg	NC
2,4-Dichlorophenol	sVOCs	98/99-3:0-2cm	300	µg/kg	U	98/99-3:0-10cm	300	µg/kg	U	NC	µg/kg	NC
1,2,4-Trichlorobenzene	sVOCs	98/99-3:0-2cm	59	µg/kg	U	98/99-3:0-10cm	60	µg/kg	U	NC	µg/kg	NC
Naphthalene	sVOCs	98/99-3:0-2cm	33	µg/kg	J	98/99-3:0-10cm	51	µg/kg	J	18	µg/kg	35.29%
Carbon Normalized Naphthalene	CN-SVOC	98/99-3:0-2cm	1.32	mg/kgOC	J	98/99-3:0-10cm	1.88	mg/kgOC	J	0.56	mg/kgOC	29.60%
4-Chloroaniline	sVOCs	98/99-3:0-2cm	300	µg/kg	U	98/99-3:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Hexachlorobutadiene	sVOCs	98/99-3:0-2cm	59	µg/kg	U	98/99-3:0-10cm	60	µg/kg	U	NC	µg/kg	NC
4-Chloro-3-methylphenol	sVOCs	98/99-3:0-2cm	300	µg/kg	U	98/99-3:0-10cm	300	µg/kg	U	NC	µg/kg	NC
2-Methylnaphthalene	sVOCs	98/99-3:0-2cm	30	µg/kg	J	98/99-3:0-10cm	45	µg/kg	J	15	µg/kg	33.33%
Hexachlorocyclopentadiene	sVOCs	98/99-3:0-2cm	300	µg/kg	U	98/99-3:0-10cm	300	µg/kg	U	NC	mg/kg	NC
2,4,6-Trichlorophenol	sVOCs	98/99-3:0-2cm	300	µg/kg	U	98/99-3:0-10cm	300	µg/kg	U	NC	µg/kg	NC
2,4,5-Trichlorophenol	sVOCs	98/99-3:0-2cm	300	µg/kg	U	98/99-3:0-10cm	300	µg/kg	U	NC	µg/kg	NC
2-Chloronaphthalene	sVOCs	98/99-3:0-2cm	59	µg/kg	U	98/99-3:0-10cm	60	µg/kg	U	NC	µg/kg	NC
2-Nitroaniline	sVOCs	98/99-3:0-2cm	300	µg/kg	U	98/99-3:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Dimethylphthalate	sVOCs	98/99-3:0-2cm	59	µg/kg	U	98/99-3:0-10cm	60	µg/kg	U	NC	µg/kg	NC
Acenaphthylene	sVOCs	98/99-3:0-2cm	36	µg/kg	J	98/99-3:0-10cm	77	µg/kg		41	µg/kg	53.25%
Carbon Normalized Acenaphthylene	CN-SVOC	98/99-3:0-2cm	1.44	mg/kgOC		98/99-3:0-10cm	2.83	mg/kgOC		1.39	mg/kgOC	49.13%
3-Nitroaniline	sVOCs	98/99-3:0-2cm	300	µg/kg	U	98/99-3:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Acenaphthene	sVOCs	98/99-3:0-2cm	42	µg/kg	J	98/99-3:0-10cm	45	µg/kg	J	3	µg/kg	6.67%
Carbon Normalized Acenaphthene	CN-SVOC	98/99-3:0-2cm	1.68	mg/kgOC	J	98/99-3:0-10cm	1.65	mg/kgOC	J	-0.03	mg/kgOC	1.55%
2,4-Dinitrophenol	sVOCs	98/99-3:0-2cm	590	µg/kg	U	98/99-3:0-10cm	600	µg/kg	U	NC	µg/kg	NC
4-Nitrophenol	sVOCs	98/99-3:0-2cm	300	µg/kg	U	98/99-3:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Dibenzofuran	sVOCs	98/99-3:0-2cm	59	µg/kg	U	98/99-3:0-10cm	42	µg/kg	J	NC	µg/kg	NC
2,6-Dinitrotoluene	sVOCs	98/99-3:0-2cm	300	µg/kg	U	98/99-3:0-10cm	300	µg/kg	U	NC	µg/kg	NC
2,4-Dinitrotoluene	sVOCs	98/99-3:0-2cm	300	µg/kg	U	98/99-3:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Diethylphthalate	sVOCs	98/99-3:0-2cm	59	µg/kg	U	98/99-3:0-10cm	60	µg/kg	U	NC	µg/kg	NC
4-Chlorophenyl-phenylether	sVOCs	98/99-3:0-2cm	59	µg/kg	U	98/99-3:0-10cm	60	µg/kg	U	NC	µg/kg	NC
Fluorene	sVOCs	98/99-3:0-2cm	39	µg/kg	J	98/99-3:0-10cm	120	µg/kg		81	µg/kg	67.50%
Carbon Normalized Fluorene	CN-SVOC	98/99-3:0-2cm	1.56	mg/kgOC	J	98/99-3:0-10cm	4.41	mg/kgOC		2.9	mg/kgOC	64.64%
4-Nitroaniline	sVOCs	98/99-3:0-2cm	300	µg/kg	U	98/99-3:0-10cm	300	µg/kg	U	NC	µg/kg	NC

Table A-11 (Continued). Sample Locations: 98/99-3

Result Parameter Name	Sampling Category	Sample IDs								Difference from 0-2cm to 0-10cm	Unit	% difference relative to the 0-10cm value
		0-2cm Sample ID	Value	Unit	Result Data Qualifier	0-10cm Sample ID	Value	Unit	Result Data Qualifier			
4,6-Dinitro-2-Methylphenol	sVOCs	98/99-3:0-2cm	590	µg/kg	U	98/99-3:0-10cm	600	µg/kg	U	NC	µg/kg	NC
N-Nitrosodiphenylamine	sVOCs	98/99-3:0-2cm	59	µg/kg	U	98/99-3:0-10cm	60	µg/kg	U	NC	µg/kg	NC
4-Bromophenyl-phenylether	sVOCs	98/99-3:0-2cm	59	µg/kg	U	98/99-3:0-10cm	60	µg/kg	U	NC	µg/kg	NC
Hexachlorobenzene	sVOCs	98/99-3:0-2cm	59	µg/kg	U	98/99-3:0-10cm	60	µg/kg	U	NC	µg/kg	NC
Pentachlorophenol	sVOCs	98/99-3:0-2cm	300	µg/kg	U	98/99-3:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Phenanthrene	sVOCs	98/99-3:0-2cm	250	µg/kg		98/99-3:0-10cm	590	µg/kg		340	µg/kg	57.63%
Carbon Normalized Phenanthrene	CN-SVOC	98/99-3:0-2cm	10	mg/kgOC		98/99-3:0-10cm	21.69	mg/kgOC		11.7	mg/kgOC	53.90%
Carbazole	sVOCs	98/99-3:0-2cm	42	µg/kg	J	98/99-3:0-10cm	160	µg/kg		118	µg/kg	73.75%
Anthracene	sVOCs	98/99-3:0-2cm	100	µg/kg		98/99-3:0-10cm	910	µg/kg		810	µg/kg	89.01%
Carbon Normalized Anthracene	CN-SVOC	98/99-3:0-2cm	4	mg/kgOC		98/99-3:0-10cm	33.46	mg/kgOC		29	mg/kgOC	88.04%
Di-n-Butylphthalate	sVOCs	98/99-3:0-2cm	150	µg/kg		98/99-3:0-10cm	330	µg/kg		180	µg/kg	54.55%
Fluoranthene	sVOCs	98/99-3:0-2cm	550	µg/kg		98/99-3:0-10cm	1500	µg/kg		950	µg/kg	63.33%
Carbon Normalized Fluoranthene	CN-SVOC	98/99-3:0-2cm	22	mg/kgOC		98/99-3:0-10cm	55.15	mg/kgOC		33.1	mg/kgOC	60.11%
Pyrene	sVOCs	98/99-3:0-2cm	500	µg/kg		98/99-3:0-10cm	1500	µg/kg		1000	µg/kg	66.67%
Carbon Normalized Pyrene	CN-SVOC	98/99-3:0-2cm	20	mg/kgOC		98/99-3:0-10cm	55.15	mg/kgOC		35.1	mg/kgOC	63.73%
Butylbenzylphthalate	sVOCs	98/99-3:0-2cm	59	µg/kg		98/99-3:0-10cm	83	µg/kg		24	µg/kg	28.92%
3,3'-Dichlorobenzidine	sVOCs	98/99-3:0-2cm	300	µg/kg	U	98/99-3:0-10cm	300	µg/kg	U	NC	µg/kg	NC
Benzo(a)anthracene	sVOCs	98/99-3:0-2cm	240	µg/kg		98/99-3:0-10cm	1300	µg/kg		1060	µg/kg	81.54%
Carbon Normalized Benzo(a)anthracene	CN-SVOC	98/99-3:0-2cm	9.6	mg/kgOC		98/99-3:0-10cm	47.79	mg/kgOC		38.2	mg/kgOC	79.91%
bis(2-Ethylhexyl)phthalate	sVOCs	98/99-3:0-2cm	290	µg/kg		98/99-3:0-10cm	280	µg/kg		-10	µg/kg	3.57%
Chrysene	sVOCs	98/99-3:0-2cm	390	µg/kg		98/99-3:0-10cm	2400	µg/kg		2010	µg/kg	83.75%
Carbon Normalized Chrysene	CN-SVOC	98/99-3:0-2cm	15.6	mg/kgOC		98/99-3:0-10cm	88.24	mg/kgOC		72.6	mg/kgOC	82.32%
Di-n-Octyl phthalate	sVOCs	98/99-3:0-2cm	59	µg/kg	U	98/99-3:0-10cm	60	µg/kg	U	NC	µg/kg	NC
Benzo(a)pyrene	sVOCs	98/99-3:0-2cm	260	µg/kg		98/99-3:0-10cm	1200	µg/kg		940	µg/kg	78.33%
Carbon Normalized Benzo(a)pyrene	CN-SVOC	98/99-3:0-2cm	10.4	mg/kgOC		98/99-3:0-10cm	44.12	mg/kgOC		33.7	mg/kgOC	76.43%
Indeno(1,2,3-cd)pyrene	sVOCs	98/99-3:0-2cm	180	µg/kg		98/99-3:0-10cm	510	µg/kg		330	µg/kg	64.71%
Carbon Normalized Indeno(1,2,3-cd)pyrene	CN-SVOC	98/99-3:0-2cm	7.2	mg/kgOC		98/99-3:0-10cm	18.75	mg/kgOC		11.6	mg/kgOC	61.60%
Dibenzo(a,h)anthracene	sVOCs	98/99-3:0-2cm	48	µg/kg	J	98/99-3:0-10cm	210	µg/kg		162	µg/kg	77.14%
Carbon Normalized Dibenzo(a,h)anthracene	CN-SVOC	98/99-3:0-2cm	1.92	mg/kgOC	J	98/99-3:0-10cm	7.72	mg/kgOC		5.80	mg/kgOC	75.13%
Benzo(g,h,i)perylene	sVOCs	98/99-3:0-2cm	210	µg/kg		98/99-3:0-10cm	520	µg/kg		310	µg/kg	59.62%
Carbon Normalized Benzo(g,h,i)perylene	sVOCs	98/99-3:0-2cm	8.4	mg/kgOC		98/99-3:0-10cm	19.12	mg/kgOC		10.7	mg/kgOC	56.06%
1-Methylnaphthalene	sVOCs	98/99-3:0-2cm	59	µg/kg	U	98/99-3:0-10cm	60	µg/kg	U	NC	µg/kg	NC
Total Benzofluoranthenes	sVOCs	98/99-3:0-2cm	540	µg/kg		98/99-3:0-10cm	2600	µg/kg		2060	µg/kg	79.23%
Carbon Normalized Total Benzofluoranthenes	CN-SVOC	98/99-3:0-2cm	21.6	mg/kgOC		98/99-3:0-10cm	19.85	mg/kgOC		-1.75	mg/kgOC	8.80%

*TOC value outside range normally accepted for use in carbon normalization.

Calculated value - not in the EDD

NA = Not applicable

NC = not calculated. If analyltes are not detected, carbon normalized values and differences are not calculated.

2012 Non-LTM Data, Excerpted from Navy (2013h)

Table A-12. OU B Terrestrial Summary of Sampling Results – Non-Volatiles Summer/Fall 2012

		Monitoring Plan Analyte		Endrin (ng/L)	Dissolved Cadmium (µg/L)	TSS (mg/L)
		Compliance Criteria		50	8.8	ND
Well ID	Location Cross-Reference	Sample ID	Sample Date			
Groundwater						
428R	MW-428R	PMP-12-306	10/2/2012	NA	NA	9.5
410R	MW-410R	OUBT-12-301	10/1/2012	NA	NA	7.5
432	PS07-MW03	OUBT-12-432	10/1/2012	NA	NA	5.0
LTMP-1	720	OUBT-12-305	9/26/2012	NA	NA	5.0 U
406R	MW-406R	PMP-12-304	9/28/2012	NA	NA	7.0
LTMP-3	722	OUBT-12-306	9/27/2012	NA	NA	5.0
LTMP-3[1]	722	OUBT-12-307	9/27/2012	NA	NA	6.5
LTMP-4	723	OUBT-12-308	10/2/2012	NA	NA	5.0 U
LTMP-5	724	OUBT-12-309	9/28/2012	NA*	NA*	6.0
810	NA	OUBT-12-312	10/3/2012	NA	NA	5.0 U
903	NA	OUBT-12-314	9/27/2012	0.99 U	0.030 UJ	9.0
905	NA	OUBT-12-316	10/1/2012	NA	NA	13.5
Background Well 346	PS11-MW01L	BG-12-301	10/3/2012	1.0 U	0.030 UJ	5.0 U
Surface Water						
Sinclair Inlet	--	SI-12-301	10/2/2012	1.0 U	0.073	23.0
Quality Control						
Equipment Blank	--	OUBT-11-319	11/1/2011	0.52 U	0.030 UJ	NA
Field Blank	--	OUBT-11-320	11/1/2011	0.50 U	0.030 UJ [2]	NA

Notes:
[1] Field duplicate sample
[2] Field blank results for metals are total metals, rather than dissolved metals.
µg/L – micrograms per liter
J – estimated value
mg/L – milligrams per liter
NA – not analyzed
NA* - not analyzed for Non-LTM reporting. Results required for LTM and reported in LTM Data Summary Reports.
ND – Not determined
ng/L – nanograms per liter
TSS – total suspended solids
U – not detected at the indicated quantitation limit
UJ – not detected at the indicated, estimated quantitation limit

Table A-13. OU B Terrestrial Summary of Groundwater Sampling Results – Volatiles Summer/Fall 2012

Well ID	410R		432		704		704[1]		809		810		811		904		905		907		Trip Blank	
Sample ID	OUBT-12-301		OUBT-12-302		OUBT-12-303		OUBT-12-304		OUBT-12-311		OUBT-12-312		OUBT-12-313		OUBT-12-315		OUBT-12-316		OUBT-12-317		TB--12-302	
Sample Date	10/1/2012		10/1/2012		10/3/2012		10/3/2012		10/3/2012		10/3/2012		10/3/2012		9/27/2012		10/1/2012		10/2/2012		10/1/2012	
Analytical Method	8260C	8260C SIM	8260C	8260C SIM	8260C	8260C SIM	8260C	8260C SIM	8260C	8260C SIM	8260C	8260C SIM	8260C	8260C SIM	8260C	8260C SIM	8260C	8260C SIM	8260C	8260C SIM	8260C	8260C SIM
	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Analyte																						
Dichlorodifluoromethane	0.5 UJ		0.50 U		0.50 U	-	0.50 U		0.50 U	-	0.50 UJ	-	0.50 UJ	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	
Chloromethane	0.50 U		0.50 U		0.50 U	-	0.50 U		0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	
Vinyl Chloride	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.026	1.2	1.2	0.50 U	0.013 J	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U
Bromomethane	0.50 U		0.50 U		0.50 U	-	0.50 U		0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	
Chloroethane	0.50 U		0.50 U		0.50 U	-	0.50 U		0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	
Trichlorofluoromethane	0.50 U		0.50 U		0.50 U	-	0.50 U		0.28 J	-	0.27 J	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	
1,1-Dichloroethene	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 UJ	0.50 U	0.020 U	0.50 U	0.013 J	0.50 U	0.017 J	0.50 U	0.020 U	0.50 U	0.020 UJ	0.50 U	0.020 U	0.50 U	0.0063 J	0.50 U	0.020 U
Acetone	20 U		20 U		20 U	-	20 U		20 U	-	20 U	-	20 U	-	20 U	-	20 U	-	20 U	-	20 U	
Carbon Disulfide	0.50 U		0.50 U		0.50 U	-	0.50 U		0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.17 J	-	0.50 U	
Methylene Chloride	2.0 U		2.0 U		2.0 U	-	2.0 U		2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	
Methyl tert-Butyl Ether	0.50 U		0.50 U		0.50 U	-	0.50 U		0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	
trans-1,2-Dichloroethene	0.42 J	0.48	0.50 U	0.013 J	0.50 U	0.020 U	0.50 U	0.020 U	0.14 J	0.098	0.11 J	0.093	0.50 U	0.0048 J	0.50 U	0.020 U	0.50 U	0.011 J	0.50 U	0.020 U	0.50 U	0.020 U
1,1-Dichloroethane	0.19 J		0.50 U		0.50 U	-	0.50 U		0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	
2,2-Dichloropropane	0.50 U		0.50 U		0.50 U	-	0.50 U		0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	
cis-1,2-Dichloroethene	2.6	3.1	0.50 U	0.06	0.50 U	0.020 U	0.50 U	0.020 U	0.34 J	0.330	2.8	2.8	0.50 U	0.014 J	0.50 U	0.020 U	0.29 J	0.280	0.23 J	0.22	0.50 U	0.020 U
2-Butanone (MEK)	20 U		20 U		20 U	-	20 U		20 U	-	20 U	-	20 U	-	20 U	-	20 U	-	20 U	-	2.3 J	
Bromochloromethane	0.50 U		0.50 U		0.50 U	-	0.50		0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	
Chloroform	0.34 J	0.31	0.56	0.55	9.7	11 D	9.7	10 D	0.50 U	0.0079 J	0.50 U	0.020 U	9.8	9.7	0.11 J	0.140	0.50 U	0.068 J	0.63	0.63	0.50 U	0.020 U
1,1,1-Trichloroethane (TCA)	0.24 J		0.080		0.50 U	-	0.50 U		0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	
Carbon Tetrachloride	0.50 U	0.020 U	0.50 U	0.028	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.022	0.50 U	0.023	0.50 U	0.011 J	0.50 U	0.020 U
1,1-Dichloropropene	0.50 U		0.50 U		0.50 U	-	0.50 U		0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	
Benzene	0.50 U		0.50 U		0.50 U	-	0.50 U		0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.050 U	-	0.50 U	
1,2-Dichloroethane (EDC)	0.50 U	0.0079	0.50 U	33 D	0.50 U	0.020 U	0.50 U	0.064	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U
Trichloroethene (TCE)	15	13 D	36	0.086	0.50 U	0.067	0.50 U	0.14	3.9	4.1 J	1.5	1.4	0.50 U	0.028	4.6	5.8	1.2	1.2	1.1	1.0	0.50 U	
1,2-Dichloropropane	0.50 U		0.50 U		0.50 U	-	0.50 U		0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	
Dibromomethane	0.50 U		0.50 U		0.50 U	-	0.50 U		0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	
Bromodichloromethane	0.50 U		0.50 U		0.50 U	-	0.50 U		0.50 U	-	0.50 U	-	0.54 J	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	
cis-1,3-Dichloropropene	0.50 U		0.50 U		0.50 U	-	0.50 U		0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	
4-Methyl-2-pentanone (MIBK)	20 U		20 U		20 U	-	20 U		20 U	-	20 U	-	20 U	-	20 U	-	20 U	-	20 U	-	20 U	
Toluene	0.50 U		0.50 U		0.46 J	-	0.50 U		0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.24 J	
trans-1,3-Dichloropropene	0.50 U		0.50 U		0.50 U	-	0.50 U		0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	
1,1,2-Trichloroethane	0.50 U		0.50 U		0.50 U	-	0.50 U		0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	
Tetrachloroethene (PCE)	0.50 U	0.065	0.50 U	0.086	0.50 U	0.140	0.12 J	0.14	0.50 U	0.020 U	0.10 J	0.090	0.50 U	0.020 U	0.50 U	0.020 U	49	43 D	0.42 J	0.41	0.50 U	
2-Hexanone	20 U		20 UJ		20 UJ		20 UJ		20 UJ	-	20 U	-	20 U	-	20 UJ	-	20 UJ	-	20 UJ	-	20 UJ	
1,3-Dichloropropane	0.50 U		0.50 U		0.50 U		0.50 U		0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	
Dibromochloromethane	0.50 U		0.50 U		0.50 U		0.50 U		0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	
1,2-Dibromoethane (EDB)	2.0 U		2.0 U		2.0 U		2.0 U		2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	
Chlorobenzene	0.50 U		0.50 U		0.50 U		0.50 U		0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	

Table A-13 (Continued). OU B Terrestrial Summary of Groundwater Sampling Results – Volatiles Summer/Fall 2012

Well ID	410R		432		704		704[1]		809		810		811		904		905		907		Trip Blank	
Sample ID	OUBT-12-301		OUBT-12-302		OUBT-12-303		OUBT-12-304		OUBT-12-311		OUBT-12-312		OUBT-12-313		OUBT-12-315		OUBT-12-316		OUBT-12-317		TB--12-302	
Sample Date	10/1/2012		10/1/2012		10/3/2012		10/3/2012		10/3/2012		10/3/2012		10/3/2012		9/27/2012		10/1/2012		10/2/2012		10/1/2012	
Analytical Method	8260C	8260C SIM	8260C	8260C SIM	8260C	8260C SIM	8260C	8260C SIM	8260C	8260C SIM	8260C	8260C SIM	8260C	8260C SIM	8260C	8260C SIM	8260C	8260C SIM	8260C	8260C SIM	8260C	8260C SIM
	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Analyte (continued)																						
Ethylbenzene	0.50 U		0.50 U		0.50 U		0.50 U		0.50 U		0.50 U		0.50 U		0.50 U		0.50 U		0.50 U		0.50 U	
1,1,1,2-Tetrachloroethane	0.50 U		0.50 U		0.50 U		0.50 U		0.50 U		0.50 U		0.50 U		0.50 U		0.50 U		0.50 U		0.50 U	
m,p-Xylenes	0.23 J		0.50 U		0.50 U		0.50 U		0.50 U		0.50 U		0.50 U		0.50 U		0.50 U		0.50 U		0.50 U	
o-Xylene	0.080 J		0.50 U		0.50 U	-	0.50 U		0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	
Styrene	0.50 U		0.50 U		0.50 U	-	0.50 U		0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	
Bromoform	0.50 UJ		0.50 UJ		0.50 UJ	-	0.50 UJ		0.50 UJ	-	0.50 UJ	-	0.50 UJ	-	0.50 UJ	-	0.50 UJ	-	0.50 UJ	-	0.50 UJ	
Isopropylbenzene	2.0 U		2.0 U		2.0 U	-	2.0 U		2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	
1,1,2,2-Tetrachloroethane	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U
Bromobenzene	2.0 U		2.0 U		2.0 U	-	2.0 U		2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	
n-Propylbenzene	2.0 U		2.0 U		2.0 U	-	2.0 U		2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	
1,2,3-Trichloropropane	0.5 U		0.5 U		0.50 U	-	0.50 U		0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	
2-Chlorotoluene	2.0 U		2.0 U		2.0 U	-	2.0 U		2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	
1,3,5-Trimethylbenzene	2.0 U		2.0 U		2.0 U	-	2.0 U		2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	
4-Chlorotoluene	2.0 U		2.0 U		2.0 U	-	2.0 U		2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	
tert-Butylbenzene	2.0 U		2.0 U		2.0 U	-	2.0 U		2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	
1,2,4-Trimethylbenzene	0.13 J		2.0 U		2.0 U	-	2.0 U		2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	
sec-Butylbenzene	2.0 U		2.0 U		2.0 U	-	2.0 U		2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	
4-Isopropyltoluene	2.0 U		2.0 U		2.0 U	-	2.0 U		2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	
1,3-Dichlorobenzene	0.5 U		0.5 U		0.50 U	-	0.50 U		0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	
1,4-Dichlorobenzene	0.50 U		0.5 U		0.50 U	-	0.50 U		0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	
n-Butylbenzene	2.0 U		2.0 U		2.0 U	-	2.0 U		2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	
1,2-Dichlorobenzene	0.50 U		0.5 U		0.50 U	-	0.50 U		0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	
1,2-Dibromo-3-chloropropane	2.0 U		2.0 U		2.0 U	-	2.0 U		2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	
1,2,4-Trichlorobenzene	2.0 U		2.0 U		2.0 U	-	2.0 U		2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	
Hexachlorobutadiene	2.0 U		2.0 U		2.0 U	-	2.0 U		2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	
Naphthalene	0.11 J		2.0 U		2.0 U	-	2.0 U		2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	
1,2,3-Trichlorobenzene	2.0 U		2.0 U		2.0 U	-	2.0 U		2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	

Notes:
[1] Field duplicate sample
- not analyzed
µg/L – micrograms per liter
D - result is from a diluted analysis
J – estimated value
SIM – selected ion monitoring
U – not detected at the indicated quantitation limit
UJ – not detected at the indicated, estimated quantitation limit

Table A-14. OU B Terrestrial Summary of Sampling Results – Low-Level Mercury Summer/Fall 2012 and Winter/Spring 2013

Location ID	Location Cross-Reference	Sample ID	Total Mercury (µg/L)
Compliance Criteria			**0.025**
Groundwater			
900	NA	OUBT-LL-12-306	0.00062
900	NA	OUBT-LL-13-106	0.00065 UJ
901	NA	OUBT-LL-12-307	**0.0311**
901	NA	OUBT-LL-13-107	**0.109**
903	NA	OUBT-LL-308	0.00042 UJ
Background Well 346	PS11-MW01L	NSC-LL-11-312	0.00039 U
Background Well 346	PS11-MW01L	BG-LL-13-101	0.00040 U
Surface Water			
Sinclair Inlet	NA	SI-LL-12-301	0.00421
Sinclair Inlet	NA	SI-LL-13-101	0.00124
Quality Control			
Equipment Blank	NA	EB-LL-12-301	0.00041 UJ
Equipment Blank	NA	EB-LL-13-101	0.00040 U
Field Blank	NA	FB-LL-12-301	0.00041 UJ
Field Blank	NA	FB-LL-13-101	0.00040 U
Trip Blank	NA	TB-LL-12-301	0.00019 B
Trip Blank	NA	TB-LL-13-101	0.00040 U

Notes:
Bold data indicates concentrations exceeding compliance criteria.
J – estimated value
B- As applicable to mercury, the result is qualified as estimated because it is greater than the method detection limit but less than the quantitation limit.
µg/L – micrograms per liter
NA – not applicable
UJ – not detected at the indicated, estimated quantitation limit

Table A-15. OU NSC Summary of Sampling Results – Volatiles Summer/Fall 2012

Well ID	902		Trip Blank	
Sample ID	NSC-12-306		TB-12-301	
Sample Date	9/26/2012		9/26/2012	
Analytical Method	8260C (µg/L)	8260C SIM (µg/L)	8260C (µg/L)	8260C SIM (µg/L)
Analyte				
Dichlorodifluoromethane	0.50 U	-	0.50 U	-
Chloromethane	0.50 U	-	0.50 U	-
Vinyl Chloride	0.50 U	0.020 U	0.50 U	0.020 U
Bromomethane	0.50 U	-	0.50 U	-
Chloroethane	0.50 U	-	0.50 U	-
Trichlorofluoromethane	0.50 U	-	0.50 U	-
1,1-Dichloroethene	0.50 U	0.020 UJ	0.50 U	0.020 U
Acetone	20 U	-	3.3 J	-
Carbon Disulfide	0.50 U	-	0.50 U	-
Methylene Chloride	2.0 U	-	2.0 U	-
Methyl tert-Butyl Ether	0.50 U	-	0.50 U	-
trans-1,2-Dichloroethene	0.50 U	0.020 U	0.50 U	0.020 U
1,1-Dichloroethane	0.50 U	-	0.50 U	-
2,2-Dichloropropane	0.50 U	-	0.50 U	-
cis-1,2-Dichloroethene	0.50 U	0.015 J	0.50 U	0.020 U
2-Butanone (MEK)	20 U	-	2.4 J	-
Bromochloromethane	0.50 U	-	0.50 U	-
Chloroform	0.50 U	0.020 U	0.50 U	0.020 U
1,1,1-Trichloroethane (TCA)	0.50 U	-	0.50 U	-
Carbon Tetrachloride	0.50 U	0.020 U	0.50 U	0.020 U
1,1-Dichloropropene	0.50 U	-	0.50 U	-
Benzene	0.50 U	-	0.50 U	-
1,2-Dichloroethane (EDC)	0.50 U	0.020 U	0.50 U	0.020 U
Trichloroethene (TCE)	0.50 U	0.0052 J	0.50 U	0.020 U
1,2-Dichloropropane	0.50 U	-	0.50 U	-
Dibromomethane	0.50 U	-	0.50 U	-
Bromodichloromethane	0.50 U	-	0.50 U	-
cis-1,3-Dichloropropene	0.50 U	-	0.50 U	-
4-Methyl-2-pentanone (MIBK)	20 U	-	20 U	-
Toluene	0.50 U	-	0.090	-
trans-1,3-Dichloropropene	0.50 U	-	0.50 U	-
1,1,2-Trichloroethane	0.50 U	-	0.50 U	-
Tetrachloroethene (PCE)	0.50 U	0.020 U	0.50 U	0.020 U
2-Hexanone	20 U	-	20 U	-
1,3-Dichloropropane	0.50 U	-	0.50 U	-
Dibromochloromethane	0.50 U	-	0.50 U	-
1,2-Dibromoethane (EDB)	2.0 U	-	2.0 U	-
Chlorobenzene	0.50 U	-	0.50 U	-
Ethylbenzene	0.50 U	-	0.50 U	-
1,1,1,2-Tetrachloroethane	0.50 U	-	0.50 U	-

Table A-15 (Continued). OU NSC Summary of Sampling Results – Volatiles Summer/Fall 2012

Well ID	902		Trip Blank	
Sample ID	NSC-12-306		TB-12-301	
Sample Date	9/26/2012		9/26/2012	
Analytical Method	8260B (µg/L)	8260B SIM (µg/L)	8260B (µg/L)	8260B SIM (µg/L)
Analyte (continued)				
m,p-Xylenes	0.50 U	-	0.50 U	-
o-Xylene	0.50 U	-	0.50 U	-
Styrene	0.50 U	-	0.50 U	-
Bromoform	0.50 UJ	-	0.50 UJ	-
Isopropylbenzene	2.0 U	-	2.0 U	-
1,1,2,2-Tetrachloroethane	0.50 U	0.020 U	05.0 U	0.020 U
Bromobenzene	2.0 U	-	2.0 U	-
n-Propylbenzene	2.0 U	-	2.0 U	-
1,2,3-Trichloropropane	0.50 U	-	0.50 U	-
2-Chlorotoluene	2.0 U	-	2.0 U	-
1,3,5-Trimethylbenzene	2.0 U	-	2.0 U	-
4-Chlorotoluene	2.0 U	-	2.0 U	-
tert-Butylbenzene	2.0 U	-	2.0 U	-
1,2,4-Trimethylbenzene	2.0 U	-	2.0 U	-
sec-Butylbenzene	2.0 U	-	2.0 U	-
4-Isopropyltoluene	2.0 U	-	2.0 U	-
1,3-Dichlorobenzene	0.50 U	-	0.50 U	-
1,4-Dichlorobenzene	0.50 U	-	0.50 U	-
n-Butylbenzene	2.0 U	-	2.0 U	-
1,2-Dichlorobenzene	0.50 U	-	0.50 U	-
1,2-Dibromo-3-chloropropane	2.0 U	-	2.0 U	-
1,2,4-Trichlorobenzene	2.0 U	-	2.0 U	-
Hexachlorobutadiene	2.0 U	-	2.0 U	-
Naphthalene	2.0 U	-	2.0 U	-
1,2,3-Trichlorobenzene	2.0 U	-	2.0 U	-

Notes:
- not analyzed
µg/L – micrograms per liter
J – estimated value
SIM – selected ion monitoring
U – not detected at the indicated quantitation limit
UJ – not detected at the indicated, estimated quantitation limit

Table A-16. OU NSC Summary of Sampling Results – Low-Level Mercury Summer/Fall 2012 and Winter/Spring 2013

Location ID	Location Cross-Reference	Sample ID	Total Mercury (µg/L)
Compliance Criteria			**0.025**
Groundwater			
902	NA	NSC-LL-12-301	0.00041 U
902	NA	NSC-LL-13-101	0.00042 U
Background Well 346	PS11-MW01L	NSC-LL-11-312	0.00039 U
Background Well 346	PS11-MW01L	BG-LL-13-101	0.00040 U
Surface Water			
Sinclair Inlet	NA	SI-LL-12-301	0.00421
Sinclair Inlet	NA	SI-LL-13-101	0.00124
Quality Control			
Equipment Blank	NA	EB-LL-12-301	0.00041 UJ
Equipment Blank	NA	EB-LL-13-101	0.00040 U
Field Blank	NA	FB-LL-12-301	0.00041 UJ
Field Blank	NA	FB-LL-13-101	0.00040 U
Trip Blank	NA	TB-LL-12-301	0.00019 B
Trip Blank	NA	TB-LL-13-101	0.00040 U

Notes:
Bold data indicates concentrations exceeding compliance criteria.
J – estimated value
B- As applicable to mercury, the result is qualified as estimated because it is greater than the method detection limit but less than the quantitation limit.
µg/L – micrograms per liter
NA – not applicable
UJ –not detected at the indicated, estimated quantitation limit

Table A-17. OU NSC Summary of Sampling Results – Non-Volatiles Summer/Fall 2012

			Monitoring Plan Analyte	TSS (mg/L)
OU NSC Compliance Criteria				**NA**
Well ID	**Location Cross-Reference**	**Sample ID**	**Sample Date**	
Groundwater				
392R	MW392R	PMP-12-302	9/27/2012	6.5
Background Well 346	PS11-MW01L	BG-12-301	10/3/2012	5.0 U
Surface Water				
Sinclair Inlet	--	SI-12-301	10/2/2012	23.0

Notes:
NA – not applicable
mg/L – milligrams per liter
TSS – total suspended solids
U – not detected at the indicated quantitation limit

2013-2014 Non-LTM Data, Excerpted from Navy (2014h)

Table A-18. OU B Terrestrial Summary of Sampling Results – Pesticides, Metals, and Total Suspended Solids – Summer/Fall 2013

		Monitoring Plan Analyte		Endrin (ng/L)	Dissolved Cadmium (µg/L)	TSS (mg/L)
		Compliance Criteria		50	8.8	ND
Well ID	Location Cross-Reference	Sample ID	Sample Date			
Groundwater						
406R	MW-406R	PMP-13-303	10/1/2013	NA	NA	5.5
410R	MW-410R	OUBT-13-301	10/3/2013	NA	NA*	8.0
432	PS07-MW03	OUBT-13-302	10/3/2013	NA	NA	5.0
LTMP-1	720	OUBT-13-305	9/30/2013	NA	NA*	5.0 U
LTMP-3	722	OUBT-13-306	9/30/2013	NA	NA*	5.0
LTMP-4	723	OUBT-13-308	10/3/2013	NA	NA*	10.0
LTMP-5	724	OUBT-13-309	10/1/2013	NA*	NA*	5.5
LTMP-5[1]	724	OUBT-13-310	10/1/2013	NA*	NA	6.0
810	NA	OUBT-13-312	9/30/2013	NA	NA	5.0 U
903	NA	OUBT-13-314	10/1/2013	9.9 U	0.020 U	12.0
905	NA	OUBT-13-316	10/2/2013	NA	NA	5.0 U
Background Well 346	PS11-MW01L	BG-13-301	10/15/2013	10 U	0.020 UJ	5.0 U
Surface Water						
Sinclair Inlet	--	SI-13-301	10/8/2013	1.6 J	0.111	23.5

Notes:
[1] Field duplicate sample
J – estimated value
µg/L – micrograms per liter
mg/L – milligrams per liter
NA – not analyzed
NA* – Not analyzed for Non-LTM reporting. Results required for LTM and reported in LTM Data Summary Report.
ND – not determined
ng/L – nanograms per liter
TSS – total suspended solids
U – not detected at the indicated quantitation limit
UJ – not detected at the indicated, estimated quantitation limit

Table A-19. OU B Terrestrial Summary of Groundwater Sampling Results – Volatiles – Summer/Fall 2013

Well ID	410R	425	432	432[1]	704	809	810	811	904	905	907	Background Well 346	Trip Blanks Varies[2]	
Sample ID	OUBT-13-301	PMP-13-304	OUBT-13-302	OUBT-13-303	OUBT-13-304	OUBT-13-311	OUBT-13-312	OUBT-13-400	OUBT-13-315	OUBT-13-316	OUBT-13-317	BG-13-301	Varies[2]	
Sample Date	10/3/2013	10/7/2013	10/3/2013	10/3/2013	10/2/2013	9/30/2013	9/30/2013	10/29/2013	10/1/2013	10/2/2013	10/7/2013	10/15/2013		
Analytical Method	8260C (µg/L)	8260C SIM (µg/L)	8260C (µg/L)	8260C SIM (µg/L)	8260C (µg/L)	8260C SIM (µg/L)	8260C (µg/L)	8260C SIM (µg/L)	8260C (µg/L)	8260C SIM (µg/L)	8260C (µg/L)	8260C SIM (µg/L)	8260C (µg/L)	8260C SIM (µg/L)	8260C (µg/L)	8260C SIM (µg/L)	8260C (µg/L)	8260C SIM (µg/L)	8260C (µg/L)	8260C SIM (µg/L)	8260C (µg/L)	8260C SIM (µg/L)	8260C (µg/L)	8260C SIM (µg/L)	8260C (µg/L)	8260C SIM (µg/L)
Analyte																										
Dichlorodifluoromethane	0.50 UJ	-	0.50 UJ	-	0.50 UJ	-	0.50 UJ	-	0.50 UJ	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 UJ	-	0.50 UJ	-	0.50 UJ	-	0.50 U to 0.50 UJ	-
Chloromethane	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 UJ	-	0.50 U	-	0.50 U	-	0.50 UJ	-	0.50 U	-	0.50 UJ	-	0.50 U	-	0.50 U	-	0.50 U to 0.50 UJ	-
Vinyl Chloride	0.50 UJ	0.020 U	0.50 UJ	0.020 U	0.50 UJ	0.020 U	0.50 UJ	0.020 U	0.50 U	0.020 U	0.50 U	0.014 J	2.1	2.0	0.50 U	0.067 J	0.50 U	0.020 U	0.50 U	0.020 U	0.50 UJ	0.020 U	0.50 UJ	0.020 U	0.50 U to 0.50 UJ	0.020 U
Bromomethane	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 UJ	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U to 0.50 UJ	-
Chloroethane	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.28 J	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
Trichlorofluoromethane	0.50 U	-	0.37 J	-	0.50 U	-	0.50 U	-	0.50 U	-	0.26 J	-	0.27 J	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
1,1-Dichloroethene	0.50 U	0.020 U	0.50 U	0.029	0.50 U	0.020 U	0.50 U	0.025	0.50 U	0.020 U	0.50 U	0.014 J	0.50 U	0.020	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.0092 J	0.50 U	0.020 U	0.50 U	0.020 U
Acetone	20 U	-	20 U	-	20 U	-	20 U	-	20 UJ	-	20 UJ	-	20 UJ	-	6.3 J	-	20 UJ	-	20 UJ	-	20 U	-	20 U	-	20 U to 20 UJ	-
Carbon Disulfide	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
Methylene Chloride	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U to 0.16 J	-
Methyl tert-Butyl Ether	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
trans-1,2-Dichloroethene	0.40 J	0.40	0.50 U	0.17 J	0.50 U	0.011 J	0.50 U	0.011 J	0.50 U	0.020 U	0.13 J	0.098	0.10 J	0.12	0.50 U	0.012 J	0.50 U	0.020 U	0.50 U	0.0092 J	0.50 U	0.0038 J	0.50 U	0.020 U	0.50 U	0.020 U
1,1-Dichloroethane	0.14 J	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
2,2-Dichloropropane	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
cis-1,2-Dichloroethene	2.4	2.5	0.44 J	0.40	0.070 J	0.057	0.50 U	0.056	0.50 U	0.020 U	0.32 J	0.32	2.9	3.2	0.50 U	0.039	0.50 U	0.020 U	0.20 J	0.18	0.20 J	0.21	0.50 U	0.020 U	0.50 U	0.020 U
2-Butanone (MEK)	20 U	-	20 U	-	20 U	-	20 U	-	20 UJ	-	20 UJ	-	20 UJ	-	20 U	-	20 UJ	-	20 UJ	-	20 U	-	20 U	-	20 UJ	-
Bromochloromethane	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
Chloroform	0.50 U	0.41 UJ	1.5	1.7	0.65 UJ	0.72 UJ	0.65 UJ	0.73 UJ	2.7	2.9 J	0.50 U	0.020 U	0.50 U	0.020 U	3.8	2.7 J	0.50 U	0.18 UJ	0.50 U	0.080 UJ	0.67 UJ	0.70 UJ	0.50 U	0.020 U	0.50 U to 0.20 J	0.077 to 0.23
1,1,1-Trichloroethane	0.27 J	-	0.080 J	-	0.080 J	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.080 J	-	0.50 U	-	0.50 U	-
Carbon Tetrachloride	0.50 U	0.020 UJ	0.50 U	0.068 J	0.50 U	0.028 J	0.50 U	0.028 J	0.50 U	0.020 UJ	0.50 U	0.020 UJ	0.50 U	0.020 UJ	0.50 U	0.020 U	0.50 U	0.020 J	0.50 U	0.028 J	0.50 U	0.013 J	0.50 U	0.020 U	0.50 U	0.020 U to 0.023 UJ
1,1-Dichloropropene	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
Benzene	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.12 J	-	0.50 U	-	0.50 U	-	0.050 U	-	0.50 U	-	0.50 U	-
1,2-Dichloroethane	0.50 U	0.0094 J	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U
Trichloroethene (TCE)	15	14 D	**77 D**	**81 D**	27	25 D	27	26 D	0.50 U	0.062	4.6	4.9	1.5	1.5	0.50 U	0.047	4.6	4.9	1.3	1.3	1.2	1.2	0.50 U	0.020 U	0.50 U	0.020 U
1,2-Dichloropropane	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
Dibromomethane	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
Bromodichloromethane	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.25 J	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
cis-1,3-Dichloropropene	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
4-Methyl-2-pentanone (MIBK)	20 U	-	20 U	-	20 U	-	20 U	-	20 UJ	-	20 UJ	-	20 UJ	-	20 U	-	20 UJ	-	20 UJ	-	20 U	-	20 U	-	20 U to 20 UJ	-
Toluene	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.13 J	-	0.50 U	-	0.50 U	-	0.30 J	-	0.50 U	-	0.50 U	-	0.50 U	-	0.070 J	-	0.50 U	-
trans-1,3-Dichloropropene	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
1,1,2-Trichloroethane	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
Tetrachloroethene (PCE)	0.10 J	0.083	0.11 J	0.093	0.50 U	0.053	0.50 U	0.044 UJ	0.21 J	0.17	0.50 U	0.020 U	0.11 J	0.088	0.50 U	0.010 J	0.50 U	0.020 U	45	35 D	0.38 J	0.30	0.50 U	0.023 UJ	0.50 U	0.020 U to 0.032
2-Hexanone	20 U	-	20 U	-	20 U	-	20 U	-	20 UJ	-	20 UJ	-	20 UJ	-	20 U	-	20 UJ	-	20 UJ	-	20 U	-	20 U	-	20 U to 20 UJ	-
1,3-Dichloropropane	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
Dibromochloromethane	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
1,2-Dibromoethane	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-
Chlorobenzene	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-

Table A-19. OU B Terrestrial Summary of Groundwater Sampling Results – Volatiles – Summer/Fall 2013 (Continued)

Well ID	410R		425		432		432[1]		704		809		810		811		904		905		907		Background Well 346		Trip Blanks	
Sample ID	OUBT-13-301		PMP-13-304		OUBT-13-302		OUBT-13-303		OUBT-13-304		OUBT-13-311		OUBT-13-312		OUBT-13-400		OUBT-13-315		OUBT-13-316		OUBT-13-317		BG-13-301			
Sample Date	10/3/2013		10/7/2013		10/3/2013		10/3/2013		10/2/2013		9/30/2013		9/30/2013		10/29/2013		10/1/2013		10/2/2013		10/7/2013		10/15/2013			
Analytical Method	8260C	8260C SIM	8260C	8260C SIM	8260C	8260C SIM	8260C	8260C SIM	8260C	8260C SIM	8260C	8260C SIM	8260C	8260C SIM	8260C	8260C SIM	8260C	8260C SIM	8260C	8260C SIM	8260C	8260C SIM	8260C	8260C SIM	8260C	8260C SIM
	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Analyte (continued)																										
Ethylbenzene	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.63	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
1,1,1,2-Tetrachloroethane	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 UJ	-	0.50 U	-
m,p-Xylenes	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	4.7	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U to 0.50 UJ	-
o-Xylene	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	12	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
Styrene	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
Bromoform	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 UJ	-	0.50 U to 0.50 UJ	-
Isopropylbenzene	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	0.35 J	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-
1,1,2,2-Tetrachloroethane	0.50 U	0.020 U	0.50 U	0.020 U	0.020 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 UJ	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U to 0.50 UJ	0.020 U
Bromobenzene	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-
n-Propylbenzene	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	1.4 J	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U to 2.0 UJ	-
1,2,3-Trichloropropane	0.5 U	-	0.50 U	-	0.5 U	-	0.5 U	-	0.50 UJ	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 UJ	-	0.50 U	-	0.50 U	-	0.50 U to 0.50 UJ	-
2-Chlorotoluene	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-
1,3,5-Trimethylbenzene	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	31	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-
4-Chlorotoluene	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 UJ	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U to 2.0 UJ	-
tert-Butylbenzene	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-
1,2,4-Trimethylbenzene	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	45 J	-	2.0 U	-	2.0 U	-	2.0 U	-	0.080 J	-	2.0 U to 2.0 UJ	-
sec-Butylbenzene	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	1.0 J	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-
4-Isopropyltoluene	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.1 J	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U to 2.0 UJ	-
1,3-Dichlorobenzene	0.50 U	-	0.50 U	-	0.5 U	-	0.5 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
1,4-Dichlorobenzene	0.50 U	-	0.50 U	-	0.5 U	-	0.5 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
n-Butylbenzene	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 UJ	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U to 2.0 UJ	-
1,2-Dichlorobenzene	0.50 U	-	0.50 U	-	0.5 U	-	0.5 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
1,2-Dibromo-3-chloropropane	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 UJ	-	2.0 UJ	-	2.0 UJ	-	2.0 U	-	2.0 UJ	-	2.0 UJ	-	2.0 U	-	2.0 U	-	2.0 UJ	-
1,2,4-Trichlorobenzene	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-
Hexachlorobutadiene	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U to 2.0 UJ	-
Naphthalene	2.0 UJ	-	2.0 UJ	-	2.0 UJ	-	2.0 UJ	-	2.0 UJ	-	2.0 UJ	-	2.0 UJ	-	4.0	-	2.0 UJ	-	2.0 UJ	-	2.0 UJ	-	2.0 U	-	2.0 U to 2.0 UJ	-
1,2,3-Trichlorobenzene	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 UJ	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 UJ	-	2.0 U	-	2.0 U	-	2.0 U to 2.0 UJ	-

Notes:
[1] Field duplicate sample
[2] Trip blanks were placed in each cooler containing samples for VOC analysis. The range of results for each analyte is presented here. (The sample IDs and sample dates for the trip blanks include the following: TB-13-301 on 9/30/2013, TB-13-302 on 10/02/2013, TB-13-303 on 10/07/2013, TB-13-304 on 10/15/2013, and TB-400 on 10/29/2013.
Bold data indicates concentrations exceeding compliance criteria.
- not analyzed
µg/L – micrograms per liter
D – result is from a diluted analysis
J – estimated value
SIM – selected ion monitoring`
U – not detected at the indicated quantitation limit
UJ – not detected at the indicated, estimated quantitation limit

Table A-20. OU B Terrestrial Summary of Groundwater Sampling Results – Total Petroleum Hydrocarbons – Summer/Fall 2013

Location/Location Cross-Reference	Sample ID	Matrix	Sample Date	NWTPH-HCID			NWTPH-Gx	NWTPH-Dx	
				Gasoline Range	Diesel Range	Residual Range	Gasoline Range	Diesel Range	Residual Range
811	OUBT-13-400	Water	10/29/2013	Detected	Detected	Detected	1,000 µg/L Y	2,600 µg/L Y	350 µg/L L
811	OUBT-13-401	Product	10/29/2013	Not Detected [1]	Detected	Detected	NA	1,100,000 mg/kg DYJ	2,600 mg/kg DL
TANK[2]	TANK	Product	10/29/2013	Not Detected [1]	Detected	Detected	54,000 mg/kg YJ	1,100,000 mg/kg DYJ	25,000 mg/kg DL
Trip Blank	TB-400	Water	10/29/2013	NA	NA	NA	250 µg/L U	NA	NA

Notes:

[1] Not detected in the sense that the response is attributable to petroleum product eluting in later range(s). No follow-up analysis required by laboratory. (Follow-up analysis for TANK performed at request of Sealaska for chromatogram comparison to Sample OUBT-13-400.)

[2] Aboveground storage tank containing off-road diesel fuel

D – result reported from a diluted analysis

J – result is an estimated value

L – The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.

mg/kg – milligrams per kilogram

µg/L – micrograms per liter

NA – not analyzed

U – analyte not detected at indicated quantitation limit

Y – The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.

Table A-21. OU B Terrestrial Summary of Sampling Results – Low-Level Mercury – Summer/Fall 2013 and Winter/Spring 2014

Location ID	Location Cross-Reference	Sample ID	Sample Date	Total Mercury (µg/L)
Compliance Criteria				**0.025**
Groundwater				
900	NA	OUBT-LL-13-306	10/16/2013	0.00112 UJ
900	NA	OUBT-LL-14-206	2/21/2014	0.00175
901	NA	OUBT-LL-13-307	10/16/2013	**0.0309**
901	NA	OUBT-LL-14-207	2/27/2014	**0.0641**
Background Well 346	PS11-MW01L	BG-LL-13-301	10/15/2013	0.00040 UJ
Background Well 346	PS11-MW01L	BG-LL-14-201	2/20/2014	0.00040 U
Surface Water				
Sinclair Inlet	NA	SI-LL-13-301	10/16/2013	0.00123 UJ
Sinclair Inlet	NA	SI-LL-14-201	2/27/2014	0.00868
Quality Control				
Equipment Blank	NA	EB-LL-13-301	10/15/2013	0.00041 U
Equipment Blank	NA	EB-LL-14-201	2/20/2014	0.00040 U
Trip Blank	NA	TB-LL-13-301	10/15/2013	0.00040 U
Trip Blank	NA	TB-LL-14-201	2/20/2014	0.00040 U

Notes:
Bold data indicates concentrations exceeding compliance criteria.
µg/L – micrograms per liter
NA – not applicable
U – not detected at the indicated quantitation limit
UJ – not detected at the indicated, estimated quantitation limit

Table A-22. OU NSC Summary of Groundwater Sampling Results – Volatiles – Summer/Fall 2013 and Winter/Spring 2014

Well ID	902		902		902[1]		Background Well 346		Trip Blank		Trip Blank		Trip Blank	
Sample ID	NSC-13-308		NSC-14-201		NSC-14-202		BG--13-301		TB--13-301		TB--13-304		TB-14-201	
Sample Date	9/30/2013		2/21/2014		2/21/2014		10/15/2013		9/30/2013		10/15/2013		2/21/2014	
Analytical Method	8260C (µg/L)	8260C SIM (µg/L)	8260C (µg/L)	8260C SIM (µg/L)	8260C (µg/L)	8260C SIM (µg/L)	8260C (µg/L)	8260C SIM (µg/L)	8260C (µg/L)	8260C SIM (µg/L)	8260C (µg/L)	8260C SIM (µg/L)	8260C (µg/L)	8260C SIM (µg/L)
Analyte														
Dichlorodifluoromethane	0.50 U	-	0.50 UJ	-	0.50 UJ	-	0.50 UJ	-	0.50 U	-	0.50 UJ	-	0.50 UJ	-
Chloromethane	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
Vinyl Chloride	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 UJ	0.020 U	0.50 U	0.020 U	0.50 UJ	0.020 U	0.50 U	0.020 U
Bromomethane	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
Chloroethane	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
Trichlorofluoromethane	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
1,1-Dichloroethene	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U
Acetone	20 UJ	-	20 U	-	20 U	-	20 U	-	20 UJ	-	20 U	-	20 U	-
Carbon Disulfide	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
Methylene Chloride	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	0.16 J	-	2.0 U	-	2.0 U	-
Methyl tert-Butyl Ether	0.50 U	-	0.50 UJ	-	0.50 UJ	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 UJ	-
trans-1,2-Dichloroethene	0.50 U	0.020 U	0.50 U	0.20 U	0.50 U	0.20 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U
1,1-Dichloroethane	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
2,2-Dichloropropane	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
cis-1,2-Dichloroethene	0.50 U	0.020 U	0.50 U	0.010 J	0.50 U	0.0091 J	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U
2-Butanone (MEK)	20 UJ	-	20 U	-	20 U	-	20 U	-	20 UJ	-	20 U	-	20 U	-
Bromochloromethane	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
Chloroform	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.21	0.50 U	0.23	0.50 U	0.020 U
1,1,1-Trichloroethane	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
Carbon Tetrachloride	0.50 U	0.020 UJ	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 UJ	0.50 U	0.020 U	0.50 U	0.020 U
1,1-Dichloropropene	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
Benzene	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
1,2-Dichloroethane	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U
Trichloroethene (TCE)	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U

Table A-22 (Continued). OU NSC Summary of Groundwater Sampling Results – Volatiles – Summer/Fall 2013 and Winter/Spring 2014

Well ID	902		902		902[1]		Background Well 346		Trip Blank		Trip Blank		Trip Blank	
Sample ID	NSC-13-308		NSC-14-201		NSC-14-202		BG--13-301		TB--13-301		TB--13-304		TB-14-201	
Sample Date	9/30/2013		2/21/2014		2/21/2014		10/15/2013		9/30/2013		10/15/2013		2/21/2014	
Analytical Method	8260C (µg/L)	8260C SIM (µg/L)	8260C (µg/L)	8260C SIM (µg/L)	8260C (µg/L)	8260C SIM (µg/L)	8260C (µg/L)	8260C SIM (µg/L)	8260C (µg/L)	8260C SIM (µg/L)	8260C (µg/L)	8260C SIM (µg/L)	8260C (µg/L)	8260C SIM (µg/L)
Analyte														
1,2-Dichloropropane	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
Dibromomethane	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
Bromodichloromethane	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
cis-1,3-Dichloropropene	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
4-Methyl-2-pentanone (MIBK)	20 UJ	-	20 U	-	20 U	-	20 U	-	20 UJ	-	20 U	-	20 U	-
Toluene	0.50 U	-	0.11 J	-	0.24 J	-	0.070 J	-	0.50 U	-	0.50 U	-	0.50 U	-
trans-1,3-Dichloropropene	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
1,1,2-Trichloroethane	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
Tetrachloroethene (PCE)	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.023 UJ	0.50 U	0.023 UJ	0.50 U	0.032	0.50 U	0.020 U
2-Hexanone	20 UJ	-	20 U	-	20 U	-	20 U	-	20 UJ	-	20 U	-	20 U	-
1,3-Dichloropropane	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
Dibromochloromethane	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
1,2-Dibromoethane	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-
Chlorobenzene	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
Ethylbenzene	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
1,1,1,2-Tetrachloroethane	0.50 U	-	0.50 U	-	0.50 U	-	0.50 UJ	-	0.50 U	-	0.50 UJ	-	0.50 U	-
m,p-Xylenes	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
o-Xylene	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
Styrene	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
Bromoform	0.50 U	-	0.50 U	-	0.50 U	-	0.50 UJ	-	0.50 U	-	0.50 UJ	-	0.50 U	-
Isopropylbenzene	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-
1,1,2,2-Tetrachloroethane	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U	0.50 U	0.020 U
Bromobenzene	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-
n-Propylbenzene	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-

Table A-22 (Continued). OU NSC Summary of Groundwater Sampling Results – Volatiles – Summer/Fall 2013 and Winter/Spring 2014

Well ID	902		902		902[1]		Background Well 346		Trip Blank		Trip Blank		Trip Blank	
Sample ID	NSC-13-308		NSC-14-201		NSC-14-202		BG--13-301		TB--13-301		TB--13-304		TB-14-201	
Sample Date	9/30/2013		2/21/2014		2/21/2014		10/15/2013		9/30/2013		10/15/2013		2/21/2014	
Analytical Method	8260C (µg/L)	8260C SIM (µg/L)	8260C (µg/L)	8260C SIM (µg/L)	8260C (µg/L)	8260C SIM (µg/L)	8260C (µg/L)	8260C SIM (µg/L)	8260C (µg/L)	8260C SIM (µg/L)	8260C (µg/L)	8260C SIM (µg/L)	8260C (µg/L)	8260C SIM (µg/L)
Analyte														
1,2,3-Trichloropropane	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
2-Chlorotoluene	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-
1,3,5-Trimethylbenzene	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-
4-Chlorotoluene	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-
tert-Butylbenzene	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-
1,2,4-Trimethylbenzene	2.0 U	-	2.0 U	-	2.0 U	-	0.080 J	-	2.0 U	-	2.0 U	-	2.0 U	-
sec-Butylbenzene	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-
4-Isopropyltoluene	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-
1,3-Dichlorobenzene	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
1,4-Dichlorobenzene	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
n-Butylbenzene	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-
1,2-Dichlorobenzene	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-	0.50 U	-
1,2-Dibromo-3-chloropropane	2.0 UJ	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 UJ	-	2.0 U	-	2.0 U	-
1,2,4-Trichlorobenzene	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-
Hexachlorobutadiene	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-
Naphthalene	2.0 UJ	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 UJ	-	2.0 U	-	2.0 U	-
1,2,3-Trichlorobenzene	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-	2.0 U	-

[1] Field duplicate sample
- not analyzed
µg/L – micrograms per liter
J – estimated value
SIM – selected ion monitoring
U – not detected at the indicated quantitation limit
UJ – not detected at the indicated, estimated quantitation limit

Table A-23. OU NSC Summary of Sampling Results – Low-Level Mercury – Summer/Fall 2013 and Winter/Spring 2014

Location ID	Location Cross-Reference	Sample ID	Sample Date	Total Mercury (µg/L)
OU NSC Compliance Criteria				**0.025**
Groundwater				
902	NA	NSC-LL-13-301	10/16/2013	0.00040 UJ
902	NA	NSC-LL-14-201	2/21/2014	0.00068 UJ
Background Well 346	PS11-MW01L	BG-LL-13-301	10/15/2013	0.00040 UJ
Background Well 346	PS11-MW01L	BG-LL-14-201	2/20/2014	0.00040 U
Surface Water				
Sinclair Inlet	NA	SI-LL-13-301	10/16/2013	0.00123 UJ
Sinclair Inlet	NA	SI-LL-14-201	2/27/2014	0.00868
Quality Control				
Equipment Blank	NA	EB-LL-13-301	10/15/2013	0.00041 U
Equipment Blank	NA	EB-LL-14-201	2/20/2014	0.00040 U
Trip Blank	NA	TB-LL-13-301	10/15/2013	0.00040 U
Trip Blank	NA	TB-LL-14-201	2/20/2014	0.00040 U

Notes:
µg/L – micrograms per liter
NA – not applicable
U – not detected at the indicated quantitation limit
UJ – not detected at the indicated, estimated quantitation limit

Table A-24. OU NSC Summary of Sampling Results – Total Suspended Solids – Summer/Fall 2013

Location ID	Location Cross-Reference	Sample ID	Sample Date	TSS (mg/L)
OU NSC Compliance Criteria				**NA**
Groundwater				
392R	MW392R	NSC-13-306	10/2/2013	5.0 U
Background Well 346	PS11-MW01L	BG-13-301	10/15/2013	5.0 U
Surface Water				
Sinclair Inlet	--	SI-13-301	10/8/2013	23.5

Notes:
NA – not applicable
mg/L – milligrams per liter
TSS – total suspended solids
U – not detected at the indicated quantitation limit

APPENDIX B

Site Inspection Documentation for Bremerton Naval Complex Fourth Five-Year Review

BREMERTON NAVAL COMPLEX
FOURTH FIVE-YEAR REVIEW
SITE INSPECTION
OBSERVATIONS

Operable Unit: B- Terrestrial

Date and Time: 11/16/16; 0830 - 1100/1430- 1600

Battelle Staff Performing Inspection: A. Bullard/M. Meyer

Navy Staff in Attendance: P. Sargent/B. Ransom/M. Wicklein/S. Skeehan

Weather Conditions: Overcast, ~50 F, still

PREPARATION

Review the 2015 Annual Remedy Inspection Report? yes no

Review the March 2016 O&M and IC Plan? yes no

Review the April 2016 Wet Weather and OU A Winter Shoreline Inspection Report? yes no

Review the September 2016 LTM, Inspection, and Improvement Plan? yes no

Review other pertinent documents? yes no

If yes, list:

Previous FYRs

Other comments pertaining to inspection preparation: Not used

INSTITUTIONAL CONTROLS

Observations related to access control (fencing): none

Observations related to signage: none

Observations related to groundwater use (was anyone observed withdrawing or using groundwater):

No gw use observed

Observations related to excavation management: unattended excavations - observed soil piles at excavation areas uncontrolled and without stormwater protections

Observations related to overall property use: Not used

PAVEMENT CAP AREAS

Does pavement appear to have been maintained? yes no

Observations: pavement areas appear to be maintained but many areas of cracking and areas without pavement (removed transformer/ pad area)

Are there areas of poor drainage, cracks, or other pavement deficiencies? yes no

Observations: broken pavement under dumpsters at Bldg 431, many areas of cracking

Have repairs been made to existing pavement area yes no

Observations: multiple areas with evidence of pavement repairs; not always good quality pavement restoration

Have previously unpaved areas been paved? yes no

Observations: unknown

Other observations related to pavement cap areas: utilidors in poor condition, but do appear to be sealed at bottom based on information from Navy. Large swath of gravel between OU B-T & OU D (unpaved)

VEGETATIVE CAP AREAS

Does vegetative cover appear to have been maintained? yes no

Observations: soil appears thin and vegetation sparse in areas adjacent to OU B-M

Are there areas of poor drainage, holes, erosion, or other cap deficiencies? yes no

Observations: shoreline erosion west of OU NSC and animal burrows soil/ vegetation heavily rutted by rolloff containers pushed too far off pavement

Have repairs been made to existing vegetative cap areas? yes no

Observations: unknown

Have previously uncapped areas been capped? yes no

Observations: unknown

Other observations related to vegetative cap areas: Not used

STORMWATER SYSTEM

Does stormwater piping appear to have been maintained? yes no

Observations: unknown

Do stormwater catch basins appear to be in good condition? Yes no

Observations: generally yes, but filter fabric in poor condition @ many stormdrains

Are there indications of poor drainage or other damage? yes no

Observations: several areas where water stands or there is evidence of standing water

Have repairs or expansions been made to the stormwater system? yes no

Observations: unknown

Other observations related to the stormwater system: Not used

SHORELINE

Does the shoreline appear to have been maintained? yes no

Observations: Not used

Does the shoreline appear to remain stable? yes no

Observations: generally yes but some areas where rip rap appears improperly sized/interlocked and this might be an issue in the future

Are there indications of debris on the shoreline? yes no

Observations: brick, etc.

Are there indications of repairs or expansions to the shoreline? yes no

Observations: unknown

Other observations related to shoreline areas: Not used

Door 21/ drain 1870/ Bldg 460
Storm drain w/ potential metal shavings
Possibly from hull blast work up
Wood block flooring in many bldgs. (e.g. 460 @ door 2)
When was landscaping completed at far south fence line
at Pacific Ave?
Old Foundry- Pb paint? Asbestos?
Downspouts- tied to underground?
Historical bldg. w/ copper downspout
Transformer station- torn up pad and hatch separate next to bldg. 427
Steam coming out of storm drain at bldg. 427
Bldg. demolished across from 427
Small unpaved area at machine shop / Bldg. 431
Construction (incl. pavement cutting) at Bldg. 431 (near waterfront)
Open excavation @ water line at Bldg. 431
Poorly maintained shoreline at Bldg. C0627 and pavement falling apart
Storm sewer inlet 0359- outside Bldg. 944- receiving water from tank inside hazardous waste containment area

Well 736 needs painting and 1 bolt
(GMWT 23)

BREMERTON NAVAL COMPLEX
FOURTH FIVE-YEAR REVIEW
SITE INSPECTION
OBSERVATIONS

Operable Unit: C

Date and Time: 11/16/16; 08:00-08:30

Battelle Staff Performing Inspection: A. Bullard/M. Meyer

Navy Staff in Attendance: P. Sargent/B. Ransom/M. Wicklein/S. Skeehan

Weather Conditions: Overcast, ~50 F, still

PREPARATION

Review the 2015 Annual Remedy Inspection Report? **yes** **no**

Review the March 2016 O&M and IC Plan? **yes** **no**

Review the April 2016 Wet Weather and OU A Winter Shoreline Inspection Report? **yes** **no**

Review the September 2016 LTM, Inspection, and Improvement Plan? **yes** **no**

Review other pertinent documents? **yes** **no**

If yes, list:

Previous FYRs

Other comments pertaining to inspection preparation: Not used

INSTITUTIONAL CONTROLS

Observations related to access control (fencing): some remaining fence from former steam sparging system and some perimeter fencing; however, fence is not an IC for OU C. Locked gate at site entrance.

Observations related to signage: none, few "construction area" signs

Observations related to groundwater use (was anyone observed withdrawing or using groundwater):

No gw use observed

Observations related to excavation management: none

Observations related to overall property use:

Several features associated with former steam sparging system observed; vault, electrical service

Pad – reportedly to be removed. Two wells observed – one with lockable collar on stickup (unlocked) and other dummy locked at stickup

PAVEMENT CAP AREAS

Does pavement appear to have been maintained? yes no

Observations: Not used

Are there areas of poor drainage, cracks, or other pavement deficiencies? yes no

Observations: Not used

Have repairs been made to existing pavement area no

Observations: Not used

Have previously unpaved areas been paved? yes no

Observations: Not used

Other observations related to pavement cap areas: Not used

VEGETATIVE CAP AREAS

Does vegetative cover appear to have been maintained? yes no

Observations: Not used

Are there areas of poor drainage, holes, erosion, or other cap deficiencies? yes no

Observations: Not used

Have repairs been made to existing vegetative cap areas? yes no

Observations: Not used

Have previously uncapped areas been capped? yes no

Observations: Not used

Other observations related to vegetative cap areas: Not used

STORMWATER SYSTEM

Does stormwater piping appear to have been maintained? yes no

Observations: Not used

Do stormwater catch basins appear to be in good condition? yes no

Observations: Not used

Are there indications of poor drainage or other damage? yes no

Observations: Not used

Have repairs or expansions been made to the stormwater system? yes no

Observations: Not used

Other observations related to the stormwater system: Not used

SHORELINE

Does the shoreline appear to have been maintained? yes no

Observations: Not used

Does the shoreline appear to remain stable? yes no

Observations: Not used

Are there indications of debris on the shoreline? yes no

Observations: Not used

Are there indications of repairs or expansions to the shoreline? yes no

Observations: Not used

Other observations related to shoreline areas:

Not used

BREMERTON NAVAL COMPLEX
FOURTH FIVE-YEAR REVIEW
SITE INSPECTION
OBSERVATIONS

Operable Unit: D

Date and Time: 11/16/16; 12:00- 12:30

Battelle Staff Performing Inspection: A. Bullard/M. Meyer

Navy Staff in Attendance: P. Sargent/B. Ransom/M. Wicklein/S. Skeehan

Weather Conditions: Overcast, ~50 F, still

PREPARATION

Review the 2015 Annual Remedy Inspection Report? yes no

Review the March 2016 O&M and IC Plan? yes no

Review the April 2016 Wet Weather and OU A Winter Shoreline Inspection Report? yes no

Review the September 2016 LTM, Inspection, and Improvement Plan? yes no

Review other pertinent documents? yes no

If yes, list:

Previous FYRs

Other comments pertaining to inspection preparation: Not used

INSTITUTIONAL CONTROLS

Observations related to access control (fencing): N/A; public park

Observations related to signage: none

Observations related to groundwater use (was anyone observed withdrawing or using groundwater):

No gw use observed

Observations related to excavation management: None.

Observations related to overall property use: fountains appear to have been dug into previous cover /cap; pavers are not impervious; did soil for landscaped mounds come from offsite fill or onsite barrow?

PAVEMENT CAP AREAS

Does pavement appear to have been maintained? yes no

Observations: Not used

Are there areas of poor drainage, cracks, or other pavement deficiencies? yes no

Observations: technically, pavement is actually pavers, which are not impervious

Have repairs been made to existing pavement area yes no

Observations: No repairs observed

Have previously unpaved areas been paved? yes no

Observations: No new paving observed

Other observations related to pavement cap areas: no storm water inlets in paved areas; minor failure of edge of pavers at south end of site

VEGETATIVE CAP AREAS

Does vegetative cover appear to have been maintained? yes no

Observations: Landscaping is being maintained.

Are there areas of poor drainage, holes, erosion, or other cap deficiencies? yes no

Observations: grassy areas are very wet/soft- does this suggest anything with regard to drainage?

Have repairs been made to existing vegetative cap areas? yes no unknown

Observations: No repaired areas evident.

Have previously uncapped areas been capped? yes no

Observations: No evidence of additional capping.

Other observations related to vegetative cap areas: Not used

STORMWATER SYSTEM

Does stormwater piping appear to have been maintained? yes no

Observations: Stormwater piping appears to have been maintained.

Do stormwater catch basins appear to be in good condition? yes no

Observations: Catch basins appear to be operating and in good condition

Are there indications of poor drainage or other damage? yes no

Observations: potentially the wet ground in grassy area

Have repairs or expansions been made to the stormwater system? yes no

Observations: No new stormdrains are evident.

Other observations related to the stormwater system: Not used

SHORELINE

Does the shoreline appear to have been maintained? yes no

Observations: Evidence of shoreline maintenance and repair (newer rock) observed.

Does the shoreline appear to remain stable? yes no

Observations: in short term yes

Are there indications of debris on the shoreline? yes no

Observations: minor debris in rip rap

Are there indications of repairs or expansions to the shoreline? yes no

Observations: Not used

Other observations related to shoreline areas:

Appears to be some slumping of the rip rap, leading to erosion of soil above the rip rap zone; shoreline appears stable now, but may require restoration of maintenance in the future

BREMERTON NAVAL COMPLEX
FOURTH FIVE-YEAR REVIEW
SITE INSPECTION
OBSERVATIONS

Operable Unit: NSC

Date and Time: 11/16/16; 1315-1430

Battelle Staff Performing Inspection: A. Bullard/M. Meyer

Navy Staff in Attendance: P. Sargent/B. Ransom/M. Wicklein/S. Skeehan

Weather Conditions: Overcast, ~50 F, still

PREPARATION

Review the 2015 Annual Remedy Inspection Report? **yes** **no**

Review the March 2016 O&M and IC Plan? **yes** **no**

Review the April 2016 Wet Weather and OU A Winter Shoreline Inspection Report? **yes** **no**

Review the September 2016 LTM, Inspection, and Improvement Plan? **yes** **no**

Review other pertinent documents? **yes** **no**

If yes, list:

Previous FYRs

Other comments pertaining to inspection preparation: Not used

INSTITUTIONAL CONTROLS

Observations related to access control (fencing): Not used

Observations related to signage: Not used

Observations related to groundwater use (was anyone observed withdrawing or using groundwater):

Not used

Observations related to excavation management: Not used

Observations related to overall property use:

Not used

PAVEMENT CAP AREAS

Does pavement appear to have been maintained? yes no

Observations: pavement cracking in many areas

Are there areas of poor drainage, cracks, or other pavement deficiencies? yes no

Observations: see above

Have repairs been made to existing pavement areas? yes no

Observations: Active paving ongoing at Bldg. 515, paving an excavation area (between 515 & 816)

New sidewalk across from Bldg. 467

Have previously unpaved areas been paved? yes no

Observations: see above, however, these areas were likely previously paved

Other observations related to pavement cap areas: paved over a utilidor

VEGETATIVE CAP AREAS

Does vegetative cover appear to have been maintained? yes no

Observations: Not used

Are there areas of poor drainage, holes, erosion, or other cap deficiencies? yes no

Observations: Not used

Have repairs been made to existing vegetative cap areas? yes no

Observations: Not used

Have previously uncapped areas been capped? yes no

Observations: Not used

Other observations related to vegetative cap areas: Not used

STORMWATER SYSTEM

Does stormwater piping appear to have been maintained? yes no

Observations: Not used

Do stormwater catch basins appear to be in good condition? yes no

Observations: Not used

Are there indications of poor drainage or other damage? yes no

Observations: Not used

Have repairs or expansions been made to the stormwater system? yes no

Observations: Not used

Other observations related to the stormwater system: Not used

SHORELINE

Does the shoreline appear to have been maintained? yes no

Observations: Not used

Does the shoreline appear to remain stable? yes no

Observations: Not used

Are there indications of debris on the shoreline? yes no

Observations: Not used

Are there indications of repairs or expansions to the shoreline? yes no

Observations: Not used

Other observations related to shoreline areas:

Not used

At MW 392 NSC – relative surface elevation is too low
Missing bolts
392 1/3 bolts
392R 0/3 bolts
Repaint MW 901

BREMERTON NAVAL COMPLEX
FOURTH FIVE-YEAR REVIEW
SITE INSPECTION
OBSERVATIONS

Operable Unit: A

Date and Time: 11/16/16; 12:30 pm - 1315

Battelle Staff Performing Inspection: A Bullard/M Meyer

Navy Staff in Attendance: P Sargent/B Ransom/M Wicklein/S Skeehan

Weather Conditions: overcast, ~50°F, still

PREPARATION

Review the 2015 Annual Remedy Inspection Report? yes no

Review the March 2016 O&M and IC Plan? yes no

Review the April 2016 Wet Weather and OU A Winter Shoreline Inspection Report? yes no

Review the September 2016 LTM, Inspection, and Improvement Plan? yes no

Review other pertinent documents? yes no

If yes, list:

Previous FYRs

Other comments pertaining to inspection preparation: Not used

INSTITUTIONAL CONTROLS

Observations related to access control (fencing): none

Observations related to signage: noted one sign saying "no trespassing"

Observations related to groundwater use (was anyone observed withdrawing or using groundwater):

No gw use observed

Observations related to excavation management: none

Observations related to overall property use:

Appears there is a vagrant using far western end of site above water line as squat

PAVEMENT CAP AREAS

Does pavement appear to have been maintained? yes no

Observations: Not used

Are there areas of poor drainage, cracks, or other pavement deficiencies? yes no

Observations: nothing substantial observed

Have repairs been made to existing pavement areas? yes no unknown

Observations: Not used

Have previously unpaved areas been paved? yes no

Observations: Not used

Other observations related to pavement cap areas: Not used

VEGETATIVE CAP AREAS

Does vegetative cover appear to have been maintained? yes no

Observations: generally yes

Are there areas of poor drainage, holes, erosion, or other cap deficiencies? yes no

Observations: Not used

Have repairs been made to existing vegetative cap areas? yes no

Observations: Not used

Have previously uncapped areas been capped? yes no

Observations: Not used

Other observations related to vegetative cap areas: Not used

STORMWATER SYSTEM

Does stormwater piping appear to have been maintained? yes no

Observations: none

Do stormwater catch basins appear to be in good condition? yes no

Observations: none

Are there indications of poor drainage or other damage? yes no

Observations: none

Have repairs or expansions been made to the stormwater system? yes no

Observations: Not used

Other observations related to the stormwater system: Not used

SHORELINE

Does the shoreline appear to have been maintained? yes no

Observations: actively maintaining

Does the shoreline appear to remain stable? yes no

Observations: it is clear that the mitigation area is not stable in the long term or really the short term. The rip rap shoreline is more stable but shows evidence of slump.

Are there indications of debris on the shoreline? yes no

Observations: significant debris, but may be from on site materials (e.g. fire brick, asbestos brick, metal slag)

Are there indications of repairs or expansions to the shoreline? yes no

Observations: recently, the mitigation area was restored

Other observations related to shoreline areas:

Not used

APPENDIX C

Interview Responses for Bremerton Naval Complex Fourth Five-Year Review Navy

Navy

INTERVIEW RECORD FOR FOURTH FIVE-YEAR REVIEW
Type 1 Interview – Navy Personnel
Bremerton Naval Complex
Bremerton, WA

Individual Contacted: Jai Jeffery
Title: Capital Improvements Environmental Liaison
Organization: NAVFAC NW
Contact Made by: Andrew Bullard
Date: 11/16/2016

Summary of Communication

1. What is your overall impression of remedy performance following signing of the Records of Decision (RODs) at Operable Unit (OU) A, OU B Marine, OU B Terrestrial, OU D, and OU NSC, completion of the corrective action plan for OU C, and implementation of the remedies at the Bremerton naval complex (BNC)?

Response:

2. To the best of your knowledge, has on-going maintenance of pavement and vegetative covers (caps) within the terrestrial OUs been timely and effective? Has maintenance of these caps effectively met the goals to reduce the potential for human contact with chemicals of concern (COCs) in soil and to reduce the potential for infiltrating precipitation to transport chemicals to groundwater? Please indicate the basis for your assessment of the cap maintenance.

Response: Maintenance, to the extent that it is immediately and properly reconstructed/replaced following construction disturbance has been timely and effective. In addition to obligations under the RoD, the timeliness is also assured by the operational value of every square foot of space at this installation and the drive for expedited repaving in order to put the area back into service. I have knowledge of this due to my current position involving environmental compliance and quality assurance oversight of construction.

3. To the best of your knowledge, has on-going cap and storm drain maintenance at OU A, OU B Terrestrial, and OU NSC been timely and met the goal of reducing the potential for COCs to be discharged to Sinclair Inlet? Please indicate the basis for your assessment of the cap and storm drain maintenance activities.

Response:

4. To the best of your knowledge, have the shoreline stabilization measures put in place as part of the remedies been maintained to effectively meet the goal of controlling potential erosion of fill material to Sinclair Inlet? Please indicate the basis for your assessment of the shoreline stabilization measures.

Response:

5. What is your impression regarding progress towards implementing a permanent repair of the OU A remedy?

Response: I'm not exactly certain to what this question refers, but I recall that, as the original shoreline armoring and habitat enhancement for Charleston Beach was being designed, the Navy concluded and clearly communicated to all interested parties that the design preferred by other parties would not be permanent, due to wave dynamics and energies at this location.

6. In the third five-year review (2012) for BNC, the protectiveness determinations for OU A and OU B Terrestrial were deferred pending additional investigation of potential on-going contaminant transport pathways from the terrestrial to marine environment. The 2016 addendum to the third five-year review revised the protectiveness determination for OU A to "short term protective," but retained the deferral of the protectiveness determination for OU B Terrestrial. Based on your knowledge of the status of the additional assessments that are underway regarding these issues, what is your opinion regarding the progress towards a protectiveness statement for the remedy at OU B Terrestrial?

Response:

7. The third five-year review (2012) for BNC also deferred the protectiveness determination for OU B Marine, pending additional investigation of mercury movement through the marine food web and interpretation of the implications of elevated PCB concentrations in sediment found during construction projects. Based on your knowledge of the status of the additional assessments that are underway regarding these issues, what is your opinion regarding the progress towards a protectiveness statement for the remedy at OU B Marine?

Response: To my knowledge, sediment data collected during in-water construction projects has not been used for any purpose, and both the need and the authority to require such sampling as a permit condition for various construction projects should be subjected to both scientific and legal scrutiny.

8. Are you aware of any prior or pending land use or ownership changes since the signing of the RODs for OU A, OU B Marine, OU B Terrestrial, OU D, or OU NSC, or completion of the corrective action plan for OU C, that may impact the effectiveness of any component of the selected remedies?

Response:

9. Use of groundwater from beneath BNC is prohibited for any purpose except groundwater monitoring, in accordance with instructions NAVBASEKITSAPINST

5090.14 and PSNS&IMFINST 5090.50. Are you aware of any use of groundwater from beneath the installation for any purpose other than groundwater monitoring, e.g., for human consumption, equipment maintenance, or equipment decontamination?

Response: I'm not aware of groundwater use for any of these reasons (or any other reason).

10. To the best of your knowledge, do institutional controls and operations and maintenance practices in use at BNC meet the intent of the RODs/corrective action plan regarding limiting the potential for contact with or movement of contaminants left in place, e.g. in connection with excavation management, petroleum management, and storm drain system monitoring and maintenance?

Response: With respect to excavation management, yes.

11. To the best of your knowledge, has the on-going program of groundwater monitoring, institutional controls inspection and maintenance, cap, shoreline, and storm drain inspection and maintenance, and sediment and marine biota monitoring at BNC following implementation of the remedies been sufficiently thorough and frequent to meet the goals of the RODs/corrective action plan? Please indicate the basis for your assessment.

Response:

12. Are you aware of any community concerns regarding the remedies in place at BNC? If so, please give details.

Response: No.

13. Do you have any other comments, concerns, or suggestions regarding the effectiveness of the remedies in place to protect human health and the environment at BNC?

Response:

INTERVIEW RECORD FOR FOURTH FIVE-YEAR REVIEW
Type 1 Interview – Navy Personnel
Bremerton Naval Complex
Bremerton, WA

Individual Contacted: Pamela M. Sargent, P.E.
Title: Remedial Project Manager
Organization: NAVFAC Northwest
Contact Made by: Andrew Bullard via email
Date: December 1, 2016

Summary of Communication

1. What is your overall impression of remedy performance following signing of the Records of Decision (RODs) at Operable Unit (OU) A, OU B Marine, OU B Terrestrial, OU D, and OU NSC, completion of the corrective action plan for OU C, and implementation of the remedies at the Bremerton naval complex (BNC)?

Response: Post-ROD/post remedy in place performance is adequate but has room for improvement. Storm sewer, catch basin and manhole cleaning and repairs need to be tracked and reported in the annual inspection report. Mercury source control needs to be addressed to meet the intent of the OU B Marine ROD. A portion of the OU A remedy was replaced and the performance of this portion of the remedy is poor as it requires extensive maintenance (replenishment).

2. To the best of your knowledge, has on-going maintenance of pavement and vegetative covers (caps) within the terrestrial OUs been timely and effective? Has maintenance of these caps effectively met the goals to reduce the potential for human contact with chemicals of concern (COCs) in soil and to reduce the potential for infiltrating precipitation to transport chemicals to groundwater? Please indicate the basis for your assessment of the cap maintenance.

Response: Pavement maintenance throughout OU A, OU B T, and OU NSC has improved recently, but should remain a focus in the terrestrial O&M program to provide continued protection of human health and the environment. To my knowledge, vegetative cap "maintenance" has not occurred outside mowing of some areas and some removal of invasive species. The basis for my assessment is periodic inspections over the last 2+ years (since October 2014).

3. To the best of your knowledge, has on-going cap and storm drain maintenance at OU A, OU B Terrestrial, and OU NSC been timely and met the goal of reducing the potential for COCs to be discharged to Sinclair Inlet? Please indicate the basis for your assessment of the cap and storm drain maintenance activities.

Response: Storm drain maintenance has not been tracked by NAVFAC as it is performed by BNC personnel and contractors. Therefore, I have no basis for assessing the timeliness of maintenance or potential reduction in discharge of COCs to Sinclair Inlet. Ongoing pavement cap repairs are also currently executed by the facility's contractors but these are tracked by NAVFAC and reported in the annual remedy inspection report. I do not have a specific basis to determine the timeliness of the pavement cap repairs however. The basis for my assessment of pavement cap repairs is periodic inspections over the last 2+ years (since October 2014). As stated in the response to Item 2 above, there has been very limited vegetative cap maintenance based on my site observations since October 2014.

4. To the best of your knowledge, have the shoreline stabilization measures put in place as part of the remedies been maintained to effectively meet the goal of controlling potential erosion of fill material to Sinclair Inlet? Please indicate the basis for your assessment of the shoreline stabilization measures.

Response: The shoreline stabilizations measures are generally preventing erosion of fill material into Sinclair Inlet. There are localized areas that show evidence of erosion along OU BT. Two interim beach replenishments (one in August 2015 and one in November of 2016) were necessary in OU A to prevent landfill material from being exposed and potentially eroded into Sinclair Inlet while the area is awaiting a permanent remedy repair. The basis for my assessment is periodic shoreline inspections over the last 2+ years (since October 2014).

5. What is your impression regarding progress towards implementing a permanent repair of the OU A remedy?

Response: The progress towards a permanent remedy repair at OU A has been slow and fragmented. The design moved from 90% to 100% without resolution of stakeholder comments on the 90% design. The majority of the stakeholder comments on the 90% design were related to mitigation; both for the remedy repair itself and the MILCON mitigation that would be impacted by the remedy repair.

6. In the third five-year review (2012) for BNC, the protectiveness determinations for OU A and OU B Terrestrial were deferred pending additional investigation of potential on-going contaminant transport pathways from the terrestrial to marine environment. The 2016 addendum to the third five-year review revised the protectiveness determination for OU A to "short term protective," but retained the deferral of the protectiveness determination for OU B Terrestrial. Based on your knowledge of the status of the additional assessments that are underway regarding these issues, what is your opinion regarding the progress towards a protectiveness statement for the remedy at OU B Terrestrial?

Response: Progress towards a protectiveness statement for OU B Terrestrial has not been made since the last five-year review as source control investigation work has been deferred. Source control investigation work largely focused throughout the Outfall 15 drainage basin needs to be completed to determine where mercury sources exist within this portion of the BNC storm sewer system.

7. The third five-year review (2012) for BNC also deferred the protectiveness determination for OU B Marine, pending additional investigation of mercury movement through the marine food web and interpretation of the implications of elevated PCB concentrations in sediment found during construction projects. Based on your knowledge of the status of the additional assessments that are underway regarding these issues, what is your opinion regarding the progress towards a protectiveness statement for the remedy at OU B Marine?

Response: Some progress towards a protectiveness statement for OU B Marine has been made related to pre and post construction sediment PCB concentrations as there seems to be little effect of construction projects evaluated on the PCB concentrations in surface sediments. However, regarding mercury, until upland sources are specifically identified and controlled and in-water remedy is implemented, the progress toward a protectiveness statement for OU B Marine will not be made.

8. Are you aware of any prior or pending land use or ownership changes since the signing of the RODs for OU A, OU B Marine, OU B Terrestrial, OU D, or OU NSC, or completion of the corrective action plan for OU C, that may impact the effectiveness of any component of the selected remedies?

Response: There are no pending land use or ownership changes for any of the operable units that would impact the effectiveness of any component of the selected remedies.

9. Use of groundwater from beneath BNC is prohibited for any purpose except groundwater monitoring, in accordance with instructions NAVBASEKITSAPINST 5090.14 and PSNS&IMFINST 5090.50. Are you aware of any use of groundwater from beneath the installation for any purpose other than groundwater monitoring, e.g., for human consumption, equipment maintenance, or equipment decontamination?

Response: No, I am not aware of groundwater being used for any purpose within the operable units at BNC except for groundwater monitoring (from October 2014 to present).

10. To the best of your knowledge, do institutional controls and operations and maintenance practices in use at BNC meet the intent of the RODs/corrective action plan regarding limiting the potential for contact with or movement of contaminants left in place, e.g. in connection with excavation management, petroleum management, and storm drain system monitoring and maintenance?

Response: No. General construction practices, stormwater monitoring and stormwater management SOPs and plans at BNC are responsible for limiting contact with contaminants left in place and minimizing potential for discharge of contaminants to Sinclair Inlet. The petroleum management plan has been recently updated to identify areas of known residual petroleum contamination and this information should be incorporated into the excavation management plan (which implements some of the ICs from the IC/O&M Plan) to limit the potential for contact with petroleum contamination left in place. The requirements of the IC should be more robustly included in the excavation management plan and specific responsibilities should be assigned in the excavation management plan for compliance inspections.

11. To the best of your knowledge, has the on-going program of groundwater monitoring, institutional controls inspection and maintenance, cap, shoreline, and storm drain inspection and maintenance, and sediment and marine biota monitoring at BNC following implementation of the remedies been sufficiently thorough and frequent to meet the goals of the RODs/corrective action plan? Please indicate the basis for your assessment.

Response: OU A: Frequency of inspections and LTM is adequate to meet the goals of the OU A ROD but the pavement cap and storm drain maintenance frequency/extent does not seem adequate to meet the goals. Maintenance in OU A is a low priority for the facility as it is largely a staff and equipment parking area. In addition, a section of OU A shoreline was not inspected after the remedy was in place until 2016.
OU B T: Frequency of inspections and LTM is adequate to meet the goals of the OU B T ROD but the pavement cap and storm drain maintenance frequency/extent does not seem adequate to meet the goals as paving and storm sewer maintenance priorities are placed only on areas that support mission critical activities. Shoreline repairs should be performed more frequently (see further discussion in the response to item 15 below).
OU B M: No. There is no IC and O&M plan for OU B Marine so inspection of the CAD pit area is infrequent and there is no criteria for placement of additional cover should it be necessary. Sediment and marine biota monitoring were sufficiently regular through 2014 but without source control in place, there will be little progress towards solving the elevated mercury levels in both sediment and biota in Sinclair Inlet.
OU C: Yes, LTM at OU C is adequate to meet the goals of the CAP.
OU NSC: Frequency of inspections and LTM is adequate to meet the goals of the OU B T ROD but the pavement cap and storm drain maintenance frequency/extent does not seem adequate to meet the goals as paving and storm sewer maintenance priorities are placed only on areas that support mission critical activities.
The basis for my assessment is my role of the terrestrial RPM from October 2014 through July 2016 and my role as the OU B Marine RPM from August 2016 to present.

12. Are you aware of any community concerns regarding the remedies in place at BNC? If so, please give details.

Response: During my tenure as a BNC RPM (from 10/14 to present), there have been no community concerns raised regarding the remedies in place at BNC.

However, there are ongoing stakeholder concerns regarding the following issues:

- lack of permanent repair for the OU A remedy
- lack of consultation regarding the OU A remedy repair design and mitigation
- mercury source control
- on-going marine construction projects' impact on the OU B Marine remedy in place
- lack of coordination between the BNC terrestrial and OU B Marine teams and between these teams and the BNC installation staff
- timeliness of emergency event reporting
- mercury source control, specifically within the Outfall 15 drainage basin
- elevated levels of mercury (both total and methyl) in sediment and tissue

13. Do you have any other comments, concerns, or suggestions regarding the effectiveness of the remedies in place to protect human health and the environment at BNC?

Response: Yes, my additional comments and suggestions are as follows:

- Periodic shoreline maintenance criteria should be included in the IC and O&M plan.
- Pavement inspections performed as part of the terrestrial annual remedy inspection should be performed by engineers or engineering technicians trained in pavement evaluation criteria using an established protocol for asphalt and concrete pavement inspection.
- Specific criteria should be developed and included for vegetative cap inspections (such as percent cover, condition and type of vegetation, size of any eroded areas, etc.) and such inspections should be performed by trained personnel.
- Terrestrial LTM and O&M efforts should be focused and pavement and storm sewer system maintenance.
- Groundwater monitoring frequency should be further optimized
- Groundwater monitoring well locations should be reassessed based on the current USGS groundwater model
- Unused monitoring wells should be decommissioned to further protect groundwater
- Excavation management plan should be updated to assign specific responsibilities associated with oversight of long-term excavation projects and unattended excavations

INTERVIEW RECORD FOR FOURTH FIVE-YEAR REVIEW
Type 1 Interview – Navy Personnel
Bremerton Naval Complex
Bremerton, WA

Individual Contacted: Mark Wicklein
Title: Supervisory Environmental Engineer
Organization: NAVFAC NW
Contact Made by: Battelle
Date: 20 Nov 2016

Summary of Communication

1. What is your overall impression of remedy performance following signing of the Records of Decision (RODs) at Operable Unit (OU) A, OU B Marine, OU B Terrestrial, OU D, and OU NSC, completion of the corrective action plan for OU C, and implementation of the remedies at the Bremerton naval complex (BNC)?

Response: Overall, remedy performance appears to be adequate. For OUA, there are plans within the next year to repair the remedy and decouple Pier D mitigation concerns. For OUB Marine, conditions to cease PCB monitoring appear to have been met. For OUB-T, OUC, OUD and OU-NSC, monitoring continues and there are active stakeholder discussions concerning LUCs, and the frequency and location of monitoring, to provide value-added information to the discussion of remedy effectiveness and protectiveness. For OUD, the City of Bremerton is working collaboratively with the Navy to maintain the LUCs there.

2. To the best of your knowledge, has on-going maintenance of pavement and vegetative covers (caps) within the terrestrial OUs been timely and effective? Has maintenance of these caps effectively met the goals to reduce the potential for human contact with chemicals of concern (COCs) in soil and to reduce the potential for infiltrating precipitation to transport chemicals to groundwater? Please indicate the basis for your assessment of the cap maintenance.

Response: Yes, within the bounds of a large organization such as the Navy, maintenance has been timely and effective. Yes, maintenance has met the goals. See response to 3. below.

3. To the best of your knowledge, has on-going cap and storm drain maintenance at OU A, OU B Terrestrial, and OU NSC been timely and met the goal of reducing the potential for COCs to be discharged to Sinclair Inlet? Please indicate the basis for your assessment of the cap and storm drain maintenance activities.

Response: Annual inspections have been completed by NAVFAC NW ER and additional inspections by NAVFAC NW NBK Public Works have occurred. There is

improved communication between these two organizations to identify areas for pavement repair and to solidify funding sources to implement these repairs.

4. To the best of your knowledge, have the shoreline stabilization measures put in place as part of the remedies been maintained to effectively meet the goal of controlling potential erosion of fill material to Sinclair Inlet? Please indicate the basis for your assessment of the shoreline stabilization measures.

Response: I am aware of inspections that have occurred, but I do not have knowledge of whether or not shoreline stabilization measures have been implemented.

5. What is your impression regarding progress towards implementing a permanent repair of the OU A remedy?

Response: Progress has been made in the form of finalized plans. Stakeholders appear to support the remedy repair; although stakeholders desire continued review of planning documents, as well as a possible Government to Government consultation between The Suquamish Tribe and the Navy. The Navy plans to implement a permanent repair in CY17.

6. In the third five-year review (2012) for BNC, the protectiveness determinations for OU A and OU B Terrestrial were deferred pending additional investigation of potential on-going contaminant transport pathways from the terrestrial to marine environment. The 2016 addendum to the third five-year review revised the protectiveness determination for OU A to "short term protective," but retained the deferral of the protectiveness determination for OU B Terrestrial. Based on your knowledge of the status of the additional assessments that are underway regarding these issues, what is your opinion regarding the progress towards a protectiveness statement for the remedy at OU B Terrestrial?

Response: Progress has been made in the form of USGS groundwater studies. Evaluation and project team buy-in continues.

7. The third five-year review (2012) for BNC also deferred the protectiveness determination for OU B Marine, pending additional investigation of mercury movement through the marine food web and interpretation of the implications of elevated PCB concentrations in sediment found during construction projects. Based on your knowledge of the status of the additional assessments that are underway regarding these issues, what is your opinion regarding the progress towards a protectiveness statement for the remedy at OU B Marine?

Response: Concerning mercury, there has been significant progress - information obtained should allow for remedial action decisions to be made and the completion of the FFS, PP and RODA. Concerning PCBs, 2012 investigation results indicated conditions of the ROD were met. The 2014 results did not appear to indicate fluctuations in PCB concentrations were related to anything but the temporary construction projects and the

ROD conditions continue to be met. The value of continued PCB monitoring is questionable and a thorough review of DQOs should be performed before any future monitoring.

8. Are you aware of any prior or pending land use or ownership changes since the signing of the RODs for OU A, OU B Marine, OU B Terrestrial, OU D, or OU NSC, or completion of the corrective action plan for OU C, that may impact the effectiveness of any component of the selected remedies?

Response: No.

9. Use of groundwater from beneath BNC is prohibited for any purpose except groundwater monitoring, in accordance with instructions NAVBASEKITSAPINST 5090.14 and PSNS&IMFINST 5090.50. Are you aware of any use of groundwater from beneath the installation for any purpose other than groundwater monitoring, e.g., for human consumption, equipment maintenance, or equipment decontamination?

Response: No.

10. To the best of your knowledge, do institutional controls and operations and maintenance practices in use at BNC meet the intent of the RODs/corrective action plan regarding limiting the potential for contact with or movement of contaminants left in place, e.g. in connection with excavation management, petroleum management, and storm drain system monitoring and maintenance?

Response: Yes, they meet the intent. Improvement can always be made and that is the intent and goal. More frequent communication between internal Navy organizations has occurred since the last five year review and this increases the likelihood and success of the O and M practices.

11. To the best of your knowledge, has the on-going program of groundwater monitoring, institutional controls inspection and maintenance, cap, shoreline, and storm drain inspection and maintenance, and sediment and marine biota monitoring at BNC following implementation of the remedies been sufficiently thorough and frequent to meet the goals of the RODs/corrective action plan? Please indicate the basis for your assessment.

Response: Yes, inspection and monitoring plans are in place and working. However, it is not known whether or not shoreline maintenance is occurring sufficiently to meet the goals.

12. Are you aware of any community concerns regarding the remedies in place at BNC? If so, please give details.

Response: No.

13. Do you have any other comments, concerns, or suggestions regarding the effectiveness of the remedies in place to protect human health and the environment at BNC?

Response: No.

INTERVIEW RECORD FOR FOURTH FIVE-YEAR REVIEW
Type 1 Interview – Navy Personnel
Bremerton Naval Complex
Bremerton, WA

Individual Contacted: Rory W. Lee
Title: Stormwater Program Manager
Organization: Code 106.32
Contact Made by: Andrew Bullard
Date: 11/4/2016

Summary of Communication

1. What is your overall impression of remedy performance following signing of the Records of Decision (RODs) at Operable Unit (OU) A, OU B Marine, OU B Terrestrial, OU D, and OU NSC, completion of the corrective action plan for OU C, and implementation of the remedies at the Bremerton naval complex (BNC)?

   Response: Not familiar with the ROC or the correction actions and remedies. I do feel there is lack of knowledge among the work force in regards to working in operable units and the requirements.

2. To the best of your knowledge, has on-going maintenance of pavement and vegetative covers (caps) within the terrestrial OUs been timely and effective? Has maintenance of these caps effectively met the goals to reduce the potential for human contact with chemicals of concern (COCs) in soil and to reduce the potential for infiltrating precipitation to transport chemicals to groundwater? Please indicate the basis for your assessment of the cap maintenance.

Response: I have observed several occasions when stockpiles of excavated soil was not covered. I have also seen excavation pits left opened for long durations of times, allowing surface run-off to infiltrate the ground. There is currently and excavated pit that has been left wide open east of Bld. 495 for over a month. There is also an unpaved area just east of Bld. 427 that is used as a staging area for scaffolding that is gravel (not paved surface). The area was much larger but the majority of it has been paved since the construction of the new mess area.

3. To the best of your knowledge, has on-going cap and storm drain maintenance at OU A, OU B Terrestrial, and OU NSC been timely and met the goal of reducing the potential for COCs to be discharged to Sinclair Inlet? Please indicate the basis for your assessment of the cap and storm drain maintenance activities.

Response: To the best of my knowledge there is little maintenance and repair of the storm sewer infrastructure. This would require an intensive study mapping the drainage basin and modeling precipitation. I would assume based on the age of the infrastructure and lack of supporting data that infiltration is occurring throughout the storm sewer infrastructure. As mentioned above, I am not familiar with the requirements of the on-going cap and how we are supposed to manage it. Most of my observations relating to exposed soil has been correlated with construction projects. I don't know how long they are allowed to leave excavated pits exposed or the requirements relating to OUs. This information needs to be more clear in order to give a more detailed assessment.

4. To the best of your knowledge, have the shoreline stabilization measures put in place as part of the remedies been maintained to effectively meet the goal of controlling potential erosion of fill material to Sinclair Inlet? Please indicate the basis for your assessment of the shoreline stabilization measures.

   Response: I am not involved with this process. NAVFAV NBK takes the lead on this remedy. I know that measures are in place but cannot say if is effectively meeting the goal.

5. What is your impression regarding progress towards implementing a permanent repair of the OU A remedy?

   Response: Not involved.

6. In the third five-year review (2012) for BNC, the protectiveness determinations for OU A and OU B Terrestrial were deferred pending additional investigation of potential on-going contaminant transport pathways from the terrestrial to marine environment. The 2016 addendum to the third five-year review revised the protectiveness determination for OU A to "short term protective," but retained the deferral of the protectiveness determination for OU B Terrestrial. Based on your knowledge of the status of the additional assessments that are underway regarding these issues, what is your opinion regarding the progress towards a protectiveness statement for the remedy at OU B Terrestrial?

   Response: Not involved.

7. The third five-year review (2012) for BNC also deferred the protectiveness determination for OU B Marine, pending additional investigation of mercury movement through the marine food web and interpretation of the implications of elevated PCB concentrations in sediment found during construction projects. Based on your knowledge of the status of the additional assessments that are underway regarding these issues, what is your opinion regarding the progress towards a protectiveness statement for the remedy at OU B Marine?

   Response: Not involved.

8. Are you aware of any prior or pending land use or ownership changes since the signing of the RODs for OU A, OU B Marine, OU B Terrestrial, OU D, or OU NSC, or completion of the corrective action plan for OU C, that may impact the effectiveness of any component of the selected remedies?

Response: Not aware.

9. Use of groundwater from beneath BNC is prohibited for any purpose except groundwater monitoring, in accordance with instructions NAVBASEKITSAPINST 5090.14 and PSNS&IMFINST 5090.50. Are you aware of any use of groundwater from beneath the installation for any purpose other than groundwater monitoring, e.g., for human consumption, equipment maintenance, or equipment decontamination?

   Response: Ground water is not used for anything other ground water monitoring.

10. To the best of your knowledge, do institutional controls and operations and maintenance practices in use at BNC meet the intent of the RODs/corrective action plan regarding limiting the potential for contact with or movement of contaminants left in place, e.g. in connection with excavation management, petroleum management, and storm drain system monitoring and maintenance?

To my knowledge there is little to no monitoring and maintenance (other than cleaning catch basins) that is performed on the storm drain system. I assuming this does not meet the ROD. Not familiar enough with excavation management or petroleum management to give an assessment.
Response:

11. To the best of your knowledge, has the on-going program of groundwater monitoring, institutional controls inspection and maintenance, cap, shoreline, and storm drain inspection and maintenance, and sediment and marine biota monitoring at BNC following implementation of the remedies been sufficiently thorough and frequent to

meet the goals of the RODs/corrective action plan? Please indicate the basis for your assessment.

Response: Not familiar.

12. Are you aware of any community concerns regarding the remedies in place at BNC? If so, please give details.

Response: Not aware.

13. Do you have any other comments, concerns, or suggestions regarding the effectiveness of the remedies in place to protect human health and the environment at BNC?

Response: There is a lack of knowledge among of the workforce and other environmental programs. There needs to more transparency to ensure the remedies are being implemented both in a timely manner and correctly.

INTERVIEW RECORD FOR FOURTH FIVE-YEAR REVIEW
Type 1 Interview – Navy Personnel
Bremerton Naval Complex
Bremerton, WA

Individual Contacted: Susan Moore
Title: Navy Contractor
Organization: CH2M HILL
Contact Made by: Andrew Bullard
Date: 11/29/16

Summary of Communication

1. What is your overall impression of remedy performance following signing of the Records of Decision (RODs) at Operable Unit (OU) A, OU B Marine, OU B Terrestrial, OU D, and OU NSC, completion of the corrective action plan for OU C, and implementation of the remedies at the Bremerton naval complex (BNC)?

Response: I believe the remedy performance is generally very good. For OU A, the performance will be improved with the planned remedy repair (needed following Pier D mitigation project). For OU B Marine, the long-term monitoring data for PCBs indicate that both sediment cleanup goals for OU B Marine and Sinclair Inlet were met based on the 2014 event results, in a timeframe very close to 10 years beyond the last remedy construction period. The stability of the OU B Marine remedy can be further substantiated with additional monitoring, which is an upcoming topic of discussion for the OU B Marine project team (Navy, EPA, Ecology, Suquamish Tribe, and DNR). No comments on OU B Terrestrial, OU D, OU NSC, and OU C remedy performance (limited knowledge).

2. To the best of your knowledge, has on-going maintenance of pavement and vegetative covers (caps) within the terrestrial OUs been timely and effective? Has maintenance of these caps effectively met the goals to reduce the potential for human contact with chemicals of concern (COCs) in soil and to reduce the potential for infiltrating precipitation to transport chemicals to groundwater? Please indicate the basis for your assessment of the cap maintenance.

Response: None.

3. To the best of your knowledge, has on-going cap and storm drain maintenance at OU A, OU B Terrestrial, and OU NSC been timely and met the goal of reducing the potential for COCs to be discharged to Sinclair Inlet? Please indicate the basis for your assessment of the cap and storm drain maintenance activities.

Response: None.

4. To the best of your knowledge, have the shoreline stabilization measures put in place as part of the remedies been maintained to effectively meet the goal of controlling potential erosion of fill material to Sinclair Inlet? Please indicate the basis for your assessment of the shoreline stabilization measures.

Response: None.

5. What is your impression regarding progress towards implementing a permanent repair of the OU A remedy?

Response: Various interim repairs (placement of fish mix) have been done and that there are designs in progress for a permanent repair and habitat benefits analysis to compare pre-Pier D mitigation remedy, post-Pier D mitigation, current, and post-permanent repair conditions.

6. In the third five-year review (2012) for BNC, the protectiveness determinations for OU A and OU B Terrestrial were deferred pending additional investigation of potential on-going contaminant transport pathways from the terrestrial to marine environment. The 2016 addendum to the third five-year review revised the protectiveness determination for OU A to "short term protective," but retained the deferral of the protectiveness determination for OU B Terrestrial. Based on your knowledge of the status of the additional assessments that are underway regarding these issues, what is your opinion regarding the progress towards a protectiveness statement for the remedy at OU B Terrestrial?

Response: For OU A, additional sediment samples were collected from Charleston Beach in the spring of 2015 to aid in assessing whether landfill materials at Charleston Beach may be impacting the adjacent marine sediments. The monitoring report (Final 2014 OU B Marine Phase 2 Long-term Monitoring Report [Navy, 2016]) indicated that PCBs were not detected, and detected metals (including mercury) were below state sediment cleanup objectives. The determination for OU A seems appropriate given these results and the upcoming remedy repair. No input on OU B Terrestrial; however, progress is being made to look at source control actions related to mercury impacts to OU B Marine in the vicinity of Outfall 15 (also see next response).

7. The third five-year review (2012) for BNC also deferred the protectiveness determination for OU B Marine, pending additional investigation of mercury movement through the marine food web and interpretation of the implications of elevated PCB concentrations in sediment found during construction projects. Based on your knowledge of the status of the additional assessments that are underway regarding these issues, what is your opinion regarding the progress towards a protectiveness statement for the remedy at OU B Marine?

Response: Regarding mercury movement in the marine foodweb, additional fieldwork was completed and documented by the Navy in 2013 to address this issue.

The Supplemental Mercury Investigation Report will be finalized in early 2017. This report will be a compilation and interpretation of available relevant mercury data (including the Navy's 2013 data) from Sinclair Inlet in various environmental media. Regarding the interpretation/implication of elevated PCB concentrations found during construction projects, this is an ongoing topic of discussion for the Navy and stakeholders. It is anticipated that this issue will be resolved in 2017 as part of what the Navy calls the "Decision Framework". The Decision Framework will evaluate long-term monitoring results for PCBs from 2003 through 2014 and document decisions made by Navy project team regarding future monitoring and interpretation of future data, collected as part of other programs, from OU B Marine.

8. Are you aware of any prior or pending land use or ownership changes since the signing of the RODs for OU A, OU B Marine, OU B Terrestrial, OU D, or OU NSC, or completion of the corrective action plan for OU C, that may impact the effectiveness of any component of the selected remedies?

Response: None.

9. Use of groundwater from beneath BNC is prohibited for any purpose except groundwater monitoring, in accordance with instructions NAVBASEKITSAPINST 5090.14 and PSNS&IMFINST 5090.50. Are you aware of any use of groundwater from beneath the installation for any purpose other than groundwater monitoring, e.g., for human consumption, equipment maintenance, or equipment decontamination?

Response: None.

10. To the best of your knowledge, do institutional controls and operations and maintenance practices in use at BNC meet the intent of the RODs/corrective action plan regarding limiting the potential for contact with or movement of contaminants left in place, e.g. in connection with excavation management, petroleum management, and storm drain system monitoring and maintenance?

Response: Based on discussions at OU B Marine project team meetings (Navy, EPA, Ecology, Suquamish Tribe, DNR), the documentation and follow-through on incidents/activities that could impact ROD/corrective action remedies could be improved.

11. To the best of your knowledge, has the on-going program of groundwater monitoring, institutional controls inspection and maintenance, cap, shoreline, and storm drain inspection and maintenance, and sediment and marine biota monitoring at BNC following implementation of the remedies been sufficiently thorough and frequent to meet the goals of the RODs/corrective action plan? Please indicate the basis for your assessment.

Response: I can only speak to the sediment and marine biota monitoring at BNC. The monitoring has been designed and conducted at a frequency that is consistent with planning documents and approved by the OU B Marine project team (Navy, EPA, Ecology, Suquamish Tribe, DNR).

12. Are you aware of any community concerns regarding the remedies in place at BNC? If so, please give details.

Response: None.

13. Do you have any other comments, concerns, or suggestions regarding the effectiveness of the remedies in place to protect human health and the environment at BNC?

Response: None.

INTERVIEW RECORD FOR FOURTH FIVE-YEAR REVIEW
Type 1 Interview – Navy Personnel
Bremerton Naval Complex
Bremerton, WA

Individual Contacted: Carlotta Cellucci
Title: Remedial Project Manager
Organization: NAVFAC NW
Contact Made by: Andrew Bullard
Date: 11/04/2016

Summary of Communication

1. What is your overall impression of remedy performance following signing of the Records of Decision (RODs) at Operable Unit (OU) A, OU B Marine, OU B Terrestrial, OU D, and OU NSC, completion of the corrective action plan for OU C, and implementation of the remedies at the Bremerton naval complex (BNC)?

Response: Given that the remedies are not intended to clean up the site, but to manage waste in place, the remedies have performed acceptably. Problems have been encountered due to placement of mitigation on OU A for a pier project, which has lead stakeholders to believe that the mitigation is the selected remedy, which is not supported by the ROD.

2. To the best of your knowledge, has on-going maintenance of pavement and vegetative covers (caps) within the terrestrial OUs been timely and effective? Has maintenance of these caps effectively met the goals to reduce the potential for human contact with chemicals of concern (COCs) in soil and to reduce the potential for infiltrating precipitation to transport chemicals to groundwater? Please indicate the basis for your assessment of the cap maintenance.

Response: The western portion of OU A was not inspected or maintained for a number of years due to inconsistencies between maps in the ROD and maps in historical documents. Cap inspections have documented cracks and subsidence areas, and repairs are being incorporated into installation paving projects, so cap maintenance is sufficient to protect human health and reduce infiltration.

3. To the best of your knowledge, has on-going cap and storm drain maintenance at OU A, OU B Terrestrial, and OU NSC been timely and met the goal of reducing the potential for COCs to be discharged to Sinclair Inlet? Please indicate the basis for your assessment of the cap and storm drain maintenance activities.

Response: Storm drain maintenance has not been sufficient to reduce COC discharge to Sinclair Inlet, given that damaged storm drains were identified many years ago, but have not been repaired.

4. To the best of your knowledge, have the shoreline stabilization measures put in place as part of the remedies been maintained to effectively meet the goal of controlling potential erosion of fill material to Sinclair Inlet? Please indicate the basis for your assessment of the shoreline stabilization measures.

Response: Again, problems have been encountered due to placement of mitigation on OU A for a pier project. This mitigation action replaced a hardened seawall with a soft beach over the OU A landfill. Unfortunately, the beach dynamics in this area do not support a soft beach and the soft beach is routinely scoured away through wave action and storms and redeposited toward the installation. This both places landfill waste in jeopardy of being released from the landfill into the inlet and will likely necessitate dredging in the future to continue to berth ships at the adjacent pier. Unfortunately dredging will be very tricky, given the proximity of the sediment cap on the CAD pit.

5. What is your impression regarding progress towards implementing a permanent repair of the OU A remedy?

Response: I believe that a G2G consultation will be necessary between the Navy and the Suquamish Tribe before a permanent repair can be implemented, given the tribes concerns regarding the current design and the lack of collaboration during the design phase.

6. In the third five-year review (2012) for BNC, the protectiveness determinations for OU A and OU B Terrestrial were deferred pending additional investigation of potential on-going contaminant transport pathways from the terrestrial to marine environment. The 2016 addendum to the third five-year review revised the protectiveness determination for OU A to "short term protective," but retained the deferral of the protectiveness determination for OU B Terrestrial. Based on your knowledge of the status of the additional assessments that are underway regarding these issues, what is your opinion regarding the progress towards a protectiveness statement for the remedy at OU B Terrestrial?

Response: Given the results of recent USGS groundwater modeling, it appears that there are very limited areas where OU B Terrestrial groundwater discharges directly into Sinclair Inlet. Based on this finding and the presence of a competent cap, it is unlikely that OU B Terrestrial groundwater is a significant contributor to the COCs in OU B Marine. Therefore, with the addition of wells to monitor the areas where groundwater directly discharges into the inlet, I believe that the protectiveness statement can be changed to "protective in the short term" and long term protectiveness can be evaluated using the data gathered from the new wells.

7. The third five-year review (2012) for BNC also deferred the protectiveness determination for OU B Marine, pending additional investigation of mercury movement through the marine food web and interpretation of the implications of elevated PCB concentrations in sediment found during construction projects. Based

on your knowledge of the status of the additional assessments that are underway regarding these issues, what is your opinion regarding the progress towards a protectiveness statement for the remedy at OU B Marine?

Response: I am unfamiliar with the additional assessments being performed at OU B Marine.

8. Are you aware of any prior or pending land use or ownership changes since the signing of the RODs for OU A, OU B Marine, OU B Terrestrial, OU D, or OU NSC, or completion of the corrective action plan for OU C, that may impact the effectiveness of any component of the selected remedies?

Response: OU D was transferred to the City of Bremerton who installed a park on the site. They were required to maintain a cap over the area, but have installed fountains and grassy areas. It is unclear if the development of the park is in compliance with the requirements for future use.

9. Use of groundwater from beneath BNC is prohibited for any purpose except groundwater monitoring, in accordance with instructions NAVBASEKITSAPINST 5090.14 and PSNS&IMFINST 5090.50. Are you aware of any use of groundwater from beneath the installation for any purpose other than groundwater monitoring, e.g., for human consumption, equipment maintenance, or equipment decontamination?

Response: No.

10. To the best of your knowledge, do institutional controls and operations and maintenance practices in use at BNC meet the intent of the RODs/corrective action plan regarding limiting the potential for contact with or movement of contaminants left in place, e.g. in connection with excavation management, petroleum management, and storm drain system monitoring and maintenance?

Response: No. Storm drain maintenance is not performed regularly enough to prevent soil from OU B Terrestrial from being transported to OU B Marine. I believe that the current RPM has resolved the problems with contaminated soil management with regard to excavation permitting, and soil is no longer being transported from excavation areas for use elsewhere onsite.

11. To the best of your knowledge, has the on-going program of groundwater monitoring, institutional controls inspection and maintenance, cap, shoreline, and storm drain inspection and maintenance, and sediment and marine biota monitoring at BNC following implementation of the remedies been sufficiently thorough and frequent to meet the goals of the RODs/corrective action plan? Please indicate the basis for your assessment.

Response: Again, storm drain maintenance is not performed regularly enough to prevent soil from OU B Terrestrial from being transported to OU B Marine and a

portion of OU A was not being inspected or maintained for years. I believe monitoring of the remainder of the OUs has been sufficiently thorough and frequent to meet the goals of the RODs/corrective action plan.

12. Are you aware of any community concerns regarding the remedies in place at BNC? If so, please give details.

Response: No, with the exception of the Suquamish Tribe's concerns regarding the permanent repair at OU A.

13. Do you have any other comments, concerns, or suggestions regarding the effectiveness of the remedies in place to protect human health and the environment at BNC?

Response: No.

INTERVIEW RECORD FOR FOURTH FIVE-YEAR REVIEW
Type 1 Interview – Navy Personnel
Bremerton Naval Complex
Bremerton, WA

Individual Contacted: Bryan Ransom
Title: Environmental Restoration Intern
Organization: Naval Facilities Command Northwest (NAVFAC NW)
Contact Made by: Andrew Bullard
Date: 11/07/2016

Summary of Communication

1. What is your overall impression of remedy performance following signing of the Records of Decision (RODs) at Operable Unit (OU) A, OU B Marine, OU B Terrestrial, OU D, and OU NSC, completion of the corrective action plan for OU C, and implementation of the remedies at the Bremerton naval complex (BNC)?

   Response:

   I should qualify myself and state for the record that I have only been working for NAVFAC NW for less than 7 months, and as I am still only an intern, I do not have the final responsibility for any of the OUs at BNC.

   I have mostly been involved with helping the remedial project manager (RPM) for OU A, carry out a beach-replenishment and a Habit Benefit Analysis at Charleston Beach. In my very humble opinion, the remedy for OU A, which is supposed to protect the former landfill from eroding into Sinclair Inlet, if I'm not mistaken, is currently not functioning as was intended in the ROD. This has to do with the removal of rip rap (which was part of the OU A remedy, and was functioning perfectly fine) at Charleston Beach in order to create local fish habitat for BNC since another project within the shipyard reduced some existing fish habitat area. Due to the erosion caused by intense storms and wave activity at Charleston Beach, the beach has had to be replenished several times since its construction. Even with these multiple replenishments, there have been several instances that have resulted in landfill material eroding out onto the beach in into the inlet. As of right now there is asbestos brick, metal slag, and large slabs of concrete strewn about Charleston Beach.

   I am too unfamiliar with the other operable units to speak at any length as to whether the remedies have been effective or not.

2. To the best of your knowledge, has on-going maintenance of pavement and vegetative covers (caps) within the terrestrial OUs been timely and effective? Has maintenance of these caps effectively met the goals to reduce the potential for human

contact with chemicals of concern (COCs) in soil and to reduce the potential for infiltrating precipitation to transport chemicals to groundwater? Please indicate the basis for your assessment of the cap maintenance.

Response:

To my knowledge, the on-going maintenance of pavement and vegetative cover has not been timely and effective. There are several areas within OU B Terrestrial that I have witnessed that have invasive species growing through cracks in the asphalt, a few areas where sediment has been left exposed to precipitation, and even excavation sites that do not have sufficiently cover on the exposed sediment. These examples seem to not decrease the potential for human contact with COCs in the soil or for precipitation infiltrating the soil.

3. To the best of your knowledge, has on-going cap and storm drain maintenance at OU A, OU B Terrestrial, and OU NSC been timely and met the goal of reducing the potential for COCs to be discharged to Sinclair Inlet? Please indicate the basis for your assessment of the cap and storm drain maintenance activities.

Response:

I do not know much about on-going maintenance for the cap or storm drains; however I am aware of methylmercury as a concern around outfall 15 in OU B Terrestrial. I have attended a couple of meetings about the Supplemental Mercury Investigation Report (SMIR) concerning this issue

4. To the best of your knowledge, have the shoreline stabilization measures put in place as part of the remedies been maintained to effectively meet the goal of controlling potential erosion of fill material to Sinclair Inlet? Please indicate the basis for your assessment of the shoreline stabilization measures.

Response:

As I mentioned in my response to question 1, the remedy at OU A was interrupted to create fish habitat that was lost during another construction project within the shipyard. This created beach now erodes due to the wave and storm activity in Sinclair Inlet and landfill material has eroded out from the landfill and now litters the rest of the beach.

5. What is your impression regarding progress towards implementing a permanent repair of the OU A remedy?

Response:

I have heard that there was a contract for the OU A remedy, but it wasn't able to get awarded by the end of FY16, so it got bumped to FY17. As of right now, though, I am unsure if it has been awarded yet.

6. In the third five-year review (2012) for BNC, the protectiveness determinations for OU A and OU B Terrestrial were deferred pending additional investigation of potential on-going contaminant transport pathways from the terrestrial to marine environment. The 2016 addendum to the third five-year review revised the protectiveness determination for OU A to "short term protective," but retained the deferral of the protectiveness determination for OU B Terrestrial. Based on your knowledge of the status of the additional assessments that are underway regarding these issues, what is your opinion regarding the progress towards a protectiveness statement for the remedy at OU B Terrestrial?

   Response:

   I do not know enough about OU B Terrestrial to really answer this question.

7. The third five-year review (2012) for BNC also deferred the protectiveness determination for OU B Marine, pending additional investigation of mercury movement through the marine food web and interpretation of the implications of elevated PCB concentrations in sediment found during construction projects. Based on your knowledge of the status of the additional assessments that are underway regarding these issues, what is your opinion regarding the progress towards a protectiveness statement for the remedy at OU B Marine?

   Response:

   Again, I do not feel that I know enough to answer this question.

8. Are you aware of any prior or pending land use or ownership changes since the signing of the RODs for OU A, OU B Marine, OU B Terrestrial, OU D, or OU NSC, or completion of the corrective action plan for OU C, that may impact the effectiveness of any component of the selected remedies?

   Response:

   I know that OU D has changed ownership from the Navy to the City of Bremerton, but other than that, I am unaware of any other land use or ownership changes.

9. Use of groundwater from beneath BNC is prohibited for any purpose except groundwater monitoring, in accordance with instructions NAVBASEKITSAPINST 5090.14 and PSNS&IMFINST 5090.50. Are you aware of any use of groundwater from beneath the installation for any purpose other than groundwater monitoring, e.g., for human consumption, equipment maintenance, or equipment decontamination?

Response:

I am unaware of any PSNS groundwater use outside of groundwater monitoring.

10. To the best of your knowledge, do institutional controls and operations and maintenance practices in use at BNC meet the intent of the RODs/corrective action plan regarding limiting the potential for contact with or movement of contaminants left in place, e.g. in connection with excavation management, petroleum management, and storm drain system monitoring and maintenance?

Response:

I am fairly certain that the institutional controls are lacking with regards to some of the remedies for PSNS. I believe that the Excavation Management Plan (EMP) does not adequately cover the management of excavated material piles and their rainfall runoff. I know that the EMP is slated to be discussed and potentially altered during a meeting within the 2016 calendar year, but I have not been directly involved with the planning involved for this meeting (I believe either Pam Sargent or Yorick Wahaus have been taking the lead on this).

As for the Petroleum Management Plan (PMP), I am not really sure of any issues. The storm drain system monitoring and maintenance seems to be rather hit or miss. Pam Sargent, Yorick Wahaus, Steve Skeehan, Michael Meyer, Andrew Bullard, and I all went on a PSNS site visit on 11/16 and found that although some storm drains seemed to have had their sediment catchments cleaned out and repaired fairly recently, other storm drains seemed to have been neglected.

11. To the best of your knowledge, has the on-going program of groundwater monitoring, institutional controls inspection and maintenance, cap, shoreline, and storm drain inspection and maintenance, and sediment and marine biota monitoring at BNC following implementation of the remedies been sufficiently thorough and frequent to meet the goals of the RODs/corrective action plan? Please indicate the basis for your assessment.

Response:

I believe that the groundwater monitoring program has been sufficient in meeting monitoring goals for the RODs, and after the recent USGS groundwater model has come out, I believe that NAVFAC is taking steps to utilize this updated, more accurate model to decommission unnecessary wells and improve the efficiency of the groundwater monitoring program.

The institutional controls inspection and maintenance, cap, shoreline, and storm drain inspection and maintenance appear to be insufficient in meeting the goals in the RODs. The site visit on 11/16 revealed that the storm drains needed more

attention, the cap needed to be repaired in several areas, the shoreline needed maintenance near the Bremerton ferry terminal and along the "pocket" beach in OU B Marine, and there were some on-going excavations that were not adequately address rainfall runoff.

12. Are you aware of any community concerns regarding the remedies in place at BNC? If so, please give details.

Response:

I know that the Suquamish Tribe stakeholders are concerned about being left out of the OU A remedy design process. They were involved up until the 90% Design, but have not had a say since and the design has gone final, though it has not been awarded yet (as far as I know). I also think that the community is concerned about OU B Marine. The stakeholders have jumped onboard with the Washington Department of Ecology (Ecology) in getting the Navy to come up with a marine sediment sampling plan to abide by the state's anti-degradation statutes.

13. Do you have any other comments, concerns, or suggestions regarding the effectiveness of the remedies in place to protect human health and the environment at BNC?

Response:

I know that the anthropogenic debris on the beach at OU A is not covered by the OU A ROD; however that means that this debris is left in a sort of limbo since it has been removed from the CERCLA process. This debris contains asbestos brick, chromium-containing fire brick, metal slag, and concrete debris; and even the stakeholders have asked that it be removed from the beach.

INTERVIEW RECORD FOR FOURTH FIVE-YEAR REVIEW
Type 1 Interview – Navy Personnel
Bremerton Naval Complex
Bremerton, WA

Individual Contacted: Yorick Wahaus
Title: Remedial Project Manager (NBK-Bremerton-Terrestrial)
Organization: US Navy
Contact Made by: Andy Bullard
Date: 23-Nov-2016

Summary of Communication

1. What is your overall impression of remedy performance following signing of the Records of Decision (RODs) at Operable Unit (OU) A, OU B Marine, OU B Terrestrial, OU D, and OU NSC, completion of the corrective action plan for OU C, and implementation of the remedies at the Bremerton naval complex (BNC)?

Response: With my limited experience I feel it's pretty good.

2. To the best of your knowledge, has on-going maintenance of pavement and vegetative covers (caps) within the terrestrial OUs been timely and effective? Has maintenance of these caps effectively met the goals to reduce the potential for human contact with chemicals of concern (COCs) in soil and to reduce the potential for infiltrating precipitation to transport chemicals to groundwater? Please indicate the basis for your assessment of the cap maintenance.

Response: I don't think the maintenance has been timely do to the complexity of getting things done within the shipyard. I do feel that overall the maintenance of these caps effectively met the goals because things do eventually get done and the percentage of "bad" areas is relatively small compared to the size of the base.

3. To the best of your knowledge, has on-going cap and storm drain maintenance at OU A, OU B Terrestrial, and OU NSC been timely and met the goal of reducing the potential for COCs to be discharged to Sinclair Inlet? Please indicate the basis for your assessment of the cap and storm drain maintenance activities.

Response: I don't have enough experience to answer this one.

4. To the best of your knowledge, have the shoreline stabilization measures put in place as part of the remedies been maintained to effectively meet the goal of controlling potential erosion of fill material to Sinclair Inlet? Please indicate the basis for your assessment of the shoreline stabilization measures.

Response: Yes, but there is always more maintenance that needs done and again complexity of the base makes it challenging to get done.

5. What is your impression regarding progress towards implementing a permanent repair of the OU A remedy?

Response: It's taking too long.

6. In the third five-year review (2012) for BNC, the protectiveness determinations for OU A and OU B Terrestrial were deferred pending additional investigation of potential on-going contaminant transport pathways from the terrestrial to marine environment. The 2016 addendum to the third five-year review revised the protectiveness determination for OU A to "short term protective," but retained the deferral of the protectiveness determination for OU B Terrestrial. Based on your knowledge of the status of the additional assessments that are underway regarding these issues, what is your opinion regarding the progress towards a protectiveness statement for the remedy at OU B Terrestrial?

Response: I don't have enough experience to answer this one.

7. The third five-year review (2012) for BNC also deferred the protectiveness determination for OU B Marine, pending additional investigation of mercury movement through the marine food web and interpretation of the implications of elevated PCB concentrations in sediment found during construction projects. Based on your knowledge of the status of the additional assessments that are underway regarding these issues, what is your opinion regarding the progress towards a protectiveness statement for the remedy at OU B Marine?

Response: I don't have enough experience to answer this one.

8. Are you aware of any prior or pending land use or ownership changes since the signing of the RODs for OU A, OU B Marine, OU B Terrestrial, OU D, or OU NSC, or completion of the corrective action plan for OU C, that may impact the effectiveness of any component of the selected remedies?

Response: No.

9. Use of groundwater from beneath BNC is prohibited for any purpose except groundwater monitoring, in accordance with instructions NAVBASEKITSAPINST 5090.14 and PSNS&IMFINST 5090.50. Are you aware of any use of groundwater from beneath the installation for any purpose other than groundwater monitoring, e.g., for human consumption, equipment maintenance, or equipment decontamination?

Response: No.

10. To the best of your knowledge, do institutional controls and operations and maintenance practices in use at BNC meet the intent of the RODs/corrective action plan regarding limiting the potential for contact with or movement of contaminants

left in place, e.g. in connection with excavation management, petroleum management, and storm drain system monitoring and maintenance?

Response: Mostly, there needs to be more management of piles of dirt when they are left out for extended periods. Not always following the EMP.

11. To the best of your knowledge, has the on-going program of groundwater monitoring, institutional controls inspection and maintenance, cap, shoreline, and storm drain inspection and maintenance, and sediment and marine biota monitoring at BNC following implementation of the remedies been sufficiently thorough and frequent to meet the goals of the RODs/corrective action plan? Please indicate the basis for your assessment.

Response: Yes, for the most part. I do think there could be more maintenance as it's a large old base and there is a lot of infrastructure that has been there since the early days of the base. Preventive maintenance is not always on the top of peoples to do list.

12. Are you aware of any community concerns regarding the remedies in place at BNC? If so, please give details.

Response: No.

13. Do you have any other comments, concerns, or suggestions regarding the effectiveness of the remedies in place to protect human health and the environment at BNC?

Response: I'm concerned about what happens to the ground water that is pumped out through the drydocks and where or not it has any contaminates of concern in it. I think there have been some studies that show what's in the water that is pumped form the drydocks I just need to find them and the time to read them.

Agency

INTERVIEW RECORD FOR FOURTH FIVE-YEAR REVIEW
Type 2 Interview – Regulatory Agency Staff
Bremerton Naval Complex
Bremerton, WA

Individual Contacted: Karen Keeley
Title: Project Manager for PSNS OU B Marine Only (and Charleston Beach)
Organization: EPA
Contact Made by: Email
Date: 11-7-2016

Summary of Communication

1. What is your overall impression of remedy performance following signing of the Records of Decision (RODs) for Operable Unit (OU) A, OU B Marine, OU B Terrestrial, OU D, and OU NSC, completion of the corrective action plan for OU C, and implementation of the remedies at the Bremerton naval complex (BNC)? Do you believe the remedies met the intent of the RODs/corrective action plan for these sites? Do you feel the remedies continue to be effective? Please indicate the basis for your assessment.

Response: Protectiveness for OU B Marine was deferred in the last FYR due to concerns about mercury contamination in tissue/sediments as well as concerns about upland contaminant sources (e.g., stormwater releases, groundwater discharges) and other uncontrolled ongoing sources to the marine environment. While the Navy has made some progress on the Supplemental Mercury Investigation Report, the work has been slow and for many months nothing has happened. Given that recent October 2016 sediment data show nearshore sediment concentrations with elevated mercury concentrations (e.g., 7 ppm total mercury at one station) it is imperative that this work move forward. Also, a path forward must be determined for areas where sample data related to in-water construction projects show that localized areas of higher contamination remain.

Regarding Phase 2 of the 2014 Long-term Monitoring and Reporting for OU B Marine, as of today this report is still outstanding and has not been finalized, which adversely affects the ability of the Agency to evaluate the protectiveness of the remedy.

Also, the Charles Beach replenishment efforts were meant to provide temporary protection of the OU A remedy while the final remedy repair was chosen and implemented. The final remedy repair for OU A is long overdue and these continued replenishments do not adequately protect the environment, nor do they provide for sustainable forage fish spawning habitat, as the Tribe has pointed out. EPA fully expects the Navy will respond to all comments and engage in meaningful dialogue with the stakeholders, particularly the Tribe, regarding the design and implementation of the final remedy repair for OU A/Charleston Beach.

2. In the third five-year review (2012) for BNC, the protectiveness determinations for OU A and OU B Terrestrial were deferred pending additional investigation of potential on-going contaminant transport pathways from the terrestrial to marine environment. The 2016 addendum to the third five-year review revised the protectiveness determination for OU A to "short term protective," but retained the deferral of the protectiveness determination for OU B Terrestrial. Based on your knowledge of the status of the additional assessments that are underway regarding these issues, what is your opinion regarding the progress towards a protectiveness statement for the remedy at OU B Terrestrial?

Response:

3. The third five-year review (2012) for BNC also deferred the protectiveness determination for OU B Marine, pending additional investigation of mercury movement through the marine food web and interpretation of the implications of elevated PCB concentrations in sediment found during construction projects. Based on your knowledge of the status of the additional assessments that are underway regarding these issues, what is your opinion regarding the progress towards a protectiveness statement for the remedy at OU B Marine?

Response: EPA believes that inadequate process is being made towards a protectiveness statement for the remedy at OU B Marine – as in prior years, the protectiveness statement will need to be deferred since the reports have not been completed and the project has not stayed on schedule.

4. To your knowledge, since the RODs were signed for OU A, OU B Marine, OU B Terrestrial, OU D, and OU NSC and the corrective action plan was completed for OU C have there been any new scientific findings that relate to projecting potential site risks which might call into question the protectiveness of the remedies?

Response:

5. To the best of your knowledge, are institutional controls and operations and maintenance procedures being utilized at BNC consistent with the terms of the RODs/corrective action plan?

Response:

6. Following signing of the RODs and completion of the OU C corrective action plan, have there been any complaints, violations, or other incidents related to BNC installation restoration issues that required a response by your office? If so, please provide details of the events and results of the responses.

Response:

7. To the best of your knowledge, has the on-going program of groundwater monitoring, institutional controls inspection and maintenance, cap, shoreline, and storm drain inspection and maintenance, and sediment and marine biota monitoring at BNC following implementation of the remedies been sufficiently thorough and frequent to meet the goals of the RODs/corrective action plan? Please indicate the basis for your assessment.

Response: As part of the five-year review, the adequacy of institutional controls (ICs) for the entire site must be evaluated in accordance with FYR guidance.

> See:
> https://www.epa.gov/superfund/superfund-institutional-controls
>
> See:
> *Recommended Evaluation of Institutional Controls: Supplement to the 'Comprehensive Five-Year Review Guidance,'* OSWER Directive 9355.7-18, September 13, 2011, which provides a recommended analysis of IC effectiveness during the CERCLA five-year review (FYR) process.
> https://semspub.epa.gov/work/HQ/175441.pdf

In particular, ICs for OU B Marine must be reviewed. For over a year, the Navy has agreed to determine whether the "remediated area adjacent to the CAD pit" is on State-owned Lands, and whether ICs are in place for remediated sediments where 'waste remains.' The Navy agreed to clarify if UECA or other environmental covenants/Regulated Navigation Areas are in place for the CAD (including the remediated area adjacent to the CAD). All areas where 'use is restricted' in some fashion, e.g., under a cap, must be clearly delineated/mapped. As another example, is there IC documentation for the thin and thick caps off shore of OU A/Charleston Beach? Coordination with the Tribe would need to ensure that ICs do not impact Tribal treaty rights. Environmental Covenants have been completed for other remediated sediment sites in Puget Sound.

Regarding the issue on the IC for the 'remediated area adjacent to the CAD,' information from recorded Meeting Minutes and Action Items are below:

1. 7-14-2015 Meeting minutes: *There was additional discussion on the ownership of the remediated area adjacent to the CAD pit that was originally outside of the Navy property (on State-Owned Aquatic Land [SOAL]). Ms. Keeley asked whether there is any formal covenant in place which indicates the ownership of this area adjacent to the CAD pit. Ms. Moore noted that it was part of OU B Marine (extended beyond the original exclusion zone that defined OU B Marine). Mr. Brown replied that she would confirm the exact status and ownership of this area and report back to the team.*

   Ms. Keeley also expressed concern over the possibility that the boundaries and restrictions placed on the CAD pit might be lost during future land transfers. She

noted that several states have adopted the Uniform Environmental Covenants Act (UECA). She explained that UECA establishes clear rules to ensure that any encumbrances that have been placed upon impacted lands are maintained when real estate is transferred from one party to another. She said that the Navy should register the CAD pit under UECA or, alternatively, it should register the area with the United States Coast Guard (USGS) so its restrictions are noted on nautical charts.

ACTION ITEM: Ms. Brown will clarify ownership of the CAD area, including the remediated area (thin layer cap) originally on SOAL.

2. 9-14-15 Meeting Minutes: *In regard to Action Item 4: Ms. Brown will consult with the real estate office of the Navy to further clarify the ownership of the state owned aquatic land that was incorporated into OU B Marine, adjacent to the CAD pit area as part of the Explanation of Significant Differences for the site. [ACTION ITEM]*

3. 10-14-15 Meeting Minutes: *Action Item 1- Ms. Brown had not yet had an opportunity to clarify the ownership and boundaries of the Confined Aquatic Disposal (CAD) area. The action item will be brought forward for review at the next meeting.*

8. Are you aware of any community concerns regarding the remedies in place at BNC? If so, please give details.

Response:

9. Do you have any other comments, concerns, or suggestions regarding the effectiveness of the remedies in place to protect human health and the environment at BNC?

Response: The five-year review should include a schedule for all outstanding work and work should adhere to that schedule. Based on the last five-year review (2012), the Focused Feasibility Study (FSS) for mercury was to be completed by October 2014. It is now November 2016, and the 'data gaps analysis' (which needs to be completed before the FFS) has not yet been completed.

Document Title: Type 2 Agency Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: Karen Keeley, Project Manager for PSNS OU B Marine Only (and Charleston Beach)
Agency: EPA
Date: 11/07/2016

Comment Responses by: Pamela M. Sargent, P.E., Navy OU B Marine RPM and Five-Year Review Lead
Date: 04/15/2017

#	Question Text	Response	Proposed Navy Response	Response Accepted
1	What is your overall impression of remedy performance following signing of the Records of Decision (RODs) for Operable Unit (OU) A, OU B Marine, OU B Terrestrial, OU D, and OU NSC, completion of the corrective action plan for OU C, and implementation of the remedies at the Bremerton naval complex (BNC)? Do you believe the remedies met the intent of the RODs/corrective action plan for these sites? Do you feel the remedies continue to be effective? Please indicate the basis for your assessment.	Protectiveness for OU B Marine was deferred in the last FYR due to concerns about mercury contamination in tissue/sediments as well as concerns about upland contaminant sources (e.g., stormwater releases, groundwater discharges) and other uncontrolled ongoing sources to the marine environment. While the Navy has made some progress on the Supplemental Mercury Investigation Report, the work has been slow and for many months nothing has happened.	The Supplemental Mercury Investigation Report (SMIR) has been completed. The Final SMIR is dated February 28, 2017. Additionally, an updated OU B Marine schedule was provided to the OU B Marine Team at the Team Meeting on March 7, 2017 and has been updated and forwarded to team members three times since that March meeting. The updated schedule details to interim steps necessary to proceed to a Focused Feasibility Study for OU B Marine including source control investigation and to perform another round of LTM sampling.	
		Given that recent October 2016 sediment data show nearshore sediment concentrations with elevated mercury concentrations (e.g., 7 ppm total mercury at one station) it is imperative that this work move forward. Also, a path forward must be determined for areas where sample data related to in-water construction projects show that localized areas of higher contamination remain.	The Goals and Objectives for Decision Framework Process for PCBs and Mercury in OU B Marine dated February 16, 2017 states: "Until the Decision Framework is updated, only data collected for the LTM program (grids) will be used to calculate area-weighted averages. Other data may be evaluated for use as weight of evidence to further understand site conditions, such as	

Document Title: Type 2 Agency Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: Karen Keeley, Project Manager for PSNS OU B Marine Only (and Charleston Beach)
Agency: EPA
Date: 11/07/2016

Comment Responses by: Pamela M. Sargent, P.E., Navy OU B Marine RPM and Five-Year Review Lead
Date: 04/15/2017

#	Question Text	Response	Proposed Navy Response	Response Accepted
			identifying contaminant sources or evaluating areas not previously characterized." Analysis of the non –LTM data was discussed at the April 13, 2017 OU B Marine Team Meeting and will continue to be discussed as part of the ongoing decision framework process in working towards a Focused Feasibility Study for OU B Marine.	
		Regarding Phase 2 of the 2014 Long-term Monitoring and Reporting for OU B Marine, as of today this report is still outstanding and has not been finalized, which adversely affects the ability of the Agency to evaluate the protectiveness of the remedy.	The 2014 OU B Marine Phase 2 Long-Term Monitoring Report was finalized on 11/11/17.	
		Also, the Charles(ton) Beach replenishment efforts were meant to provide temporary protection of the OU A remedy while the final remedy repair was chosen and implemented. The final remedy repair for OU A is long overdue and these continued replenishments do not adequately protect the environment, nor do they provide for sustainable forage fish spawning habitat, as the Tribe has pointed out.	Planning for OU A remedy repair has occurred over many years. Stakeholders provided input during this planning, including reviewing and providing comments on the 90 percent design. The Navy produced the 100 percent design including resolution of stakeholder comments with the exception of comments related to mitigation. A contract was	

Document Title: Type 2 Agency Interview Form for Bremerton Naval Complex Fourth Five-Year Review

Form Dated: 10/24/16

Comments by: Karen Keeley, Project Manager for PSNS OU B Marine Only (and Charleston Beach)
Agency: EPA
Date: 11/07/2016

Comment Responses by: Pamela M. Sargent, P.E., Navy OU B Marine RPM and Five-Year Review Lead
Date: 04/15/2017

#	Question Text	Response	Proposed Navy Response	Response Accepted
		EPA fully expects the Navy will respond to all comments and engage in meaningful dialogue with the stakeholders, particularly the Tribe, regarding the design and implementation of the final remedy repair for OU A/Charleston Beach.	awarded to implement the remedy repair in December 2016. A habitat analysis was performed at this same time to determine if there would be habitat loss associated with the planned remedy repair. The analysis determined habitat loss is anticipated with repair implementation. This was not envisioned during design development. As a result, the Navy is planning a review of the design as the original design did not take into account any habitat loss. Remedy repair implementation plans have ceased until internal and external stakeholders are consulted about these issues. It is not anticipated that permanent remedy repair for OUA Charleston Beach will occur in 2017 due to time related to design review, design re-development (if necessary), contracting for the work, and in-water timing related to the (fish window) work periods. Periodic beach replenishment is planned until the permanent remedy repair is completed.	
2	In the third five-year review (2012) for BNC, the protectiveness determinations	No response provided.		

Document Title: Type 2 Agency Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: Karen Keeley, Project Manager for PSNS OU B Marine Only (and Charleston Beach)
Agency: EPA
Date: 11/07/2016

Comment Responses by: Pamela M. Sargent, P.E., Navy OU B Marine RPM and Five-Year Review Lead
Date: 04/15/2017

#	Question Text	Response	Proposed Navy Response	Response Accepted
	for OU A and OU B Terrestrial were deferred pending additional investigation of potential on-going contaminant transport pathways from the terrestrial to marine environment. The 2016 addendum to the third five-year review revised the protectiveness determination for OU A to "short term protective," but retained the deferral of the protectiveness determination for OU B Terrestrial. Based on your knowledge of the status of the additional assessments that are underway regarding these issues, what is your opinion regarding the progress towards a protectiveness statement for the remedy at OU B Terrestrial?			

Document Title: Type 2 Agency Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: Karen Keeley, Project Manager for PSNS OU B Marine Only (and Charleston Beach)
Agency: EPA
Date: 11/07/2016

Comment Responses by: Pamela M. Sargent, P.E., Navy OU B Marine RPM and Five-Year Review Lead
Date: 04/15/2017

#	Question Text	Response	Proposed Navy Response	Response Accepted
3	The third five-year review (2012) for BNC also deferred the protectiveness determination for OU B Marine, pending additional investigation of mercury movement through the marine food web and interpretation of the implications of elevated PCB concentrations in sediment found during construction projects. Based on your knowledge of the status of the additional assessments that are underway regarding these issues, what is your opinion regarding the progress towards a protectiveness statement for the remedy at OU B Marine?	EPA believes that inadequate process is being made towards a protectiveness statement for the remedy at OU B Marine – as in prior years, the protectiveness statement will need to be deferred since the reports have not been completed and the project has not stayed on schedule.	The pace of work related to OU B Marine has been substantially increased recently. Subsequent to the EPA's completion of this interview form, the Navy has completed the following technical reports and documents related to OU B Marine: • 2014 OU B Marine Phase 2 Long-Term Monitoring Report, Final, dated November 11, 2016 • Goals and Objectives for Decision Framework Process for PCBs and Mercury in OU B Marine Technical Memorandum dated February 16, 2017 • Supplemental Mercury Investigation Report, Final, dated February 28, 2017 • Four OU B Marine schedule updates dated March 6, March 12, April 6, and April 12, 2017. In addition the following work is in progress: • Habitat Benefit Analysis for Charleston Beach	

Document Title: Type 2 Agency Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: Karen Keeley, Project Manager for PSNS OU B Marine Only (and Charleston Beach)
Agency: EPA
Date: 11/07/2016

Comment Responses by: Pamela M. Sargent, P.E., Navy OU B Marine RPM and Five-Year Review Lead
Date: 04/15/2017

#	Question Text	Response	Proposed Navy Response	Response Accepted
			• Pier 6 Fender Pile Replacement Sediment Monitoring Report • BNC Fourth Five-Year Review • Development of Background Section for the OU B Marine FFS • Pre and Post-Construction Sediment Sampling for the Salt Water Distribution Main Replacement Project	
4	To your knowledge, since the RODs were signed for OU A, OU B Marine, OU B Terrestrial, OU D, and OU NSC and the corrective action plan was completed for OU C have there been any new scientific findings that relate to projecting potential site risks which might call into question the protectiveness of the remedies?	No response provided.		
5	To the best of your knowledge, are institutional controls and operations and maintenance procedures being utilized at BNC consistent with the terms of the RODs/corrective action	No response provided.		

Document Title: Type 2 Agency Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: Karen Keeley, Project Manager for PSNS OU B Marine Only (and Charleston Beach)
Agency: EPA
Date: 11/07/2016

Comment Responses by: Pamela M. Sargent, P.E., Navy OU B Marine RPM and Five-Year Review Lead
Date: 04/15/2017

#	Question Text	Response	Proposed Navy Response	Response Accepted
	plan?			
6	Following signing of the RODs and completion of the OU C corrective action plan, have there been any complaints, violations, or other incidents related to BNC installation restoration issues that required a response by your office? If so, please provide details of the events and results of the responses.	No response provided.		
7	To the best of your knowledge, has the on-going program of groundwater monitoring, institutional controls inspection and maintenance, cap, shoreline, and storm drain inspection and maintenance, and sediment and marine biota monitoring at BNC following implementation of the remedies been sufficiently thorough and frequent to meet the goals of the RODs/corrective action plan? Please indicate the basis for your assessment.	As part of the five-year review, the adequacy of institutional controls (ICs) for the entire site must be evaluated in accordance with FYR guidance. See: https://www.epa.gov/superfund/superfund-institutional-controls See: *Recommended Evaluation of Institutional Controls: Supplement to the 'Comprehensive Five-Year Review Guidance*,' OSWER Directive 9355.7-18, September 13, 2011, which provides a recommended analysis of IC	ICs for the entire site are being evaluated as part of the FYR in accordance with the references cited. Additionally, the ICs for OU B Marine were researched and presented to the OU B Marine Team, at the April 13, 2017 Team Meeting. Information presented at the April 13, 2017 meeting regarding OU B Marine ICs is as follows: Site 1 - • Site 1 is within the floating security	

Document Title: Type 2 Agency Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: Karen Keeley, Project Manager for PSNS OU B Marine Only (and Charleston Beach)
Agency: EPA
Date: 11/07/2016

Comment Responses by: Pamela M. Sargent, P.E., Navy OU B Marine RPM and Five-Year Review Lead
Date: 04/15/2017

#	Question Text	Response	Proposed Navy Response	Response Accepted
		effectiveness during the CERCLA five-year review (FYR) process. https://semspub.epa.gov/work/HQ/175441.pdf In particular, ICs for OU B Marine must be reviewed. For over a year, the Navy has agreed to determine whether the "remediated area adjacent to the CAD pit" is on State-owned Lands, and whether ICs are in place for remediated sediments where 'waste remains.' The Navy agreed to clarify if UECA or other environmental covenants/Regulated Navigation Areas are in place for the CAD (including the remediated area adjacent to the CAD). All areas where 'use is restricted' in some fashion, e.g., under a cap, must be clearly delineated/mapped. As another example, is there IC documentation for the thin and thick caps off shore of OU A/Charleston Beach? Coordination with the Tribe would need to ensure that ICs do not impact Tribal treaty rights. Environmental Covenants have been completed for other remediated sediment sites in Puget Sound. Regarding the issue on the IC for the 'remediated area adjacent to the CAD,'	boom with prominent signage controls. • Site 1 ICs are included in and inspected/maintained as part of the O&M and IC Plan (Navy 2016) for terrestrial operable units. CAD Cell - • CAD cell is within an access controlled area monitored by the Navy. • NOAA and the Coast Guard indicated that they would not make updates to navigation charts regarding the presence of the CAD cell, as this area is controlled by the Navy (BNC Second Five-Year Review, 2007). • CAD cell cap ICs have been implemented periodically in conjunction with LTM work but are not fully covered by the O&M and IC Plan (Navy 2016) for terrestrial operable units. Thick and Thin Cap Areas – • ICs not required by either terrestrial or OU B Marine RODs. • ICs for these areas not included in the	

Document Title: Type 2 Agency Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: Karen Keeley, Project Manager for PSNS OU B Marine Only (and Charleston Beach)
Agency: EPA
Date: 11/07/2016

Comment Responses by: Pamela M. Sargent, P.E., Navy OU B Marine RPM and Five-Year Review Lead
Date: 04/15/2017

#	Question Text	Response	Proposed Navy Response	Response Accepted
		information from recorded Meeting Minutes and Action Items are below: 7-14-2015 Meeting minutes: *There was additional discussion on the ownership of the remediated area adjacent to the CAD pit that was originally outside of the Navy property (on State-Owned Aquatic Land [SOAL]). Ms. Keeley asked whether there is any formal covenant in place which indicates the ownership of this area adjacent to the CAD pit. Ms. Moore noted that it was part of OU B Marine (extended beyond the original exclusion zone that defined OU B Marine). Mr. Brown replied that she would confirm the exact status and ownership of this area and report back to the team.* *Ms. Keeley also expressed concern over the possibility that the boundaries and restrictions placed on the CAD pit might be lost during future land transfers. She noted that several states have adopted the Uniform Environmental Covenants Act (UECA). She explained that UECA establishes clear rules to ensure that any encumbrances that have been placed upon*	Terrestrial O&M and IC Plan (Navy 2016) Recommended Action Item form the April 13, 2017 OU B Marine Technical Team Meeting: • Create OU B Marine IC Plan (Technical Memorandum format) to clearly document OU B Marine IC requirements, and associated inspection, inspection frequency and reporting requirements.	

Document Title: Type 2 Agency Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: Karen Keeley, Project Manager for PSNS OU B Marine Only (and Charleston Beach)
Agency: EPA
Date: 11/07/2016

Comment Responses by: Pamela M. Sargent, P.E., Navy OU B Marine RPM and Five-Year Review Lead
Date: 04/15/2017

#	Question Text	Response	Proposed Navy Response	Response Accepted
		impacted lands are maintained when real estate is transferred from one party to another. She said that the Navy should register the CAD pit under UECA or, alternatively, it should register the area with the United States Coast Guard (USGS) so its restrictions are noted on nautical charts. *ACTION ITEM: Ms. Brown will clarify ownership of the CAD area, including the remediated area (thin layer cap) originally on SOAL.* *2.* 9-14-15 Meeting Minutes: *In regard to Action Item 4: Ms. Brown will consult with the real estate office of the Navy to further clarify the ownership of the state owned aquatic land that was incorporated into OU B Marine, adjacent to the CAD pit area as part of the Explanation of Significant Differences for the site. [ACTION ITEM]* 3. 10-14-15 Meeting Minutes: *Action Item 1- Ms. Brown had not yet had an opportunity to clarify the ownership and boundaries of the Confined Aquatic Disposal (CAD) area. The action item will be brought forward for review at the next meeting*.		

Document Title: Type 2 Agency Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: Karen Keeley, Project Manager for PSNS OU B Marine Only (and Charleston Beach)
Agency: EPA
Date: 11/07/2016

Comment Responses by: Pamela M. Sargent, P.E., Navy OU B Marine RPM and Five-Year Review Lead
Date: 04/15/2017

#	Question Text	Response	Proposed Navy Response	Response Accepted
8	Are you aware of any community concerns regarding the remedies in place at BNC? If so, please give details.	No response provided.		
9	Do you have any other comments, concerns, or suggestions regarding the effectiveness of the remedies in place to protect human health and the environment at BNC?	The five-year review should include a schedule for all outstanding work and work should adhere to that schedule. Based on the last five-year review (2012), the Focused Feasibility Study (FSS) for mercury was to be completed by October 2014. It is now November 2016, and the 'data gaps analysis' (which needs to be completed before the FFS) has not yet been completed.	An updated OU B Marine schedule was provided to the OU B Marine Team at the Team Meeting on March 7, 2017 and has been updated and forwarded to team members three times since that March meeting. The updated schedule details to interim steps necessary to proceed to a Focused Feasibility Study for OU B Marine including source control investigation and to perform another round of LTM sampling. While the Fourth Five Year Review will contain Milestone Dates, the overall, detailed project schedule will be maintained by the Navy RPM and forwarded to the OU B Marine Team when changes are made to the schedule.	

EPA comments on the revised PSNS FYR, August 2017

General comments:

1) Overall the document is clearly written.
2) Charleston Beach is discussed under both OUA and OUB Marine. Please clarify which OU Charleston Beach falls under. If portions of it fall under each OU, then clarify which portions are being discussed, for example, the intertidal and subtidal portions of Charleston Beach, or the upland portions of Charleston Beach.
3) EPA looks forward to working with the Navy teams to build out more detailed schedules, especially for the December 2020 Charleston Beach remedy repair, to meet the milestone dates presented in Table 8-1. This includes submitting a habitat benefit analysis, as part of the upcoming design re-submittal, per the Navy's commitment at the August 3, 2017 meeting.

General comment on Issues and Recommendations: Issues and Recommendations shown in the summary table on pages iv – ix and repeated in Tables 7-11 and 8-1 should include only those issues that affect protectiveness. Any issues and recommendations that do not affect protectiveness can be listed in the narrative text in Sections 7 and 8 but should not appear in the tables. Because the list is supposed to only show issues and recommendations that affect protectiveness, they should also appear in the protectiveness statement. For example, in order for the remedy to be protective in the long term, the following actions need to be taken (list a summary of recommendations for that OU from the issues and recommendations). Similarly, all items listed as issues or recommendations in the protectiveness statement should be listed in the issues and recommendations.

The following items are listed under issues and recommendations that affect the protectiveness of the remedy but do not appear in any of the OU protectiveness statements:

OU A:

"The 100 percent design for the remedy repair at Charleston Beach is complete, but needs to be revised to account for climate change considerations . . .."

OUA, OUB, Terrestrial, OUD, and OUNSC:

"Leverage ongoing Navy regional planning to begin an assessment of the vulnerability of the BNC remedies to climate change, in support of a future adaptation plan for BNC OUs. Yearly climate change planning updates will be provided to the stakeholder team." Somewhere in the FYR, the Navy needs to explain how this might affect protectiveness - is there a concern that contaminants might be exposed due to erosion, etc?

"Evaluate how changes to Water Quality Criteria may impact protectiveness."

OUB Marine:

"Prepare an OU B Marine IC plan to clearly document the OU B Marine IC requirements, and associated inspection, inspection frequency and reporting requirements."

"Complete a review and revalidation of the bathymetric survey data from the post-construction survey through the 2012 survey in the CAD pit, ENR and thick cap areas to validate if the physical components are functioning as intended by the ROD."

General comment: Suggest making a general comment that EPA did not review or comment on OUC because it is a petroleum-only OU being overseen by Ecology.

Specific Comments

Page 3-3, Table 3-1: "Land and Resource Use" should include ecological use for intertidal and marine areas. Might fisheries outside the site boundary be affected by contamination within the boundary (fish are contaminated within the boundary and caught outside of it)?

Section 4, general comment. All ROD cleanup levels should be presented in Section 4. If they are presented in other sections, please add language in Section 4 that explains where to find cleanup levels.

Table 4-1, Summary of Remedial Actions at BNC. During the comment period, EPA requested that detailed information be provided on the types of Institutional Controls (ICs) associated with each OU. The Navy agreed to include "Evaluation of IC Effectiveness" as part of ongoing Operation, Maintenance, and Monitoring in Table 4-1, but indicated that detailed information on ICs was not necessary for the FYR. Consistent with the OU A ROD, EPA requests that the Navy ensure that the following ICs for OU A are evaluated for effectiveness as part of future work:

- ICs for OUA were described in the OU A ROD and Responsiveness Summary:

  [ROD]. "The major components of the selected remedy for OU A are the following:

  - *Implementing institutional controls, which include fencing (such as already exists), warning signs, an extended prohibition on fish and shellfish harvesting at Charleston Beach, and land use restrictions on residential use. Residential restrictions and controls and requirements for the inspection and maintenance of the pavement cap and erosion protection will be implemented with a Bremerton Naval Complex-wide soil management plan. [Note: the underlined IC should be added to Section 4.1.1. of the FYR].*
  -
  - *"[Responsiveness Summary]. We anticipate that there will be an educational component of the proposed institutional controls to advise the community about potential risks associated with marine resources and lifestyle choices that would increase exposure.*

Section 4.1.2. Revise to include a description of actions taken after OU A remedy implementation, in the area referred to as the Charleston Beach mitigation project. The sample data discussion should include

statement that pre-existing upland soils were contaminated (landfill material) and that when the Navy constructed the mitigation project, these soils were excavated and a new bottom surface became exposed in the intertidal area; sample results representative of the new bottom surface had chemical concentrations above state SMS standards established for the protection of benthic organisms. Because of exceedances of State standards, Ecology required that 3 feet of material be maintained in the mitigation project area to ensure that the contaminated materials were contained for the protection of human health and the environment. Ecology deemed 3 feet as protective "as long as scouring is not excessive." During team meetings, EPA, Ecology, and the Tribe clearly stated that based on the available information (Ecology memos, 2007 Action Memorandum, Navy's Jefferis memo, etc.), there is a requirement for 3 feet of material to be maintained (as a 'sediment cap' not a 'cover'). Please include citations to these documents that the Navy, EPA, Ecology, and the Tribe discussed at the 5YR meetings.

> One example of relevant documentation includes the following: Addendum to the Pier D Biological Assessment (SAIC, 2001), developed when the Charleston Beach mitigation was being proposed to substitute for the Pier 8 Removal as mitigation, includes the following text: "*The project site is located at Operable Unit A of the Puget Sound Naval Shipyard CERCLA Site. Containment of contaminated fill was the primary remedy identified in the 1997 [OU A] Record of Decision. The proposed action [mitigation action] will remove contaminated fill and riprap from the marine environment. The new design would be as protective of the environment as the existing conditions through two mechanisms: First, there would be a three-foot layer of clean beach material where contaminated soil was removed. Second, the existing beach material, which shows no signs of eroding, would be replicated with the new beach material*".

This information is part of the site history, is relevant to determining protectiveness, and must be clearly stated to ensure all parties understand that the material under the cap must be contained to protect human health and the environment. Due to contamination in the nearshore sediments, the area does not meet unlimited use and unrestricted exposure requirements and an institutional control is also necessary for this area. The FYR should be revised to clearly indicate that while the OU A ROD stated that sediments in OU A would be addressed as part of OU B Remedial Actions, due to the Navy's post-ROD work in OU A (by which upland material was excavated and newly-exposed contamination was capped), there are now 'sediments' that are part of OU A.

4.1.3 OU A Operation, Maintenance, and Monitoring. This section should include a discussion of the multi beam sonar survey of the armor rock/seawall that is required per Figure 5-2 "Shoreline Inspection and Maintenance Decision Diagram for Armor Rock and Armor Rock/Seawall Segments (Page 3)" of the Navy's Operation, Maintenance, and IC Plan (March 30, 2016). This multi beam sonar survey is also required for OU B T in accordance with Section 5 of the Operation, Maintenance, and IC Plan. Figure 5-2 states "**For 5-year review,** perform multibeam sonar survey of the armor rock segments of the shoreline. Survey to be performed from top of slope to 100 feet offshore." This work does not appear to be incorporated into this FYR.

Table 4-1, Summary of Remedial Actions at BNC (OU B). For clarity, EPA requests that the column "Ongoing Operation, Maintenance, and Monitoring" be revised as follows: a) Hydrographic survey of CAD Pit and Cap/ENR Area Offshore of OU A; and, b) Sub bottom profiling survey of CAD Pit.

Section 4.2.2.2, page 4-8. The protectiveness statement indicates that Charleston Beach is in OUA. Why is it being discussed under OU B-Marine? Also, is the 2012-2015 data described in the text included in an appendix?

Section 4-7, page 4-22. Clarify in the FYR whether fish in the OUB Marine area are currently safe to eat and if not, whether seafood consumption advisories should be part of the ICs needed to make the remedy protective.

Section 6.4.1.1, page 6-3. Add language clarifying that the "ambient background levels" for inorganic contaminants are being provided for informational purposes only. What matters in the FYR is whether or not ROD cleanup levels are exceeded.

Section 6.4.1.2, page 6-5. See previous comment about ambient background levels. Arsenic concentrations in groundwater should be compared to the ROD cleanup level. State that the comparison to ambient levels is for informational purposes only.

Section 6.4.1.2, Section 6-9, first full paragraph. If the purpose of the soil sampling event was to determine if VOCs in soil may be migrating to groundwater, then the EPA residential RSL wouldn't be the appropriate comparison value. Were MTCA Method B values for the migration to groundwater pathway used?

Section 6.4.1.2, Section 6-9, first full paragraph. Was the data from the VOC-contaminated soils considered in the vapor intrusion assessment?

Section 6.1.4.5, page 6-11. See Section 6.4.1.1 comments about ambient background values.

Section 6.4.3.1, page 6-15. Suggest clarifying that what is being discussed here is the ROD MCUL and not the SMS MCUL to avoid confusion for people who are familiar with the SMS MCUL values.

Section 6.4.3.5, page 6-17. See previous comments. Clarify whether Charleston Beach is in OUA or OUB Marine.

Appendix A, Data Excerpted from Salt Water Main Break Report, Table A-3. In response to previous EPA (Keeley) Comment 47, the Navy agreed to incorporate the figure showing the station locations in Appendix A. The requested figure is still missing.

INTERVIEW RECORD FOR FOURTH FIVE-YEAR REVIEW
Type 2 Interview – Regulatory Agency Staff
Bremerton Naval Complex
Bremerton, WA

Individual Contacted: Chris Eckley
Title: Environmental Scientists
Organization: US EPA
Contact Made by: Andrew Bullard
Date: 2016/11/07

Summary of Communication

1. What is your overall impression of remedy performance following signing of the Records of Decision (RODs) for Operable Unit (OU) A, OU B Marine, OU B Terrestrial, OU D, and OU NSC, completion of the corrective action plan for OU C, and implementation of the remedies at the Bremerton naval complex (BNC)? Do you believe the remedies met the intent of the RODs/corrective action plan for these sites? Do you feel the remedies continue to be effective? Please indicate the basis for your assessment.

Response: Not familiar enough with these details of the project to comment.

2. In the third five-year review (2012) for BNC, the protectiveness determinations for OU A and OU B Terrestrial were deferred pending additional investigation of potential on-going contaminant transport pathways from the terrestrial to marine environment. The 2016 addendum to the third five-year review revised the protectiveness determination for OU A to "short term protective," but retained the deferral of the protectiveness determination for OU B Terrestrial. Based on your knowledge of the status of the additional assessments that are underway regarding these issues, what is your opinion regarding the progress towards a protectiveness statement for the remedy at OU B Terrestrial?

Response: Not familiar enough with these details of the project to comment.

3. The third five-year review (2012) for BNC also deferred the protectiveness determination for OU B Marine, pending additional investigation of mercury movement through the marine food web and interpretation of the implications of elevated PCB concentrations in sediment found during construction projects. Based on your knowledge of the status of the additional assessments that are underway regarding these issues, what is your opinion regarding the progress towards a protectiveness statement for the remedy at OU B Marine?

Response: I don't really know what a "protectiveness statement" is, but in general, I feel like the mercury data collected in the last few years at OU B Marine has added valuable additional information needed to characterizes the impact of mercury at the site on biota.

Of course, additional data/information would be helpful, but I am generally quite supportive of the work that has been done to date regarding mercury characterization.

4. To your knowledge, since the RODs were signed for OU A, OU B Marine, OU B Terrestrial, OU D, and OU NSC and the corrective action plan was completed for OU C have there been any new scientific findings that relate to projecting potential site risks which might call into question the protectiveness of the remedies?

Response: Not familiar enough with these details of the project to comment.

5. To the best of your knowledge, are institutional controls and operations and maintenance procedures being utilized at BNC consistent with the terms of the RODs/corrective action plan?

Response: Not familiar enough with these details of the project to comment.

6. Following signing of the RODs and completion of the OU C corrective action plan, have there been any complaints, violations, or other incidents related to BNC installation restoration issues that required a response by your office? If so, please provide details of the events and results of the responses.

Response: Not to my knowledge, but this hasn't been something I've been tracking.

7. To the best of your knowledge, has the on-going program of groundwater monitoring, institutional controls inspection and maintenance, cap, shoreline, and storm drain inspection and maintenance, and sediment and marine biota monitoring at BNC following implementation of the remedies been sufficiently thorough and frequent to meet the goals of the RODs/corrective action plan? Please indicate the basis for your assessment.

Response: Not familiar enough with these details of the project to comment.

8. Are you aware of any community concerns regarding the remedies in place at BNC? If so, please give details.

Response: Not known

9. Do you have any other comments, concerns, or suggestions regarding the effectiveness of the remedies in place to protect human health and the environment at BNC?

Response: None

INTERVIEW RECORD FOR FOURTH FIVE-YEAR REVIEW
Type 2 Interview – Regulatory Agency Staff
Bremerton Naval Complex
Bremerton, WA

Individual Contacted: John Evered
Title: Natural Resource Scientist
Organization: Washington State Department of Ecology
Contact Made by:
Date: 11/22/2016

Summary of Communication

1. What is your overall impression of remedy performance following signing of the Records of Decision (RODs) for Operable Unit (OU) A, OU B Marine, OU B Terrestrial, OU D, and OU NSC, completion of the corrective action plan for OU C, and implementation of the remedies at the Bremerton naval complex (BNC)? Do you believe the remedies met the intent of the RODs/corrective action plan for these sites? Do you feel the remedies continue to be effective? Please indicate the basis for your assessment.

Response: My knowledge is specific to the remedy performance at OU B Marine, which will be reflected in my response. Non-responses to the other OUs should not be construed as agreement or consent with any action, remedy or current condition related to the ROD's corrective action. It is Ecology's position that the remedy designed to lower PCB concentrations in sediment and marine tissue has met the intent of the corrective action plan that was agreed to at the time of signing of the ROD; however, it is yet to be determined if long term protectiveness has been achieved. Ecology believes that to definitively confirm that the downward trend of PCB concentrations observed in the long term monitoring results is truly representative of the PCB concentration within the OU B Marine boundary a further confirmatory round of sampling must be conducted in order to provide important information regarding the continued remedy effectiveness. Ecology believes that conducting an additional round of sampling will help to clarify which sampling event was in effect an outlier; the higher concentrations recorded in the 2012 event or the lower concentrations in the 2014 event. Additionally, Ecology stresses that this future sampling event will benefit from a revised analysis methodology which will more accurately represent true PCB concentrations and the associated risk. See answer to question 4 for more information.

2. In the third five-year review (2012) for BNC, the protectiveness determinations for OU A and OU B Terrestrial were deferred pending additional investigation of potential on-going contaminant transport pathways from the terrestrial to marine environment. The 2016 addendum to the third five-year review revised the protectiveness determination for OU A to "short term protective," but retained the deferral of the protectiveness determination for OU B Terrestrial. Based on your knowledge of the status of the additional assessments that are underway regarding

these issues, what is your opinion regarding the progress towards a protectiveness statement for the remedy at OU B Terrestrial?

Response: None

3. The third five-year review (2012) for BNC also deferred the protectiveness determination for OU B Marine, pending additional investigation of mercury movement through the marine food web and interpretation of the implications of elevated PCB concentrations in sediment found during construction projects. Based on your knowledge of the status of the additional assessments that are underway regarding these issues, what is your opinion regarding the progress towards a protectiveness statement for the remedy at OU B Marine?

Response: Ecology believes that there is cause to be concerned over the results of the recently released report for the sea water main break at PSNS that released a large volume of sea water and upland material into the sediments of OU B Marine. PCB and metal concentrations were clearly elevated above the ROD minimum cleanup level of 3 mg/kg OC as well as the cleanup goal of 1.2 mg/kg OC. These exceedances occurred not only in the upper 0-2 cm sample, which may have suggested that higher concentrations were due to a recent influx of PCB laden materials, but at deeper sample depth as well. For example, the highest concentrations, which were above Ecology's marine sediment cleanup screening level of 65 mg/kg OC (WAC 173-204-562), were recorded in the 0-10 cm sample suggesting that PCB contamination in this area is of a more pervasive nature. It will be important to make efforts to understand whether a new release of hazardous substances has occurred (WAC 173-340-110(1), 42 U.S. Code § 9601) leading to potential recontamination. Again, an additional round of detailed PCB sampling, as described in Ecology's response to question 1 above, will more clearly and accurately represent PCB concentrations and trends in tissue and sediment. This will assist the project team in understanding if this increase in concentrations is due to a new release, a confined spatial hotspot, sampling/analytical error or other.

4. To your knowledge, since the RODs were signed for OU A, OU B Marine, OU B Terrestrial, OU D, and OU NSC and the corrective action plan was completed for OU C have there been any new scientific findings that relate to projecting potential site risks which might call into question the protectiveness of the remedies?

Response: Per the provisions of the Sediment Management Standards (SMS), which is an ARAR defined in the terms of the ROD, site specific decisions may be made based on new scientific information (WAC 173-204-110(6); EPA 540-R-01-007). Ecology believes that in order to fully quantify the current risk posed by the PCB contamination that has been left in place within the OU B Marine boundary and by extension to facilitate the accurate determination of the protectiveness of the current remedy, during the future round of monitoring tissue and sediment samples should be analyzed using the PCB congener method. This will provide lower reporting limits and will allow for a clearer determination of whether PCB concentrations are truly within an acceptable risk range based upon the latest scientific understanding. Although the values that were deemed to be protective in the original ROD are based on a total Aroclor concentration, a congener analysis, such as EPA method 1668, in addition to the pre described benefits can also be used to establish total PCB concentrations.

Furthermore, the 2013 SMS revision establishes a framework for establishing cleanup levels, namely one that is the highest of regional background, PQL, or a risk based concentration which is the lowest of the marine/freshwater benthic cleanup screening level (CSL), the human health risk, higher trophic risk and any other applicable laws (WAC 173-204-560). The minimum cleanup levels and long term cleanup goals described in the ROD are based upon the 90th percentile reference area concentrations. The collection of PCB congener data will allow for the development of bioaccumulative risk-based sediment and tissue concentrations that can be compared to benthic criteria in order to identify the lowest risk-based concentration for PCBs. Alternatively as the risk based concentration for PCBs is often below background, collecting new congener data will allow for comparison to natural background which is expressed on a ppt TEQ basis (WAC 173-204-560(3)(b), 173-204-505(11), table 10-1 in SCUM II). This will, again, allow the team to accurately determine, based upon the latest scientific and technical understanding, if the remedy for PCBs within OU B marine is protective.

5. To the best of your knowledge, are institutional controls and operations and maintenance procedures being utilized at BNC consistent with the terms of the RODs/corrective action plan?

Response: To the best of my knowledge since joining the project team, institutional controls and operation and maintenance procedures have been consistent with the terms of the ROD/corrective action plan.

6. Following signing of the RODs and completion of the OU C corrective action plan, have there been any complaints, violations, or other incidents related to BNC installation restoration issues that required a response by your office? If so, please provide details of the events and results of the responses.

Response: Since joining the project team in April 2015, two events have occurred that have required a response from the Department of Ecology, namely;

- The seawater main break described in my answer to question 3, where all fifteen of the carbon-normalized results exceed the SCO for total PCBs of 12 mg/kg OC and one of the fifteen carbon-normalized results exceed the CSL for total PCBs of 65 mg/kg OC. To date it has not been determined by the team what bearing these results will have on the project at large.
- The in water hull cleaning of the ex USS Independence, and the potential for a large scale release of antifouling paint active ingredients directly into the sediments of OUB marine. At the time of this response I am unsure of the current status of the plans to continue with the hull cleaning, and what, if any, plans are to be implemented to minimize damage to the OU B Marine and OU A remedies.

7. To the best of your knowledge, has the on-going program of groundwater monitoring, institutional controls inspection and maintenance, cap, shoreline, and storm drain inspection and maintenance, and sediment and marine biota monitoring at BNC following implementation of the remedies been sufficiently thorough and frequent to

meet the goals of the RODs/corrective action plan? Please indicate the basis for your assessment.

Response: The long term sediment and tissue monitoring programs through the 2014 sampling event appear to have been thorough and frequent enough to meet the original terms of the ROD. However, per Ecology's response to earlier questions, no additional long term monitoring has occurred at OU B Marine in order to determine whether ROD objectives have reliably been met. Additionally, per Ecology's answer to question 4, we believe that a new understanding related to PCB concentrations that are protective of human and higher trophic health has emerged, in addition to new analytical methods, that are not reflected in the established long term monitoring methodology. A future monitoring event should be conducted as soon as is feasible that takes into accounts these concerns and confirms that current PCB concentrations in Sinclair Inlet are still within an acceptable risk range, in addition to clarifying the ongoing long term effectiveness of the PCB remedy.

8. Are you aware of any community concerns regarding the remedies in place at BNC? If so, please give details.

Response: NONE

9. Do you have any other comments, concerns, or suggestions regarding the effectiveness of the remedies in place to protect human health and the environment at BNC?

Response: Although the remedy designed to address elevated total and methyl mercury concentrations has not yet been implemented, Ecology is concerned that under the current approach a number of potential important issues have not been addressed. Based upon the Navy's response to comments on the Supplemental Mercury Investigation Report (SMIR) dated 11-7-16, there will be no assessment of the risks posed to higher trophic levels. The Navy's response to Ecology comment related to this issue states:

> "The justification for undertaking the 2013 sampling was a moderate level of projected risk to Suquamish Tribal subsistence seafood harvesters who obtain all of their seafood from Sinclair Inlet. This is a sufficient basis for collecting additional data, as was done in 2013, and assessing whether there are measures that show real promise for reducing these seafood consumption risks. It is not an adequate basis for initiating another remedial investigation, reevaluating ecological risk, or considering taking remedial actions to address every CSL exceedance throughout the inlet. Note that we plan to delete the RAO material from the SMIR at the suggestion of the Suquamish Tribe. No changes to the text planned in response to this comment."

Without assessing the risks posed to higher trophic levels, it will not be possible to meet the SMS framework for developing cleanup levels as described in the answer to question 4. I anticipate that under CERCLA §121(d) the SMS will be identified as an ARAR during the focused feasibility study.

Ecology is also concerned that the area that will be subject to investigation and potential remedial action for mercury contamination will be limited to the established OU B Marine boundary,

despite there being numerous benthic exceedances for mercury throughout Sinclair Inlet. The Navy's response to Ecology's raising of this concern during the SMIR review is as follows:

> "As noted in the response to comment #3 (JE3), the projected human health risks from consumption of marine species collected in Sinclair Inlet are insufficient to justify expanding the Superfund site or considering remedial action to address all exceedances of the CSL for mercury throughout the inlet. Note that the RAO material will be deleted from the SMIR at the suggestion of the Suquamish Tribe. No changes planned to the text based on this comment."

Per CERCLA §101(9) and §101(22) a site is defined as "any site or area where a hazardous substance has been deposited, stored, disposed or, or placed, or otherwise come to be located." Similarly per WAC 173-340-200 a site or facility is defined as; "any site or area where a hazardous substance, other than a consumer product in in consumer use, has been deposited, stored, disposed of, or placed, or otherwise come to be located". I believe that it is appropriate to consider all areas with elevated mercury concentrations as a potential 'site', and not arbitrarily limit the boundary based upon a previous ROD that was primarily focused on PCB contamination.

Document Title: Type 2 Agency Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: John Evered, Natural Resource Scientist
Agency: Washington State Department of Ecology
Date: 11/22/16

Comment Responses by: Pamela M. Sargent, P.E., Navy OU B Marine RPM and Five-Year Review Lead
Date: 04/15/17

#	Question Text	Response	Proposed Navy Response	Response Accepted
1	What is your overall impression of remedy performance following signing of the Records of Decision (RODs) for Operable Unit (OU) A, OU B Marine, OU B Terrestrial, OU D, and OU NSC, completion of the corrective action plan for OU C, and implementation of the remedies at the Bremerton naval complex (BNC)? Do you believe the remedies met the intent of the RODs/corrective action plan for these sites? Do you feel the remedies continue to be effective? Please indicate the basis for your assessment.	My knowledge is specific to the remedy performance at OU B Marine, which will be reflected in my response. Non-responses to the other OUs should not be construed as agreement or consent with any action, remedy or current condition related to the ROD's corrective action. It is Ecology's position that the remedy designed to lower PCB concentrations in sediment and marine tissue has met the intent of the corrective action plan that was agreed to at the time of signing of the ROD; however, it is yet to be determined if long term protectiveness has been achieved. Ecology believes that to definitively confirm that the downward trend of PCB concentrations observed in the long term monitoring results is truly representative of the PCB concentration within the OU B Marine boundary a further confirmatory round of sampling must be conducted in order to provide important information regarding the continued remedy effectiveness. Ecology believes that conducting an additional round of sampling will help to clarify which sampling event was in effect an outlier; the higher concentrations recorded in the 2012 event	OU B Marine LTM sampling is planned for 2018. Per the Joint Resolution Statement in May 2009, the minimum cleanup levels established in the OU B Marine ROD of 3 mg/kgOC total PCBs for OU B Marine and 1.2 mg/kg OC total PCBs for Sinclair Inlet as a whole did not need to be changed.	

Document Title: Type 2 Agency Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: John Evered, Natural Resource Scientist
Agency: Washington State Department of Ecology
Date: 11/22/16

Comment Responses by: Pamela M. Sargent, P.E., Navy OU B Marine RPM and Five-Year Review Lead
Date: 04/15/17

#	Question Text	Response	Proposed Navy Response	Response Accepted
		or the lower concentrations in the 2014 event. Additionally, Ecology stresses that this future sampling event will benefit from a revised analysis methodology which will more accurately represent true PCB concentrations and the associated risk. See answer to question 4 for more information.		
2	In the third five-year review (2012) for BNC, the protectiveness determinations for OU A and OU B Terrestrial were deferred pending additional investigation of potential on-going contaminant transport pathways from the terrestrial to marine environment. The 2016 addendum to the third five-year review revised the protectiveness determination for OU A to "short term protective," but retained the deferral of the protectiveness determination for OU B Terrestrial. Based on your knowledge of the status of the additional assessments that are	No response provided.		

Document Title: Type 2 Agency Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: John Evered, Natural Resource Scientist
Agency: Washington State Department of Ecology
Date: 11/22/16

Comment Responses by: Pamela M. Sargent, P.E., Navy OU B Marine RPM and Five-Year Review Lead
Date: 04/15/17

#	Question Text	Response	Proposed Navy Response	Response Accepted
	underway regarding these issues, what is your opinion regarding the progress towards a protectiveness statement for the remedy at OU B Terrestrial?			
3	The third five-year review (2012) for BNC also deferred the protectiveness determination for OU B Marine, pending additional investigation of mercury movement through the marine food web and interpretation of the implications of elevated PCB concentrations in sediment found during construction projects. Based on your knowledge of the status of the additional assessments that are underway regarding these issues, what is your opinion regarding the progress towards a protectiveness statement for the remedy at OU B Marine?	Ecology believes that there is cause to be concerned over the results of the recently released report for the sea water main break at PSNS that released a large volume of sea water and upland material into the sediments of OU B Marine.	The Navy respectfully disagrees that a large volume of upland material was released to the OU B Marine sediment. The Navy estimated that 5 cubic yards of soil was lost from OU B Terrestrial to Sinclair Inlet as a result of this incident (per the Sediment Sampling for Salt Water Main Break Report, dated October 21, 2016).	
		PCB and metal concentrations were clearly elevated above the ROD minimum cleanup level of 3 mg/kg OC as well as the cleanup goal of 1.2 mg/kg OC. These exceedances	Point by point comparison with the clean-up goal is not appropriate as documented in the Final Dispute Resolution Support Services Report, OU B Marine, dated December 3,	

Document Title: Type 2 Agency Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: John Evered, Natural Resource Scientist
Agency: Washington State Department of Ecology
Date: 11/22/16

Comment Responses by: Pamela M. Sargent, P.E., Navy OU B Marine RPM and Five-Year Review Lead
Date: 04/15/17

#	Question Text	Response	Proposed Navy Response	Response Accepted
		occurred not only in the upper 0-2 cm sample, which may have suggested that higher concentrations were due to a recent influx of PCB laden materials, but at deeper sample depth as well. For example, the highest concentrations, which were above Ecology's marine sediment cleanup screening level of 65 mg/kg OC (WAC 173-204-562), were recorded in the 0-10 cm sample suggesting that PCB contamination in this area is of a more pervasive nature. It will be important to make efforts to understand whether a new release of hazardous substances has occurred (WAC 173-340-110(1), 42 U.S. Code § 9601) leading to potential recontamination. Again, an additional round of detailed PCB sampling, as described in Ecology's response to question 1 above, will more clearly and accurately represent PCB concentrations and trends in tissue and sediment. This will assist the project team in understanding if this increase in concentrations is due to a new release, a confined spatial hotspot, sampling/analytical error or other.	2009. This report documented the Dispute Resolution Committee's Final Joint Resolution Statement of May 2009. In brief, the Final Joint Resolution Statement concluded: • the geomean is the statistical measure of PCB concentration to be used for assessing compliance with the minimum cleanup level (MCUL) established in the Record of Decision (ROD) for OU B Marine; • no change is needed at this time in the MCUL established in the ROD for OU B Marine; and • no change is needed in the cleanup goal for Sinclair Inlet as a whole established in the OU B Marine ROD. Additionally, subsequent to this comment by Ecology, the OU B Marine Team has put in place a framework that will assess OU B Marine non-LTM data as follows: The Goals and Objectives for Decision Framework Process for PCBs and Mercury in OU B Marine dated February 16, 2017 states:	

Document Title: Type 2 Agency Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: John Evered, Natural Resource Scientist
Agency: Washington State Department of Ecology
Date: 11/22/16

Comment Responses by: Pamela M. Sargent, P.E., Navy OU B Marine RPM and Five-Year Review Lead
Date: 04/15/17

#	Question Text	Response	Proposed Navy Response	Response Accepted
			"Until the Decision Framework is updated, only data collected for the LTM program (grids) will be used to calculate area-weighted averages. Other data may be evaluated for use as weight of evidence to further understand site conditions, such as identifying contaminant sources or evaluating areas not previously characterized." Analysis of the non –LTM data was discussed at the April 13, 2017 OU B Marine Team Meeting and will continue to be discussed as part of the ongoing decision framework process in working towards a Focused Feasibility Study for OU B Marine.	
4	To your knowledge, since the RODs were signed for OU A, OU B Marine, OU B Terrestrial, OU D, and OU NSC and the corrective action plan was completed for OU C have there been any new scientific findings that relate to projecting potential site risks which might call into question the	Per the provisions of the Sediment Management Standards (SMS), which is an ARAR defined in the terms of the ROD, site specific decisions may be made based on new scientific information (WAC 173-204-110(6); EPA 540-R-01-007). Ecology believes that in order to fully quantify the current risk posed by the PCB contamination that has been left in place within the OU B Marine boundary and by extension to facilitate the	See response to comment #1 and the second part of comment #2. Regarding risk to higher trophic levels, Ecology agreed in the April 13, 2017 OU B Marine Technical Team meeting to refine this comment.	

Document Title: Type 2 Agency Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: John Evered, Natural Resource Scientist
Agency: Washington State Department of Ecology
Date: 11/22/16

Comment Responses by: Pamela M. Sargent, P.E., Navy OU B Marine RPM and Five-Year Review Lead
Date: 04/15/17

#	Question Text	Response	Proposed Navy Response	Response Accepted
	protectiveness of the remedies?	accurate determination of the protectiveness of the current remedy, during the future round of monitoring tissue and sediment samples should be analyzed using the PCB congener method. This will provide lower reporting limits and will allow for a clearer determination of whether PCB concentrations are truly within an acceptable risk range based upon the latest scientific understanding. Although the values that were deemed to be protective in the original ROD are based on a total Aroclor concentration, a congener analysis, such as EPA method 1668, in addition to the pre described benefits can also be used to establish total PCB concentrations. Furthermore, the 2013 SMS revision establishes a framework for establishing cleanup levels, namely one that is the highest of regional background, PQL, or a risk based concentration which is the lowest of the marine/freshwater benthic cleanup screening level (CSL), the human health risk, higher trophic risk and any other applicable laws (WAC 173-204-560). The minimum cleanup levels and long term cleanup goals		

Document Title: Type 2 Agency Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: John Evered, Natural Resource Scientist
Agency: Washington State Department of Ecology
Date: 11/22/16

Comment Responses by: Pamela M. Sargent, P.E., Navy OU B Marine RPM and Five-Year Review Lead
Date: 04/15/17

#	Question Text	Response	Proposed Navy Response	Response Accepted
		described in the ROD are based upon the 90th percentile reference area concentrations. The collection of PCB congener data will allow for the development of bioaccumulative risk-based sediment and tissue concentrations that can be compared to benthic criteria in order to identify the lowest risk-based concentration for PCBs. Alternatively as the risk based concentration for PCBs is often below background, collecting new congener data will allow for comparison to natural background which is expressed on a ppt TEQ basis (WAC 173-204-560(3)(b), 173-204-505(11), table 10-1 in SCUM II). This will, again, allow the team to accurately determine, based upon the latest scientific and technical understanding, if the remedy for PCBs within OU B marine is protective.		
5	To the best of your knowledge, are institutional controls and operations and maintenance procedures being utilized at BNC consistent with the terms of the RODs/corrective action plan?	To the best of my knowledge since joining the project team, institutional controls and operation and maintenance procedures have been consistent with the terms of the ROD/corrective action plan.	Comment Noted.	
6	Following signing of the RODs and completion of the OU C	Since joining the project team in April 2015, two events have occurred that have required	See response to individual items below.	

Document Title: Type 2 Agency Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: John Evered, Natural Resource Scientist
Agency: Washington State Department of Ecology
Date: 11/22/16

Comment Responses by: Pamela M. Sargent, P.E., Navy OU B Marine RPM and Five-Year Review Lead
Date: 04/15/17

#	Question Text	Response	Proposed Navy Response	Response Accepted
	corrective action plan, have there been any complaints, violations, or other incidents related to BNC installation restoration issues that required a response by your office? If so, please provide details of the events and results of the responses.	a response from the Department of Ecology, namely;		
		- The seawater main break described in my answer to question 3, where all fifteen of the carbon-normalized results exceed the SCO for total PCBs of 12 mg/kg OC and one of the fifteen carbon-normalized results exceed the CSL for total PCBs of 65 mg/kg OC. To date it has not been determined by the team what bearing these results will have on the project at large.	The Goals and Objectives for Decision Framework Process for PCBs and Mercury in OU B Marine dated February 16, 2017 states: "Until the Decision Framework is updated, only data collected for the LTM program (grids) will be used to calculate area-weighted averages. Other data may be evaluated for use as weight of evidence to further understand site conditions, such as identifying contaminant sources or evaluating areas not previously characterized." Analysis of the non –LTM data is on the agenda to be discussed at the April 13, 2017 OU B Marine Team Meeting as part of the ongoing decision framework process in working towards a Focused Feasibility Study for OU B Marine.	
		- The in water hull cleaning of the ex USS Independence, and the potential for a large scale release of antifouling paint active ingredients directly into the sediments of OUB marine. At the time of this response I	NAVFAC NW is awaiting direction from NAVFAC Headquarters on how the matter of the ex-Independence hull cleaning relative to the Fourth Five-Year Review should be handled. This issue may require involvement	

Document Title: Type 2 Agency Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: John Evered, Natural Resource Scientist
Agency: Washington State Department of Ecology
Date: 11/22/16

Comment Responses by: Pamela M. Sargent, P.E., Navy OU B Marine RPM and Five-Year Review Lead
Date: 04/15/17

#	Question Text	Response	Proposed Navy Response	Response Accepted
		am unsure of the current status of the plans to continue with the hull cleaning, and what, if any, plans are to be implemented to minimize damage to the OU B Marine and OU A remedies.	of the Department of Justice to resolve.	
7	To the best of your knowledge, has the on-going program of groundwater monitoring, institutional controls inspection and maintenance, cap, shoreline, and storm drain inspection and maintenance, and sediment and marine biota monitoring at BNC following implementation of the remedies been sufficiently thorough and frequent to meet the goals of the RODs/corrective action plan? Please indicate the basis for your assessment.	The long term sediment and tissue monitoring programs through the 2014 sampling event appear to have been thorough and frequent enough to meet the original terms of the ROD. However, per Ecology's response to earlier questions, no additional long term monitoring has occurred at OU B Marine in order to determine whether ROD objectives have reliably been met. Additionally, per Ecology's answer to question 4, we believe that a new understanding related to PCB concentrations that are protective of human and higher trophic health has emerged, in addition to new analytical methods, that are not reflected in the established long term monitoring methodology. A future monitoring event should be conducted as soon as is feasible that takes into accounts these concerns and confirms that current PCB concentrations in Sinclair Inlet are still within an acceptable risk range, in addition	OU B Marine LTM sampling is planned for 2018. Concerns regarding risk to the higher trophic level organisms will be reframed by Ecology (per discussion at OU B Marine Technical Team Meeting on April 13, 2017) and will be considered further after specific concerns are identified. Also, see response to comment #1 and the second part of comment #2.	

Document Title: Type 2 Agency Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: John Evered, Natural Resource Scientist
Agency: Washington State Department of Ecology
Date: 11/22/16

Comment Responses by: Pamela M. Sargent, P.E., Navy OU B Marine RPM and Five-Year Review Lead
Date: 04/15/17

#	Question Text	Response	Proposed Navy Response	Response Accepted
		to clarifying the ongoing long term effectiveness of the PCB remedy.		
8	Are you aware of any community concerns regarding the remedies in place at BNC? If so, please give details.	None.	Comment noted.	
9	Do you have any other comments, concerns, or suggestions regarding the effectiveness of the remedies in place to protect human health and the environment at BNC?	Although the remedy designed to address elevated total and methyl mercury concentrations has not yet been implemented, Ecology is concerned that under the current approach a number of potential important issues have not been addressed. Based upon the Navy's response to comments on the Supplemental Mercury Investigation Report (SMIR) dated 11-7-16, there will be no assessment of the risks posed to higher trophic levels. The Navy's response to Ecology comment related to this issue states: "The justification for undertaking the 2013 sampling was a moderate level of projected risk to Suquamish Tribal subsistence seafood harvesters who obtain all of their seafood from Sinclair Inlet. This is a sufficient basis for collecting additional data, as was done in 2013, and assessing whether there are	Concerns regarding risk to the higher trophic level organisms will be reframed by Ecology (per April 13, 2017) and will be considered further after specific concerns are identified.	

Document Title: Type 2 Agency Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: John Evered, Natural Resource Scientist
Agency: Washington State Department of Ecology
Date: 11/22/16

Comment Responses by: Pamela M. Sargent, P.E., Navy OU B Marine RPM and Five-Year Review Lead
Date: 04/15/17

#	Question Text	Response	Proposed Navy Response	Response Accepted
		measures that show real promise for reducing these seafood consumption risks. It is not an adequate basis for initiating another remedial investigation, reevaluating ecological risk, or considering taking remedial actions to address every CSL exceedance throughout the inlet. Note that we plan to delete the RAO material from the SMIR at the suggestion of the Suquamish Tribe. No changes to the text planned in response to this comment." Without assessing the risks posed to higher trophic levels, it will not be possible to meet the SMS framework for developing cleanup levels as described in the answer to question 4. I anticipate that under CERCLA §121(d) the SMS will be identified as an ARAR during the focused feasibility study.		

Document Title: Type 2 Agency Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: John Evered, Natural Resource Scientist
Agency: Washington State Department of Ecology
Date: 11/22/16

Comment Responses by: Pamela M. Sargent, P.E., Navy OU B Marine RPM and Five-Year Review Lead
Date: 04/15/17

#	Question Text	Response	Proposed Navy Response	Response Accepted
		Ecology is also concerned that the area that will be subject to investigation and potential remedial action for mercury contamination will be limited to the established OU B Marine boundary, despite there being numerous benthic exceedances for mercury throughout Sinclair Inlet. The Navy's response to Ecology's raising of this concern during the SMIR review is as follows: "As noted in the response to comment #3 (JE3), the projected human health risks from consumption of marine species collected in Sinclair Inlet are insufficient to justify expanding the Superfund site or considering remedial action to address all exceedances of the CSL for mercury throughout the inlet. Note that the RAO material will be deleted from the SMIR at the suggestion of the Suquamish Tribe. No changes planned to the text based on this comment." Per CERCLA §101(9) and §101(22) a site is defined as "any site or area where a hazardous substance has been deposited, stored, disposed or, or placed, or otherwise come to be located." Similarly per WAC 173-	Subsequent to this comment from Ecology, in the OU B Marine Technical Team meeting on February 15, 2017, Mr. Evered agreed that the site boundary would be handled in the context of the upcoming FFS.	

Document Title: Type 2 Agency Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: John Evered, Natural Resource Scientist
Agency: Washington State Department of Ecology
Date: 11/22/16

Comment Responses by: Pamela M. Sargent, P.E., Navy OU B Marine RPM and Five-Year Review Lead
Date: 04/15/17

#	Question Text	Response	Proposed Navy Response	Response Accepted
		340-200 a site or facility is defined as; "any site or area where a hazardous substance, other than a consumer product in in consumer use, has been deposited, stored, disposed of, or placed, or otherwise come to be located". I believe that it is appropriate to consider all areas with elevated mercury concentrations as a potential 'site', and not arbitrarily limit the boundary based upon a previous ROD that was primarily focused on PCB contamination.		

INTERVIEW RECORD FOR FOURTH FIVE-YEAR REVIEW
Type 2 Interview – Regulatory Agency Staff
Bremerton Naval Complex
Bremerton, WA

Individual Contacted: Mahbub Alam
Title: Environmental Engineer
Organization: WA State Department of Ecology
Contact Made by:
Date: November 22, 2016

Summary of Communication

1. What is your overall impression of remedy performance following signing of the Records of Decision (RODs) for Operable Unit (OU) A, OU B Marine, OU B Terrestrial, OU D, and OU NSC, completion of the corrective action plan for OU C, and implementation of the remedies at the Bremerton naval complex (BNC)? Do you believe the remedies met the intent of the RODs/corrective action plan for these sites? Do you feel the remedies continue to be effective? Please indicate the basis for your assessment.

Response: In general, the remedy selected for each operable unit has been performing as planned and designed. However, there are areas that need attention. In regards to active remediation performance, it is necessary that shoreline cap erosion at OU A needs to be more permanent. Since a major component of all the selected remedies were based on institutional controls to reduce or prevent exposure from the contaminants remaining at the site, it is difficult at times to measure performance given that no quantitative measures were stipulated in the RODs. There is a need for instituting both quantitative and qualitative measures in the Institution Control Implementation and Assurance Plan (ICIAP) that measures performance or progress towards a goal. Some of the ideas are provided in response to other questions.

2. In the third five-year review (2012) for BNC, the protectiveness determinations for OU A and OU B Terrestrial were deferred pending additional investigation of potential on-going contaminant transport pathways from the terrestrial to marine environment. The 2016 addendum to the third five-year review revised the protectiveness determination for OU A to "short term protective," but retained the deferral of the protectiveness determination for OU B Terrestrial. Based on your knowledge of the status of the additional assessments that are underway regarding these issues, what is your opinion regarding the progress towards a protectiveness statement for the remedy at OU B Terrestrial?

Response: The progress toward a protectiveness determination for both OU A and OU B Terrestrial is still outstanding. Since pavement repair and storm system restoration is part of the remedy, there needs to be effectiveness evaluation and quantifiable evidence to

measure any progress towards protectiveness determination. Among other lines of evidence, stormwater runoff/discharge and storm drain system solids should be analyzed for chemical analysis of all terrestrial COCs to evaluate the magnitude and potential of COC transport to marine environment. In addition to collecting stormwater runoff discharge, in line sediment traps may be installed near the end of outfall pipes to capture storm system solids before discharge. This is necessary because many pollutants such as, PCBs, PAHs, have higher partitioning to solid particles that are not easily detected with a sample of water discharge. These contaminants eventually make their way to the inlet sediments with solid phase discharge. In addition, sediment trap sampling result helps in source tracing/source control to prioritize areas that need more attention than others. Refer to Portland Harbor and Lower Duwamish Waterway Superfund sites for accelerated source tracing and source control through sediment traps installed in storm drain systems.

3. The third five-year review (2012) for BNC also deferred the protectiveness determination for OU B Marine, pending additional investigation of mercury movement through the marine food web and interpretation of the implications of elevated PCB concentrations in sediment found during construction projects. Based on your knowledge of the status of the additional assessments that are underway regarding these issues, what is your opinion regarding the progress towards a protectiveness statement for the remedy at OU B Marine?

Response: The protectiveness determination of OU B Marine also depends on the protectiveness evaluation of OU B Terrestrial since a major portion of source control for OU B Marine is tied with cutting off the OU B Terrestrial pathway. As described in the previous response, the stormwater pathway needs to be thoroughly investigated for potential contaminant migration.

4. To your knowledge, since the RODs were signed for OU A, OU B Marine, OU B Terrestrial, OU D, and OU NSC and the corrective action plan was completed for OU C have there been any new scientific findings that relate to projecting potential site risks which might call into question the protectiveness of the remedies?

Response: See response to question no. 9.

5. To the best of your knowledge, are institutional controls and operations and maintenance procedures being utilized at BNC consistent with the terms of the RODs/corrective action plan?

Response: There are some instances where institutional controls and operation and maintenance procedures are not working as planned. The asphalt cap is deteriorating throughout the site and groundwater monitoring frequency at OU C is not occurring as stated in the Cleanup Action Plan (CAP). The petroleum management plan (PMP) is still in the works and excavation management plan (EMP) needs attention regarding compliance with MTCA.

6. Following signing of the RODs and completion of the OU C corrective action plan, have there been any complaints, violations, or other incidents related to BNC installation restoration issues that required a response by your office? If so, please provide details of the events and results of the responses.

Response: As stated previously, monitoring frequency has not been carried forth as indicated by the CAP for the OU C and O&M for cap maintenance at other areas of the BNC has fallen behind.

7. To the best of your knowledge, has the on-going program of groundwater monitoring, institutional controls inspection and maintenance, cap, shoreline, and storm drain inspection and maintenance, and sediment and marine biota monitoring at BNC following implementation of the remedies been sufficiently thorough and frequent to meet the goals of the RODs/corrective action plan? Please indicate the basis for your assessment.

Response: The inspections may have been sufficient, however, maintenance of cap areas need to be prioritized and implemented accordingly. These actions should not be deferred as an ancillary component of any future construction or infrastructure upgrade project.

8. Are you aware of any community concerns regarding the remedies in place at BNC? If so, please give details.

Response: No.

9. Do you have any other comments, concerns, or suggestions regarding the effectiveness of the remedies in place to protect human health and the environment at BNC?

Response: There are some COCs throughout the site (e.g., PCBs, pesticides) that have been dropped from monitoring based on non-detect results while the laboratory reporting limit may have been above cleanup level or screening levels. Over the years, improvements in analytical techniques resulted in lower reporting levels and the Navy should investigate whether some COCs need to be monitored with improved analytical techniques. This is necessary since contaminants remaining at the site above unrestricted use levels are subject to institutional controls and long term monitoring. For example, PCBs were removed from groundwater monitoring at OU-A and OU-NSC site based on laboratory reporting limit of 0.2 ug/L in January 2000. The newly promulgated total PCBs criterion for human health protection in WA state is 0.000007 ug/L, which is a surface water quality ARAR for this site. It is necessary to reach out for better analytical method to better characterize the surface water runoff and ground water and to measure progress towards achieving the ARAR.

Rationale for PCBs analysis by high resolution congener method: Analysis of PCBs as Aroclors is subject to many limitations (Leidos, 2016). Some of these are:

1) Identification and Quantification of which Aroclors are being analyzed can be dependent on subjective decision when multiple Aroclors exist or subsequent weathering has occurred.
2) An Aroclor is a mixture of several PCB congeners, some of which may not be analyzed. Thus, Aroclor concentrations can be biased low since identification is based only on 5 to 10 key congeners identified in that Aroclor.
3) Aroclors from different lots do not always have same the congener profiles (Frame et al. 1996). This creates an issue between Aroclor standard and identifying the Aroclor present in the field sample.
4) Composition of Aroclor 1254 has changed over time (Frame 1999, Okun 2011).
5) Aroclors are subject to transformation and degradation in the environment. An Aroclor goes through degradation and may not retain the composition of original mixture. Aroclor may be transformed through selective transport e.g., leaching of more soluble congeners with pore water.
6) Aroclor concentration can be sometimes biased high due to interference with other halogenated compounds (e.g., PBDEs) during analysis.

Two studies (Battelle Memorial Institute et al. 2012; EPA Region 4 2013) recommended to avoid Aroclor analyses when weathering is expected.

EPA method 1668 is a more precise analytical method which uses high resolution mass spectrometry (HRMS) to detect individual PCB congeners at parts per trillion (ppt) to part per quadrillion (ppq) level. Since this method can detect all 209 PCB congeners, there is no issue associated with Aroclor being degraded or transported selectively in the environment, potentially causing a misidentification or resulting in unreliable concentrations.

Therefore, Ecology highly recommends that PCBs analysis are conducted with EPA method 1668 in addition to traditional Aroclor analysis for making sound and rational cleanup decision.

References:

Battelle Memorial Institute et al. (Battelle Memorial Institute, GeoChem Matrix Inc., U.S. Navy SPAWAR Systems Center, and U.S. Environmental Protection Agency Office of Research and Development). 2012. A Handbook for Determining the Sources of PCB Contamination in Sediments. Technical Report TR-NAVFAC EXWC-EV-1302. Prepared for NAVFAC Engineering and Expeditionary Warfare Center, Port Hueneme, CA. October 2012.

EPA Region 4 (EPA Region 4 Technical Services Section). 2013. Issue Paper for Polychlorinated Biphenyl Characterization at Region 4 Superfund and RCRA Sites. Prepared by H. Kay Wischkaemper, Andrew F. Beliveau, and Russell W. Henderson. February 28, 2013. Available online at: <http://www.epa.gov/region4/superfund/images/allprogrammedia/pdfs/riskassesspcbpaper05152013.pdf>.

Frame, George M., Jack W. Cochran, and Søren S. Bøwaldt. 1996. Complete PCB Congener Distributions for 17 Aroclor Mixtures Determined by 3 HRCG Systems Optimized for Comprehensive, Quantitative, Congener-Specific Analysis. Journal of High Resolution Chromatography. Volume 19: 657-668. December.

Frame, G.M. 1999. Improved Procedure for Single DB-XLB Column GC-MS-SIM Quantitation of PCB Congener Distributions and Characterization of Two Different Preparations Sold as "Aroclor 1254". Journal of High Resolution Chromatography. 22 (10): 533-540.

Leidos, Inc. 2016. Green-Duwamish River Watershed PCB Congener Study: Phase 1. Prepared for Toxics Cleanup Program, Northwest Regional Office, Washington State Department of Ecology, Bellevue, Washington. April 2016. Available online at: <https://fortress.wa.gov/ecy/gsp/DocViewer.ashx?did=54944>.

Okun, J.D. 2011. Differences between Type 1 and Type 2 Aroclor 1254 (PCBs). O'Reilly, Talbot & Okun, Springfield, MA. http://oto-env.com/blog/type-1-and-2-aroclor-1254/, September 6, 2011. (Accessed February 5, 2015).

Document Title: Type 2 Agency Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: Mahbub Alam
Agency: Washington State Department of Ecology
Date: November 22, 2016

Comment Responses by: Mark Wicklein, Navy Supervisor, Yorick Wahaus, Navy BNC Terrestrial RPM, and Pamela M. Sargent, P.E., OU B Marine RPM
Dated: 04/15/17

#	Question Text	Response	Proposed Navy Response	Response Accepted
1	What is your overall impression of remedy performance following signing of the Records of Decision (RODs) for Operable Unit (OU) A, OU B Marine, OU B Terrestrial, OU D, and OU NSC, completion of the corrective action plan for OU C, and implementation of the remedies at the Bremerton naval complex (BNC)? Do you believe the remedies met the intent of the RODs/corrective action plan for these sites? Do you feel the remedies continue to be effective? Please indicate the basis for your assessment.	In general, the remedy selected for each operable unit has been performing as planned and designed. However, there are areas that need attention.	Comment noted.	
		In regards to active remediation performance, it is necessary that shoreline cap erosion at OU A needs to be more permanent.	Planning for OU A remedy repair has occurred over many years. Stakeholders provided input during this planning, including reviewing and providing comments on the 90 percent design. The Navy produced the 100 percent design including resolution of stakeholder comments with the exception of comments related to mitigation. A contract was awarded to implement the remedy repair in December 2016. A habitat analysis was performed at this same time to determine if there would be habitat loss associated with the planned remedy repair. The analysis determined habitat loss is anticipated with repair implementation. This was not envisioned during design development. As a result, the Navy is planning a review of the design as the original design did not take into account any habitat loss. Remedy repair implementation plans have ceased until internal and external	

Document Title: Type 2 Agency Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: Mahbub Alam
Agency: Washington State Department of Ecology
Date: November 22, 2016

Comment Responses by: Mark Wicklein, Navy Supervisor, Yorick Wahaus, Navy BNC Terrestrial RPM, and Pamela M. Sargent, P.E., OU B Marine RPM
Dated: 04/15/17

#	Question Text	Response	Proposed Navy Response	Response Accepted
			stakeholders are consulted about these issues. It is not anticipated that permanent remedy repair for OUA Charleston Beach will occur in 2017 due to time related to design review, design re-development (if necessary), contracting for the work, and in-water timing related to the (fish window) work periods. Periodic beach replenishment is planned until the permanent remedy repair is completed.	
		Since a major component of all the selected remedies were based on institutional controls to reduce or prevent exposure from the contaminants remaining at the site, it is difficult at times to measure performance given that no quantitative measures were stipulated in the RODs. There is a need for instituting both quantitative and qualitative measures in the Institution Control Implementation and Assurance Plan (ICIAP) that measures performance or progress towards a goal. Some of the ideas are provided in response to other questions.	BNC has a combined Operation & Maintenance and Institutional Control (O&M and IC) Plan, not an ICIAP. The current O&M and IC Plan (30 Mar 2016) was approved by the stakeholders, including Ecology. This plan details the inspection and maintenance requirements identified in the Records of Decision (RODs) for OU NSC, OU A, and OU B T (Navy, Ecology, and EPA 1996, 1997, and 2004, respectively). The objectives of ICs are to protect human health, the environment, and the integrity of the remedies in place by controlling and monitoring the activities that may occur at a particular contaminated site.	

Document Title: Type 2 Agency Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: Mahbub Alam
Agency: Washington State Department of Ecology
Date: November 22, 2016

Comment Responses by: Mark Wicklein, Navy Supervisor, Yorick Wahaus, Navy BNC Terrestrial RPM, and Pamela M. Sargent, P.E., OU B Marine RPM
Dated: 04/15/17

#	Question Text	Response	Proposed Navy Response	Response Accepted
			Additionally, remediation action has been deferred because this federal facility is not scheduled to go through base closure; therefore, there were no clean-up goals set-up in the terrestrial RODs.	
2	In the third five-year review (2012) for BNC, the protectiveness determinations for OU A and OU B Terrestrial were deferred pending additional investigation of potential on-going contaminant transport pathways from the terrestrial to marine environment. The 2016 addendum to the third five-year review revised the protectiveness determination for OU A to "short term protective," but retained the deferral of the protectiveness determination for OU B Terrestrial. Based on your knowledge of the status of the additional assessments that are underway regarding these issues, what is your opinion	Among other lines of evidence, stormwater runoff/discharge and storm drain system solids should be analyzed for chemical analysis of all terrestrial COCs to evaluate the magnitude and potential of COC transport to marine environment.	There is no requirement in any of the terrestrial RODs to sample storm drain system solids. Stormwater facility cleaning performed as part of the remedy for OU NSC as well as a stormwater system treatability study in central OU B Terrestrial demonstrated that cleaning is an effective means of removing a potential contaminant source from the site. An updated OU B Marine schedule was provided to the OU B Marine Team at the Team Meeting on March 7, 2017 and has been updated/forwarded to team members three times since that March meeting. The updated schedule details to interim steps necessary to proceed to a Focused Feasibility Study for OU B Marine including source control investigation and to perform another round of LTM sampling.	

Document Title: Type 2 Agency Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: Mahbub Alam
Agency: Washington State Department of Ecology
Date: November 22, 2016

Comment Responses by: Mark Wicklein, Navy Supervisor, Yorick Wahaus, Navy BNC Terrestrial RPM, and Pamela M. Sargent, P.E., OU B Marine RPM
Dated: 04/15/17

#	Question Text	Response	Proposed Navy Response	Response Accepted
	regarding the progress towards a protectiveness statement for the remedy at OU B Terrestrial?	In addition to collecting stormwater runoff discharge, in line sediment traps may be installed near the end of outfall pipes to capture storm system solids before discharge. This is necessary because many pollutants such as, PCBs, PAHs, have higher partitioning to solid particles that are not easily detected with a sample of water discharge. These contaminants eventually make their way to the inlet sediments with solid phase discharge. In addition, sediment trap sampling result helps in source tracing/source control to prioritize areas that need more attention than others. Refer to Portland Harbor and Lower Duwamish Waterway Superfund sites for accelerated source tracing and source control through sediment traps installed in storm drain systems.	Storm water system at BNC includes catch basins and manholes. In accordance with the operation and maintenance requirements set forth in the original Final Operation and Maintenance Plan, Bremerton Naval Complex, Bremerton, Washington (Navy, Feb 2006), the primary inspection point for the storm drain system shall be the last catch basin of the system prior to discharge to Sinclair Inlet. A listing of the catch basins noted with high levels of solids during the annual O&M inspection are forward on to the NBK Bremerton Public Works Department through Water & Environmental Planning Department to be cleaned/cleared. Solids from stormwater system catch basins that are accessible for cleaning are removed at least annually by NBK Bremerton Public Works Department.	
3	The third five-year review (2012) for BNC also deferred the protectiveness determination for OU B Marine, pending additional investigation of mercury movement through the marine food web and interpretation of	The protectiveness determination of OU B Marine also depends on the protectiveness evaluation of OU B Terrestrial since a major portion of source control for OU B Marine is tied with cutting off the OU B Terrestrial pathway. As described in the previous response, the stormwater pathway needs to	Comment noted. See response to first part of comment #2 above.	

Document Title: Type 2 Agency Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: Mahbub Alam
Agency: Washington State Department of Ecology
Date: November 22, 2016

Comment Responses by: Mark Wicklein, Navy Supervisor, Yorick Wahaus, Navy BNC Terrestrial RPM, and Pamela M. Sargent, P.E., OU B Marine RPM
Dated: 04/15/17

#	Question Text	Response	Proposed Navy Response	Response Accepted
	the implications of elevated PCB concentrations in sediment found during construction projects. Based on your knowledge of the status of the additional assessments that are underway regarding these issues, what is your opinion regarding the progress towards a protectiveness statement for the remedy at OU B Marine?	be thoroughly investigated for potential contaminant migration.		
4	To your knowledge, since the RODs were signed for OU A, OU B Marine, OU B Terrestrial, OU D, and OU NSC and the corrective action plan was completed for OU C have there been any new scientific findings that relate to projecting potential site risks which might call into question the protectiveness of the remedies?	See response to question no. 9.	Comment noted.	
5	To the best of your knowledge, are institutional controls and operations and maintenance procedures being utilized at BNC consistent with the terms of the	There are some instances where institutional controls and operation and maintenance procedures are not working as planned.	Comment noted. Responses to specific issues are provided below.	
		The asphalt cap is deteriorating throughout the site.	Asphalt reduces the potential for chemical transport and control the threat of	

Document Title: Type 2 Agency Interview Form for Bremerton Naval Complex Fourth Five-Year Review

Form Dated: 10/24/16

Comments by: Mahbub Alam
Agency: Washington State Department of Ecology
Date: November 22, 2016

Comment Responses by: Mark Wicklein, Navy Supervisor, Yorick Wahaus, Navy BNC Terrestrial RPM, and Pamela M. Sargent, P.E., OU B Marine RPM
Dated: 04/15/17

#	Question Text	Response	Proposed Navy Response	Response Accepted
	RODs/corrective action plan?		recontamination of the adjacent marine environment from infiltration of surface water into site soil"; OU B-T ROD Nov2003. Pavement caps and vegetative covers at BNC minimize infiltration of surface water. The intent of the pavement cap remedy at OU B-T was not to have a 100 percent impermeable cap at all times. Asphalt deteriorates as part of normal operations. In addition, deterioration of asphalt does not signify that water is permeating through the asphalt. The pavement caps and vegetative cover are evaluated annually and evaluation results are reported in the Annual Remedy Inspection Report. The draft 2016 Annual Remedy Inspection Report has documented only 4.6% poor pavement in OU A, 2.46% in OU B T, and 2.4% in OU NCS (within paved areas of OU A, OU B T, and OU NSC) with an overall poor pavement percentage of 2.54%. Additionally, paving projects have been completed since the time of the 2016 inspection and currently there are two projects with large paving components in progress in areas where poor pavement was	

Document Title: Type 2 Agency Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: Mahbub Alam
Agency: Washington State Department of Ecology
Date: November 22, 2016

Comment Responses by: Mark Wicklein, Navy Supervisor, Yorick Wahaus, Navy BNC Terrestrial RPM, and Pamela M. Sargent, P.E., OU B Marine RPM
Dated: 04/15/17

#	Question Text	Response	Proposed Navy Response	Response Accepted
			identified during the 2016 Annual Remedy Inspection.	
		… and groundwater monitoring frequency at OU C is not occurring as stated in the Cleanup Action Plan (CAP).	The CAP requires sampling of five wells for TPH-DRO & TPH-RRO and measurement of product thickness in seven wells. In 2012, the sampling plan SAP was optimized and approved to only sample one well for TPH-DRO & TPH-RRO and to measure product thickness in 12 wells. In 2014, the SAP was optimized again and approved to sample two wells for TPH-DRO & TPH-RRO and measure product thickness in 12 wells.	
		The petroleum management plan (PMP) is still in the works and excavation management plan (EMP) needs attention regarding compliance with MTCA.	The 2003 Amended PMP is the current PMP. The Final 2017 Petroleum Management Plan will be forwarded to the BNC Terrestrial Stakeholders by 21-Apr-17.	
			The Navy concurs that the EMP needs to be updated. The EMP is a joint document (NAVFAC & NAVSEA) that requires multiple commands within BNC to agree to content changes. Internal evaluation of the EMP is currently underway to determine methods for streamlining approval of updates to this plan. The goal is to complete a revision to the EMP by Sep 2018 with input from both Navy internal and external stakeholders.	

Document Title: Type 2 Agency Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: Mahbub Alam
Agency: Washington State Department of Ecology
Date: November 22, 2016

Comment Responses by: Mark Wicklein, Navy Supervisor, Yorick Wahaus, Navy BNC Terrestrial RPM, and Pamela M. Sargent, P.E., OU B Marine RPM
Dated: 04/15/17

#	Question Text	Response	Proposed Navy Response	Response Accepted
6	Following signing of the RODs and completion of the OU C corrective action plan, have there been any complaints, violations, or other incidents related to BNC installation restoration issues that required a response by your office? If so, please provide details of the events and results of the responses.	As stated previously, monitoring frequency has not been carried forth as indicated by the CAP for the OU C and O&M for cap maintenance at other areas of the BNC has fallen behind.	See response to question #5 above regarding OU C monitoring. See the response to question #6 below regarding pavement cap maintenance.	
7	To the best of your knowledge, has the on-going program of groundwater monitoring, institutional controls inspection and maintenance, cap, shoreline, and storm drain inspection and maintenance, and sediment and marine biota monitoring at BNC following implementation of the remedies been sufficiently thorough and frequent to meet the goals of the RODs/corrective action plan? Please indicate the basis for your assessment.	The inspections may have been sufficient, however, maintenance of cap areas need to be prioritized and implemented accordingly. These actions should not be deferred as an ancillary component of any future construction or infrastructure upgrade project.	Pavement repairs at BNC are implemented routinely, both in conjunction with MILCON projects and as stand-alone projects. As with all projects at BNC, paving projects are prioritized based on how critical a project is in supporting the mission of the war fighters and what the impacts are to facility operations. The 2016 Annual Remedy Inspection Report has documented only 2.54% poor pavement overall (within paved areas of OU A, OU B T, and OU NSC). Additionally, paving projects have been completed since the time of the inspection and currently there are two projects with large paving components in	

Document Title: Type 2 Agency Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: Mahbub Alam
Agency: Washington State Department of Ecology
Date: November 22, 2016

Comment Responses by: Mark Wicklein, Navy Supervisor, Yorick Wahaus, Navy BNC Terrestrial RPM, and Pamela M. Sargent, P.E., OU B Marine RPM
Dated: 04/15/17

#	Question Text	Response	Proposed Navy Response	Response Accepted
			progress in areas where poor pavement was identified during the 2016 annual inspection.	
8	Are you aware of any community concerns regarding the remedies in place at BNC? If so, please give details.	No.	Comment noted.	
9	Do you have any other comments, concerns, or suggestions regarding the effectiveness of the remedies in place to protect human health and the environment at BNC?	There are some COCs throughout the site (e.g., PCBs, pesticides) that have been dropped from monitoring based on non-detect results while the laboratory reporting limit may have been above cleanup level or screening levels. Over the years, improvements in analytical techniques resulted in lower reporting levels and the Navy should investigate whether some COCs need to be monitored with improved analytical techniques. This is necessary since contaminants remaining at the site above unrestricted use levels are subject to institutional controls and long term monitoring. For example, PCBs were removed from groundwater monitoring at OU-A and OU-NSC site based on laboratory reporting limit of 0.2 ug/L in January 2000. The newly promulgated total PCBs criterion for human health protection in WA state is 0.000007 ug/L, which is a surface water	The ROD for OU B T (Mar 2004) states that "the Navy will collect and analyze a product or product/water sample for total PCB Aroclors in groundwater monitoring wells containing petroleum free product." Soil and catch basin sediments were tested for PCBs during the RI but such testing is not a requirement of the ROD. The ROD for OU A (Jan 1997) states the RAO is to "Prevent people from coming in contact with soil containing lead, arsenic, PCBs, and PAHs above acceptable levels". The ROD for OU NSC (Dec 1996) has a similar RAO for soil "to reduce human exposure to the chemicals of concern and to reduce or control contamination of groundwater." The COC's in the soil are lead, cPAHs, PCBs, and TPH.	

Document Title: Type 2 Agency Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: Mahbub Alam
Agency: Washington State Department of Ecology
Date: November 22, 2016

Comment Responses by: Mark Wicklein, Navy Supervisor, Yorick Wahaus, Navy BNC Terrestrial RPM, and Pamela M. Sargent, P.E., OU B Marine RPM
Dated: 04/15/17

#	Question Text	Response	Proposed Navy Response	Response Accepted
		quality ARAR for this site. It is necessary to reach out for better analytical method to better characterize the surface water runoff and ground water and to measure progress towards achieving the ARAR. Rationale for PCBs analysis by high resolution congener method: Analysis of PCBs as Aroclors is subject to many limitations (Leidos, 2016). Some of these are: 1) Identification and Quantification of which Aroclors are being analyzed can be dependent on subjective decision when multiple Aroclors exist or subsequent weathering has occurred. 2) An Aroclor is a mixture of several PCB congeners, some of which may not be analyzed. Thus, Aroclor concentrations can be biased low since identification is based only on 5 to 10 key congeners identified in that Aroclor. 3) Aroclors from different lots do not always have same the congener profiles (Frame et al. 1996). This creates an issue between Aroclor standard and identifying the Aroclor present in the field sample.	The terrestrial RODs do not require PCB congener analysis.	

Document Title: Type 2 Agency Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: Mahbub Alam
Agency: Washington State Department of Ecology
Date: November 22, 2016

Comment Responses by: Mark Wicklein, Navy Supervisor, Yorick Wahaus, Navy BNC Terrestrial RPM, and Pamela M. Sargent, P.E., OU B Marine RPM
Dated: 04/15/17

#	Question Text	Response	Proposed Navy Response	Response Accepted
		4) Composition of Aroclor 1254 has changed over time (Frame 1999, Okun 2011). 5) Aroclors are subject to transformation and degradation in the environment. An Aroclor goes through degradation and may not retain the composition of original mixture. Aroclor may be transformed through selective transport e.g., leaching of more soluble congeners with pore water. 6) Aroclor concentration can be sometimes biased high due to interference with other halogenated compounds (e.g., PBDEs) during analysis. Two studies (Battelle Memorial Institute et al. 2012; EPA Region 4 2013) recommended to avoid Aroclor analyses when weathering is expected. EPA method 1668 is a more precise analytical method which uses high resolution mass spectrometry (HRMS) to detect individual PCB congeners at parts per trillion (ppt) to part per quadrillion (ppq) level. Since this method can detect all 209 PCB congeners, there is no issue associated with Aroclor being degraded or transported		

Document Title: Type 2 Agency Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: Mahbub Alam
Agency: Washington State Department of Ecology
Date: November 22, 2016

Comment Responses by: Mark Wicklein, Navy Supervisor, Yorick Wahaus, Navy BNC Terrestrial RPM, and Pamela M. Sargent, P.E., OU B Marine RPM
Dated: 04/15/17

#	Question Text	Response	Proposed Navy Response	Response Accepted
		selectively in the environment, potentially causing a misidentification or resulting in unreliable concentrations. Therefore, Ecology highly recommends that PCBs analysis are conducted with EPA method 1668 in addition to traditional Aroclor analysis for making sound and rational cleanup decision.		

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
PO Box 47600 • Olympia, WA 98504-7600 • 360-407-6000
711 for Washington Relay Service • Persons with a speech disability can call 877-833-6341

September 7, 2017

Pamela M. Sargent, P.E.
Remedial Project Manager
NAVFAC Northwest
1101 Tautog Circle, Suite 203
Silverdale, WA 98315-1101

Re: Comments on *Draft Final* Fourth Five-Year Review, Puget Sound Naval Shipyard (PSNS) Complex Superfund Site, Bremerton, Washington, dated August 2017.

- **Site Name: US NAVY PSNS**
- **FSID: 175**

Dear Ms. Sargent:

The Department of Ecology (Ecology) appreciates the opportunity to review and comment on the *Draft Final* Fourth Five-Year Review prepared for the Puget Sound Naval Shipyard (PSNS) Complex Superfund Site. While Ecology agrees and concurs with many sections of the report, the following represents Ecology's position on the subject matter. Ecology anticipates future dialog among the project team to resolve these matters and make progress to improve the human health and environment.

OU A Protectiveness Determination

Per Ecology's comments on the draft version of the PSNS Five Year Review dated May 30 and the subsequent comment resolution team meetings dated June 19 and August 3, Ecology does not concur with the Navy's determination that the remedy at Operable Unit A should be deemed short term protective, as is reflected in the draft final document (Ref. Table ES-1, Five-Year Review Summary Form, Section 9.0).

During initial consultation Ecology asserted that the placement of the 3 feet of 'fish mix' habitat material was intended as a containment measure, and for protectiveness to be maintained, this material should remain on the beach.

Ecology asserts that the OU A remedy should be deemed non protective due to the continued erosion of containment material that has been witnessed at Charleston Beach, which has required several previous replenishment efforts. Ecology believes that the OU A remedy should be deemed non protective and a permanent remedy repair be designed and constructed with consensus with the project team in the next five year review period. Furthermore this permanent remedy should ensure that there is no net loss of habitat based on the post pier D construction baseline.

Ecology is supportive of the proposed schedule that would see a permanent OU A remedy being designed by 2019 and constructed in 2020, and looks forward to working collaboratively towards a permanent solution.

Upland Source Control (Ecology general RTC# 3)

Ecology is not satisfied with the Navy's response on source control for terrestrial COCs. While the Navy agrees that source control is critical for successful sediment remediation but fails to provide any data driven mechanism that documents continued progress and effectiveness of upland source control efforts. The Navy refers to other management programs or plans including the SWPPP for source control buts fails to provide any quantitative measures or data to meet the remedial action objective of OU BT ROD "*Reduce the potential for chemical transport and control the threat of recontamination of the adjacent marine environment*" and to establish a source control trend. Ecology stands by its recommendation to establish a data driven source control program throughout the BNC.

Recommendation on Trend Analysis (M. Alam RTC# 3a and Section 7.6.6)

Ecology does not agree with the Navy's recommendation to discontinue trend analyses and other associated recommendations as stated in the section 7.6.6 of the Five-Year Review Report. Even though the ground water contaminant concentrations were above remediation goals during the time ROD was written, it was anticipated that contaminant levels will go down in the future. One of the objectives of groundwater monitoring stated in the OU A ROD were to "*determine whether contaminant levels in groundwater are being reduced through capping, placement of riprap, and natural processes*." The Fourth Five-Year Review Report fails to show how this objective is met when trend analyses show stable or increasing contaminant trends (section 6.4.1.1). Cu, Zn, and Hg show increasing trend at LTMP-1. Without trend analyses these would not have been revealed. Ecology would like to see these analyses continue.

PQL Based RGs (M. Alam RTC#8 and RTC#5)

Ecology do not agree with the Navy's assertion that laboratory LOQs have not significantly changed since the COCs were dropped from groundwater monitoring program. Table 7-4, 7-8, 7-10 show current LOQs for some pollutants are more than two orders of magnitude lower than ROD PQLs. In addition, if PCBs were to be analyzed with current congener method (EPA method 1668), the LOQs would drop by more than 4 orders of magnitude.
When remediation goals are based on PQL, it is unknown whether they are protective of human health and the environment. Therefore, whenever there are changes in the PQLs, the monitoring that was dropped based on "non-detect" results in the past should be resumed to ascertain that those contaminants are still non-detect. As such, Ecology stands by its recommendation to monitor PCBs and other applicable COCs in ground water.

If you have any questions or if we can be of further service, please feel free to contact Mahbub Alam at (360) 407-6913, by email mahbub.alam@ecy.wa.gov or, John Evered at (360) 407-7071, by email john.evered@ecy.wa.gov.

Sincerely,

Mahbub Alam, PhD, PE,
Cleanup Project Manager

John Evered
Cleanup Project Manager

cc: Bonnie Arthur, EPA
Karen Keeley, EPA
Denice Taylor, Suquamish Tribe
Joy Gryzenia, NAVFAC Northwest

Enclosure(s)

Natural Resource Trustee

INTERVIEW RECORD FOR FOURTH FIVE-YEAR REVIEW
Type 3 Interview – Natural Resources Trustee
Bremerton Naval Complex
Bremerton, WA

Individual Contacted: Denice Taylor
Title: Environmental Scientist, Suquamish Tribe project manager
Organization: Suquamish Tribe
Contact Made by:
Date: Nov. 21, 2016

Summary of Communication

1. What is your overall impression of remedy performance following signing of the Records of Decision (RODs) for Operable Unit (OU) A, OU B Marine, OU B Terrestrial, OU D, and OU NSC, completion of the corrective action plan for OU C, and implementation of the remedies at the Bremerton naval complex (BNC)? Do you believe the remedies met the intent of the RODs/corrective action plan for these sites? Do you feel the remedies continue to be effective? Please indicate the basis for your assessment.

   Response: I believe that the remedies were generally implemented as intended by the RODs. However, some remedy components have not achieved long-term goals for the protection of human health and the environment. (Refer to the Addendum to the Third Five Year Review for the most recent protectiveness determinations.)

   Of particular concern are:
   1) the long overdue remedy repair for the OU A shoreline at Charleston Beach
   2) the continued release of mercury from the upland areas to the marine environment
   3) the accumulation of mercury in marine sediments and aquatic organisms, which continues to present an unacceptable health risk via consumption of seafood
   4) potential impacts of PSNS construction projects and operations on in-place remedies, and
   5) lack of communication and coordination between different Navy commands regarding implementation of ICs, LUCs and O&M procedures designed to protect the remedies. (This includes spill and release events such as the 2015 Salt Water Main break.)

2. In your experience, what effects have remedy implementation at BNC had on your agency and the surrounding community?

Response: As commented in previous Five Year Reviews, the actions taken have been important steps in reducing the contaminant load in Sinclair Inlet. However, the remedial actions have had limited direct benefit to tribal members as harvest restrictions remain in effect. In addition, armoring of the BNC shoreline, while generally effective in preventing erosion, is detrimental to the habitat of treaty-protected resources.

3. Are you aware of any concerns within your agency or the community regarding the remedies in place at BNC? If so, please give details.

Response: Please see the responses to the first 2 questions.

4. To the best of your knowledge, are institutional controls and operations and maintenance procedures being utilized at BNC consistent with the terms of the RODs/corrective action plan?

Response: As mentioned in the response to the first question, at times there is an apparent lack of communication and coordination between different Navy commands regarding the implementation of ICs, LUCs and O&M procedures designed to protect the remedies. This also pertains to communication regarding spill and release events and follow up actions.

With regard to Charleston Beach, the Tribe believes that the Navy has stretched what was intended to be a limited interim action into ongoing maintenance. The overall impact is continued disruption of a documented forage fish spawning area.

It should also be noted that the Tribe does not generally regard the use of ICs, specifically fish advisories and harvest restrictions, as viable long-term remedies. In the Tribe's perspective, ICs are used to avoid and/or minimize exposure until the remedial objectives and goals for the sites are met. ICs alone do not reduce contaminant concentrations or control sources.

5. To the best of your knowledge, has the on-going program of environmental monitoring at BNC following implementation of the remedies been sufficiently thorough and frequent to meet the goals of the RODs/corrective action plan? Please indicate the basis for your assessment.

Response: In general, the long-term monitoring programs were designed to meet the goals of the RODs. The groundwater monitoring programs for the terrestrial operable units are continuing to be reviewed, modified and streamlined to reflect more than 2 decades of data collection and to clarify current objectives.

The last marine long-term monitoring effort demonstrated compliance with clean up levels for PCBs in sediment. The project team has not yet reached agreement on how to verify that natural recovery (as a remedy component) is continuing and/or

stable, or how to integrate data from MILCON-related sampling into a decision framework for OU B Marine.

6. Do you have any other comments, concerns, or suggestions regarding the effectiveness of the remedies in place to protect human health and the environment at BNC?

Response:

The Tribe fully expects that the Navy will respond to all comments and engage in meaningful dialogue with the Tribe regarding the design and implementation of the final remedy repair for OU A/Charleston Beach.

The Tribe anticipates that the Navy will implement a remedial action to control sources of mercury from the terrestrial operable units and to reduce legacy sources of mercury in the marine environment.

The Tribe supports the optimization of long-term monitoring for the terrestrial operable units and recommends that monitoring of the terrestrial and marine environments be addressed from a more holistic perspective to ensure long-term protectiveness of human health and the environment.

The Tribe encourages the Navy to develop more effective communication and coordination strategies for ongoing and routine operation and maintenance activities, as well as spill/release notification and response.

Document Title: Type 3 Natural Resource Trustee Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: Denice Taylor, Environmental Scientist, Suquamish Tribe Project Manager
Organization: Suquamish Tribe
Date: 11/21/16

Comment Responses by: Pamela M. Sargent, P.E., Navy OU B Marine RPM and Five-Year Review Lead
Date: 04/15/17

#	Question Text	Response	Proposed Navy Response	Response Accepted
1	What is your overall impression of remedy performance following signing of the Records of Decision (RODs) for Operable Unit (OU) A, OU B Marine, OU B Terrestrial, OU D, and OU NSC, completion of the corrective action plan for OU C, and implementation of the remedies at the Bremerton naval complex (BNC)? Do you believe the remedies met the intent of the RODs/corrective action plan for these sites? Do you feel the remedies continue to be effective? Please indicate the basis for your assessment.	I believe that the remedies were generally implemented as intended by the RODs. However, some remedy components have not achieved long-term goals for the protection of human health and the environment. (Refer to the Addendum to the Third Five Year Review for the most recent protectiveness determinations.) Of particular concern are:	Comment noted and specific responses to individual concerns are provided below.	
		1) the long overdue remedy repair for the OU A shoreline at Charleston Beach	Planning for OU A remedy repair has occurred over many years. Stakeholders provided input during this planning, including reviewing and providing comments on the 90 percent design. The Navy produced the 100 percent design including resolution of stakeholder comments with the exception of comments related to mitigation. A contract was awarded to implement the remedy repair in December 2016. A habitat analysis was performed at this same time to determine if there would be habitat loss associated with the planned remedy repair. The analysis determined habitat loss is anticipated	

Document Title: Type 3 Natural Resource Trustee Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: Denice Taylor, Environmental Scientist, Suquamish Tribe Project Manager
Organization: Suquamish Tribe
Date: 11/21/16

Comment Responses by: Pamela M. Sargent, P.E., Navy OU B Marine RPM and Five-Year Review Lead
Date: 04/15/17

#	Question Text	Response	Proposed Navy Response	Response Accepted
			with repair implementation. This was not envisioned during design development. As a result, the Navy is planning a review of the design as the original design did not take into account any habitat loss. Remedy repair implementation plans have ceased until internal and external stakeholders are consulted about these issues. It is not anticipated that permanent remedy repair for OUA Charleston Beach will occur in 2017 due to time related to design review, design re-development (if necessary), contracting for the work, and in-water timing related to the (fish window) work periods. Periodic beach replenishment is planned until the permanent remedy repair is completed.	
		2) the continued release of mercury from the upland areas to the marine environment	Source control work is planned following additional investigation work by USGS and the development of an Engineering Evaluation/Cost Analysis (EE/CA) and action memorandum for source control.	

Document Title: Type 3 Natural Resource Trustee Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: Denice Taylor, Environmental Scientist, Suquamish Tribe Project Manager
Organization: Suquamish Tribe
Date: 11/21/16

Comment Responses by: Pamela M. Sargent, P.E., Navy OU B Marine RPM and Five-Year Review Lead
Date: 04/15/17

#	Question Text	Response	Proposed Navy Response	Response Accepted
		3) the accumulation of mercury in marine sediments and aquatic organisms, which continues to present an unacceptable health risk via consumption of seafood	Source control work is planned as stated above and an FFS will be completed to select the remedy to address mercury-related health risks associated with consumption of seafood in Sinclair Inlet. The selected remedy will be implemented after the completion of the Proposed Plan and ROD (or ROD amendment).	
		4) potential impacts of PSNS construction projects and operations on in-place remedies,	The Goals and Objectives for Decision Framework Process for PCBs and Mercury in OU B Marine dated February 16, 2017 states: "Until the Decision Framework is updated, only data collected for the LTM program (grids) will be used to calculate area-weighted averages. Other data may be evaluated for use as weight of evidence to further understand site conditions, such as identifying contaminant sources or evaluating areas not previously characterized." Additionally, this technical memorandum states:	

Document Title: Type 3 Natural Resource Trustee Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: Denice Taylor, Environmental Scientist, Suquamish Tribe Project Manager
Organization: Suquamish Tribe
Date: 11/21/16

Comment Responses by: Pamela M. Sargent, P.E., Navy OU B Marine RPM and Five-Year Review Lead
Date: 04/15/17

#	Question Text	Response	Proposed Navy Response	Response Accepted
			"Development of Conceptual Site Model for Monitored Natural Recovery Consistent with the "Goals and Objectives for Decision Framework Process for PCBs and Mercury in OU B Marine," a Conceptual Site Model for Monitored Natural Recovery (MNR) will be developed based on 14 years of LTM data, incorporating what we have learned from the in-water construction work and other studies that have produced data regarding sediment deposition/erosion/resuspension." Analysis of the non –LTM data was discussed at the April 13, 2017 OU B Marine Team Meeting and will continue to be discussed as part of the ongoing decision framework process in working towards a Focused Feasibility Study for OU B Marine.	
		5) lack of communication and coordination between different Navy commands regarding implementation of	In the April 13, 2017 OU B Marine Team meeting, the Suquamish Tribe	

Document Title: Type 3 Natural Resource Trustee Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: Denice Taylor, Environmental Scientist, Suquamish Tribe Project Manager
Organization: Suquamish Tribe
Date: 11/21/16

Comment Responses by: Pamela M. Sargent, P.E., Navy OU B Marine RPM and Five-Year Review Lead
Date: 04/15/17

#	Question Text	Response	Proposed Navy Response	Response Accepted
		ICs, LUCs and O&M procedures designed to protect the remedies. (This includes spill and release events such as the 2015 Salt Water Main break.)	representative agreed to reformulate this issue such that it could be more easily responded to and formulated into a finding and/or recommendation.	
2	In your experience, what effects have remedy implementation at BNC had on your agency and the surrounding community?	As commented in previous Five Year Reviews, the actions taken have been important steps in reducing the contaminant load in Sinclair Inlet. However, the remedial actions have had limited direct benefit to tribal members as harvest restrictions remain in effect. In addition, armoring of the BNC shoreline, while generally effective in preventing erosion, is detrimental to the habitat of treaty-protected resources.	Comment noted.	
3	Are you aware of any concerns within your agency or the community regarding the remedies in place at BNC? If so, please give details.	Please see the responses to the first 2 questions.	Comment noted.	
4	To the best of your knowledge, are institutional controls and operations and maintenance procedures being utilized at BNC consistent with the terms of the RODs/corrective action	As mentioned in the response to the first question, at times there is an apparent lack of communication and coordination between different Navy commands regarding the implementation of ICs, LUCs and O&M procedures designed to protect the remedies. This also pertains to communication regarding spill and release events and follow up actions.	In the April 13, 2017 OU B Marine Team meeting, the Suquamish Tribe representative agreed to reformulate this issue such that it could be more easily responded to and formulated into a finding and/or recommendation.	

Document Title: Type 3 Natural Resource Trustee Interview Form for Bremerton Naval Complex Fourth Five-Year Review

Form Dated: 10/24/16

Comments by: Denice Taylor, Environmental Scientist, Suquamish Tribe Project Manager
Organization: Suquamish Tribe
Date: 11/21/16

Comment Responses by: Pamela M. Sargent, P.E., Navy OU B Marine RPM and Five-Year Review Lead
Date: 04/15/17

#	Question Text	Response	Proposed Navy Response	Response Accepted
	plan?	With regard to Charleston Beach, the Tribe believes that the Navy has stretched what was intended to be a limited interim action into ongoing maintenance. The overall impact is continued disruption of a documented forage fish spawning area.	Planning for OU A remedy repair has occurred over many years. Stakeholders provided input during this planning, including reviewing and providing comments on the 90 percent design. The Navy produced the 100 percent design including resolution of stakeholder comments with the exception of comments related to mitigation. A contract was awarded to implement the remedy repair in December 2016. A habitat analysis was performed at this same time to determine if there would be habitat loss associated with the planned remedy repair. The analysis determined habitat loss is anticipated with repair implementation. This was not envisioned during design development. As a result, the Navy is planning a review of the design as the original design did not take into account any habitat loss. Remedy repair implementation plans have ceased until internal and external stakeholders are consulted about these issues. It is not anticipated that	

Document Title: Type 3 Natural Resource Trustee Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: Denice Taylor, Environmental Scientist, Suquamish Tribe Project Manager
Organization: Suquamish Tribe
Date: 11/21/16

Comment Responses by: Pamela M. Sargent, P.E., Navy OU B Marine RPM and Five-Year Review Lead
Date: 04/15/17

#	Question Text	Response	Proposed Navy Response	Response Accepted
			permanent remedy repair for OUA Charleston Beach will occur in 2017 due to time related to design review, design re-development (if necessary), contracting for the work, and in-water timing related to the (fish window) work periods. Periodic beach replenishment is planned until the permanent remedy repair is completed.	
		It should also be noted that the Tribe does not generally regard the use of ICs, specifically fish advisories and harvest restrictions, as viable long-term remedies. In the Tribe's perspective, ICs are used to avoid and/or minimize exposure until the remedial objectives and goals for the sites are met. ICs alone do not reduce contaminant concentrations or control sources.	Comment noted.	
5	To the best of your knowledge, has the on-going program of environmental monitoring at BNC following implementation of the remedies been sufficiently thorough and frequent to meet the goals of the RODs/corrective action plan?	In general, the long-term monitoring programs were designed to meet the goals of the RODs. The groundwater monitoring programs for the terrestrial operable units are continuing to be reviewed, modified and streamlined to reflect more than 2 decades of data collection and to clarify current objectives.	Comment noted.	

Document Title: Type 3 Natural Resource Trustee Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: Denice Taylor, Environmental Scientist, Suquamish Tribe Project Manager
Organization: Suquamish Tribe
Date: 11/21/16

Comment Responses by: Pamela M. Sargent, P.E., Navy OU B Marine RPM and Five-Year Review Lead
Date: 04/15/17

#	Question Text	Response	Proposed Navy Response	Response Accepted
	Please indicate the basis for your assessment.			
		The last marine long-term monitoring effort demonstrated compliance with clean up levels for PCBs in sediment. The project team has not yet reached agreement on how to verify that natural recovery (as a remedy component) is continuing and/or stable, or how to integrate data from MILCON-related sampling into a decision framework for OU B Marine.	See response to comment #1, sub-comment 4) above.	
6	Do you have any other comments, concerns, or suggestions regarding the effectiveness of the remedies in place to protect human health and the environment at BNC?	The Tribe fully expects that the Navy will respond to all comments and engage in meaningful dialogue with the Tribe regarding the design and implementation of the final remedy repair for OU A/Charleston Beach.	Planning for OU A remedy repair has occurred over many years. Stakeholders provided input during this planning, including reviewing and providing comments on the 90 percent design. The Navy produced the 100 percent design including resolution of stakeholder comments with the exception of comments related to mitigation. A contract was awarded to implement the remedy repair in December 2016. A habitat analysis	

Document Title: Type 3 Natural Resource Trustee Interview Form for Bremerton Naval Complex Fourth Five-Year Review

Form Dated: 10/24/16

Comments by: Denice Taylor, Environmental Scientist, Suquamish Tribe Project Manager
Organization: Suquamish Tribe
Date: 11/21/16

Comment Responses by: Pamela M. Sargent, P.E., Navy OU B Marine RPM and Five-Year Review Lead
Date: 04/15/17

#	Question Text	Response	Proposed Navy Response	Response Accepted
			was performed at this same time to determine if there would be habitat loss associated with the planned remedy repair. The analysis determined habitat loss is anticipated with repair implementation. This was not envisioned during design development. As a result, the Navy is planning a review of the design as the original design did not take into account any habitat loss. Remedy repair implementation plans have ceased until internal and external stakeholders are consulted about these issues. It is not anticipated that permanent remedy repair for OUA Charleston Beach will occur in 2017 due to time related to design review, design re-development (if necessary), contracting for the work, and in-water timing related to the (fish window) work periods. Periodic beach replenishment is planned until the permanent remedy repair is completed.	

Document Title: Type 3 Natural Resource Trustee Interview Form for Bremerton Naval Complex Fourth Five-Year Review
Form Dated: 10/24/16

Comments by: Denice Taylor, Environmental Scientist, Suquamish Tribe Project Manager
Organization: Suquamish Tribe
Date: 11/21/16

Comment Responses by: Pamela M. Sargent, P.E., Navy OU B Marine RPM and Five-Year Review Lead
Date: 04/15/17

#	Question Text	Response	Proposed Navy Response	Response Accepted
		The Tribe anticipates that the Navy will implement a remedial action to control sources of mercury from the terrestrial operable units and to reduce legacy sources of mercury in the marine environment.	Source control work is planned following additional investigation work by USGS and the development of an EE/CA and action memorandum for source control.	
		The Tribe supports the optimization of long-term monitoring for the terrestrial operable units and recommends that monitoring of the terrestrial and marine environments be addressed from a more holistic perspective to ensure long-term protectiveness of human health and the environment.	Comment noted.	
		The Tribe encourages the Navy to develop more effective communication and coordination strategies for ongoing and routine operation and maintenance activities, as well as spill/release notification and response.	In the April 13, 2017 OU B Marine Team meeting, the Suquamish Tribe representative agreed to reformulate this issue such that it could be more easily responded to and formulated into a finding and/or recommendation.	

PHONE (360) 598-3311
Fax (360) 598-6295
http://www.suquamish.nsn.us

THE SUQUAMISH TRIBE
PO Box 498 Suquamish, WA 98392-0498

September 7, 2017

Ms. Pam Sargent
NAVFAC NW
1101 Tautog Circle
Silverdale, WA 98315

RE: Draft Final Fourth Five Year Review
PSNS Complex Superfund Site
Bremerton, WA

Dear Ms. Sargent:

The Suquamish Tribe (the Tribe) has reviewed the draft final Fourth Five Year Review (5YR) for the PSNS Complex Superfund Site, as well as the Navy's response to comments submitted on the draft 5YR. The primary purpose of this letter is to identify points of agreement or non-concurrence regarding protectiveness and recommendations for each of the operable units (OUs). The Tribe requests that this letter be included with the final 5YR and suggests that it be considered as an addendum to the initial interview record.

OU A/Charleston Beach Protectiveness Determination

The Tribe agrees with the Navy that the OU A shoreline remedy is not protective in the long-term, but disagrees with the Navy's conclusion that the OU A shoreline remedy is protective in the short-term. The Tribe's priority is to ensure that there are no long-term site-related impacts to treaty protected rights and resources. However, given the failure to implement a long-term remedy repair, the Tribe is concerned that use of available funds to continue "interim" actions, and reliance on a finding of short-term protectiveness may be used to justify further delay of a permanent repair.

As documented by Suzanna Jefferis, a former NAVFAC RPM, it became evident more than 10 years ago that significant erosion was occurring at the Charleston Beach mitigation site to the extent that contaminated landfill debris was appearing on the beach near the bluff. A survey of the site in 2007 confirmed that sufficient fish mix and top soil had eroded, both horizontally and vertically, resulting in a breach at both the base of the bluff and in the surface of the beach. Of particular interest was the extent of erosion at locations where contamination had previously been observed at levels above the Washington State sediment management standards (SMS). At two of the contaminated locations, the extent of erosion observed in the 2007 survey indicated that contaminated sediments had been exposed. At another location, the extent of erosion was such that approximately one foot of fish mix cover remained.

In response to the observed erosion, the Navy initiated a TCRA in 2007-2008 to implement interim actions to address the erosion at the bluff and to replenish the fish mix cover over the beach. At that time, the Navy also initiated a process to evaluate and design a remedy repair for Charleston Beach that would meet the intent of the OU A ROD and ensure long-term protectiveness. Today, despite a significant level of effort by the OU A/Charleston Beach project team, the development and evaluation of numerous design alternatives, and a final design and contract, the Navy still has not implemented a long-term remedy repair at Charleston Beach. Instead, several years after the first interim action, the Navy placed a pile of fish mix, referred to as a "feeder berm", at the edge of the intertidal area, allowing it to be passively eroded and re-distributed by the tides and storm events. The Navy continues to "replenish" the berm with increasing frequency and asserts that this is sufficient to ensure protectiveness in the short-term.

The Tribe does not believe that a minimum 3 foot depth of fish mix has been, or is currently being, maintained as required to ensure protectiveness and avoid degradation. As stipulated by Ecology during the design of the Charleston Beach mitigation, and evidenced by correspondence between Ecology and the Navy during the design and permitting process, Ecology was concerned that sediment having historical contamination at levels greatly exceeding standards would be exposed during the mitigation action. Ecology agreed with the placement of a 3 foot thick fish mix layer to contain contamination, with the caveat that the 3 foot thickness must be maintained aside from any anticipated losses after placement.

Additionally, the Tribe does not agree with the Navy's conclusions that the limited sampling of intertidal surface sediments at Charleston Beach demonstrates that the OU A remedy remains protective in the short-term. Sample locations were not chosen to correlate to locations where contamination had previously been observed; the sampling interval was generally limited to the top 10 cm and may not have intercepted contamination at greater depths, and the data were not evaluated in the context of assessment of risk to human health or the environment.

In summary, the Tribe does not believe the Navy has presented information or data to support the finding that the OU A remedy at Charleston Beach achieves short-term protectiveness. The Tribe recommends that the OU A protectiveness statement be revised to state that a determination of protectiveness is deferred until a permanent remedy repair is selected and implemented in consultation with the Tribe, Ecology, EPA and DNR.

OU A/Charleston Beach Recommendations and Milestones

The Tribe agrees with the 5YR recommendations to: revise the remedy repair design at Charleston Beach to account for climate change and to comply with ARARs, including performance of a habitat benefit analysis; to complete consultation with the stakeholder group regarding plans for implementation of the remedy repair; and to complete construction of the repair. The milestone date for the first two actions is December 2019; the milestone date to complete construction of the repair is December 2020.

The Tribe has commented that compliance with ARARs must include meeting requirements that there be no net loss of habitat resulting from the action. The Tribe agrees with the Navy that post-Pier D mitigation conditions would represent an appropriate baseline for consideration.

Please note that the process of consultation is not complete when the planning process is finished. The Tribe expects to be actively engaged throughout the repair. In addition, based on the Tribe's experience on this project over the last 10 years, there has been a lack of consistent consultation, or even response to project team concerns and comments. It has also become apparent during project team discussion that there has been a lack of internal Navy agreement and support for this project, which has served to undermine decision-making and implementation. As a result, a considerable amount of time and money has been lost and the remedy remains unprotective. The Tribe intends to initiate more formal government to government communication with the Navy to seek confirmation that the Navy is committed to carrying out the 5YR recommendations through consultation, meeting the intent of the ARARs, and achieving project milestones.

OU B Marine Protectiveness Determination

The Tribe agrees that a protectiveness determination of the OU B Marine remedy cannot be made until further information is obtained regarding the source and extent of mercury contamination in the marine environment.

OU B Marine Recommendations and Milestones

Overall, the Tribe agrees with the recommendations and milestones for the OU B Marine follow-up actions.

As additional comments, the Tribe notes that the recommendations concerning the source control evaluation and potential EE/CA and action memorandum to address the discharge of mercury through the storm drain system and through groundwater appear in Table 8-1 under OU B Marine. While these are sources of contamination to the marine environment, the actions necessary to control these sources would seem to be more appropriately covered as OU B Terrestrial actions. Also, as previously commented, the source control recommendations fail to specifically identify sediments as a legacy source of contamination in the marine environment. Remedial alternatives developed in the FFS for mercury must address all sources.

OU B Terrestrial Protectiveness Determination

The Tribe agrees that a protectiveness determination cannot be made for OU B Terrestrial until further information is obtained regarding terrestrial sources of mercury contamination in the marine environment.

OU B Terrestrial Recommendations and Milestones

Overall, the Tribe agrees with the recommendations and milestones for OU B Terrestrial.

Please refer to the additional comment under OU B Marine regarding source control evaluation, the EE/CA and the action memo.

OU C, OU NSC and OU D Protectiveness Determinations

The Tribe agrees that the remedies for OU C, OU NSC and OU D are functioning as intended and remain protective of human health and the environment.

In addition to the comments provided in this letter, comments submitted previously via e-mail are incorporated by reference in this review. The Tribe requests a response to all outstanding comments.

Sincerely,

Denice Taylor

Denice Taylor
Environmental Scientist
Fisheries Department
Suquamish Tribe
dtaylor@suquamish.nsn.us
360-394-8449

cc: Karen Keeley, EPA
Bonnie Arthur, EPA
John Evered, Ecology
Mahbub Alam, Ecology
Erika Shaffer, DNR

INTERVIEW RECORD FOR FOURTH FIVE-YEAR REVIEW
Type 3 Interview – Natural Resources Trustee
Bremerton Naval Complex
Bremerton, WA

Individual Contacted: Tom Cressman
Title: Park Maintenance Manager
Organization: City of Bremerton
Contact Made by: Andrew Bullard
Date: 11/9/16

Summary of Communication

1. What is your overall impression of remedy performance following signing of the Records of Decision (RODs) for Operable Unit (OU) A, OU B Marine, OU B Terrestrial, OU D, and OU NSC, completion of the corrective action plan for OU C, and implementation of the remedies at the Bremerton naval complex (BNC)? Do you believe the remedies met the intent of the RODs/corrective action plan for these sites? Do you feel the remedies continue to be effective? Please indicate the basis for your assessment.

Response: None

2. In your experience, what effects have remedy implementation at BNC had on your agency and the surrounding community?

Response: None

3. Are you aware of any concerns within your agency or the community regarding the remedies in place at BNC? If so, please give details.

Response: None

4. To the best of your knowledge, are institutional controls and operations and maintenance procedures being utilized at BNC consistent with the terms of the RODs/corrective action plan?

Response: None

5. To the best of your knowledge, has the on-going program of environmental monitoring at BNC following implementation of the remedies been sufficiently thorough and frequent to meet the goals of the RODs/corrective action plan? Please indicate the basis for your assessment.

Response: None

6. Do you have any other comments, concerns, or suggestions regarding the effectiveness of the remedies in place to protect human health and the environment at BNC?

Response: None

INTERVIEW RECORD FOR FOURTH FIVE-YEAR REVIEW
Type 3 Interview – Natural Resources Trustee
Bremerton Naval Complex
Bremerton, WA

Individual Contacted: Brittany Gordon
Title: Area Habitat Biologist
Organization: WDFW
Contact Made by: Andrew Bullard
Date: 11/15/2016

Summary of Communication

1. What is your overall impression of remedy performance following signing of the Records of Decision (RODs) for Operable Unit (OU) A, OU B Marine, OU B Terrestrial, OU D, and OU NSC, completion of the corrective action plan for OU C, and implementation of the remedies at the Bremerton naval complex (BNC)? Do you believe the remedies met the intent of the RODs/corrective action plan for these sites? Do you feel the remedies continue to be effective? Please indicate the basis for your assessment.

Response: WDFW has not had enough involvement in these remedies to provide feedback at this time.

2. In your experience, what effects have remedy implementation at BNC had on your agency and the surrounding community?

Response: WDFW has not had enough involvement in these remedies to provide feedback at this time.

3. Are you aware of any concerns within your agency or the community regarding the remedies in place at BNC? If so, please give details.

Response: I am not aware of any concerns.

4. To the best of your knowledge, are institutional controls and operations and maintenance procedures being utilized at BNC consistent with the terms of the RODs/corrective action plan?

Response: WDFW has not had enough involvement in these remedies, the RODs, or the corrective action plan to provide feedback at this time.

5. To the best of your knowledge, has the on-going program of environmental monitoring at BNC following implementation of the remedies been sufficiently thorough and frequent to meet the goals of the RODs/corrective action plan? Please indicate the basis for your assessment.

Response: WDFW has not had enough involvement in these remedies, the RODs, or the corrective action plan to provide feedback at this time.

6. Do you have any other comments, concerns, or suggestions regarding the effectiveness of the remedies in place to protect human health and the environment at BNC?

Response: None

APPENDIX D

Crosswalk between CERCLA and MTCA Requirements for Bremerton Naval Complex Fourth Five-Year Review

Crosswalk between CERCLA Five-Year Review Report and the MTCA Periodic Review Criteria for Operable Unit C

MTCA Periodic Review Criteria	Discussion in Five-Year Review
The effectiveness of ongoing or completed clean-up actions, including the effectiveness of engineering controls and institutional controls in limiting exposure to hazardous substances remaining at the site [WAC 173-340-420 (4) (a)]	Conclusion are primarily found in Section 7.1, with a specific discussion regarding institutional controls in Section 6.5.
New scientific information for individual hazardous substances or mixtures present at the site [WAC 173-340-420 (4) (b)]	An assessment of changes in toxicological information for site contaminants is included in Section 7.2.
New applicable state and federal laws for hazardous substances present at the site [WAC 173-340-420 (4) (c)]	Any new state or federal laws pertaining to the remedial action are discussed in Section 7.2.
Current and projected site and resource uses [WAC 173-340-420 (4) (d)]	Site and resource use is summarized in Section 3. OU C is currently used for industrial purposes. There have been no changes in current or projected future OU C land or resource uses.
The availability and practicality of more permanent remedies [WAC 173-340-420 (4) (e)]	The institutional controls in place for this OU prevent exposure to residual soil contaminants. While higher preference is given to active cleanup technologies during ROD and CAP decision making, the selection of institutional controls in the OUC CAP remains protective of human health and the environment.
The availability of improved analytical techniques to evaluate compliance with cleanup levels [WAC 173-340-420 (4) (f)]	Any changes in analytical techniques that would affect evaluation of the remedy are discussed in Section 7.2. The analytical methods used at the time of the remedial investigation and issuance of the OU C CAP were provided reporting limits below MTCA cleanup levels. The presence of improved analytical techniques would not affect decisions or recommendations made for OU C.

APPENDIX E

Stakeholder Comment Resolution for Bremerton Naval Complex

Fourth Five-Year Review

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

Comments from: Denice Taylor, Environmental Scientist, Fisheries Department, Suquamish Tribe,
Comments dated: May 30, 2017

#	Operable Unit	Comment	Proposed Response
1	A	The Tribe does not agree with statements in the 5YR that the OU A remedy is functioning as intended and is protective in the short-term. A full decade after reporting that landfill material was being released to the shoreline and marine environments, it is obvious that temporary erosion control measures do not provide satisfactory protection of human health or the environment in either the short- or long- term. The Tribe believes this constitutes a failure of the OU A remedy.	The Navy agrees that the OU A remedy needs a permanent repair. However, the Navy respectfully disagrees that the OU A remedy is not short term protective. Unlike Segment 4, the anthropogenic materials along the intertidal area at Charleston Beach are not being released to the shoreline due to shoreline protection system (combination of rip rap, sheetpile and fish mix berm) erosion. These materials were present in/on the beach at the time the OU A and OU B Marine RODs were signed and do not constitute a new condition. The Navy considers the remedy implemented at OU A to be short-term protective based on interim erosion control measure undertaken at Charleston Beach and the recent intertidal sampling results adjacent to OU A.
2	A	While the Tribe acknowledges that planning for the repair of the OU A remedy has occurred over many years, and while the Tribe has consistently attempted to work collaboratively with the project team to address this issue, recent Navy actions have been taken without notice, consultation or the opportunity to provide meaningful input to the decision-making process. The draft 5YR, including the response to interview comments, needs to be revised to	The following will be added after the last sentence in Section 4.1.2 to capture the timeline and milestones of the remedy repair design: The remedy repair related activities during this five-year review period include: • The stakeholders reviewed and provided comments in November 2013 on the 90% design submittal. Stakeholders identified potential habitat loss and the need for mitigation in their comment on the 90% design submittal. • The Navy finalized the 100% remedy repair design in October 2015 without further stakeholder input.

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Operable Unit	Comment	Proposed Response
		describe the actual course of recent events pertaining to the OU A remedy repair. For example, the draft 5YR implies that the Navy provided response to comments and coordinated with the project team through the finalization of the report and preparation of the habitat survey. In fact, the Navy unilaterally decided to finalize the most recent design and to conduct a habitat survey without addressing comments on the 90% design that were submitted by the Tribe and other stakeholders in November 2013 and without involving the Tribe in the habitat evaluation, as the Tribe had previously requested. To date, the Navy has not provided the project team with the habitat survey report. In addition, statements in the 5YR that the design must now be reviewed because it was not anticipated that the repair would result in habitat loss are disingenuous. All of the stakeholders, including the Tribe, repeatedly identified potential habitat loss as an issue that needed to be evaluated and addressed as part of the design process. Subsequent to the issuance of the draft 5YR, the project team was also informed by the Navy's RPM that, due to lack of internal agreement and support by	• The Navy awarded a habitat benefit analysis in September 2016 to quantify any habitat loss based on the 100% remedy repair design. • The Navy awarded remedy repair construction contract in December 2016 and subsequently terminated the contract in April 2017. • The internal Draft Habitat Benefit Analysis dated December 2016 shows habitat loss of 0.5 acres between the Post-Pier D Mitigation condition and the Post-Construction Condition of 100% remedy repair design. The remedy repair project has been reprogramed for late FY19 award. This allows for consultation with the project stakeholders, revision of the design and associated habitat benefit analysis ahead of project implementation, and submittal of the associated deliverables for stakeholder review. The estimated publication date of the final project closeout report is October 2022.

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Operable Unit	Comment	Proposed Response
		Navy management, the contract to implement the repair has been cancelled and that the project no longer has funding. The recommendation in Section 8 of the 5YR to "complete" a consultation with the stakeholder group for implementation of the remedy repair and to implement the final repair is not consistent with the current status of the project, as understood by Tribal staff. The Tribe recommends that the project team, with support from legal staff as necessary, determine an appropriate administrative process to address the OU A remedy failure in a timely manner, with definitive timelines and accountability. As previously commented, the Tribe expects the Navy to engage in meaningful consultation with the Tribe regarding the evaluation of potential impacts to treaty-protected rights and resources, as well the review and re-design of any future remedial action at OU A.	
3	A	The Tribe again recommends that the anthropogenic material (fire bricks) observed on the shore at OU A be removed and disposed of properly. The same activity has been recommended by the Navy for material observed in Segment 4. Material could be	The presence of anthropogenic materials at Segment 4 is a result of shoreline protection system (riprap) erosion. Rip rap is no longer protecting underlying materials and they are in turn eroding. The Segment 4 shoreline protection system needs repair to prevent erosion of the underlying fill materials. Anthropogenic debris co-incident with the repair area along Segment 4 will be removed and disposed of properly.

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Operable Unit	Comment	Proposed Response
		removed from both areas during the same field mobilization. Add this as an issue to Table 7-11 and a recommendation to Table 8-1.	In contrast to Segment 4, the anthropogenic materials observed along the intertidal area adjacent to OU A are not being released from behind the shoreline protection system (combination of rip rap, sheetpile and fish mix berm). These materials were present in/on the beach at the time the ROD was signed. The Navy does not intend to remove anthropogenic debris from within OU B Marine along the OU A shoreline.
4	A	The Tribe does not agree with the statement on Table 5-1 that sediment results from Charleston Beach indicate that there is no contaminant pathway from OU A to OU B Marine. A more accurate conclusion is that surface sediment results indicate that there is no apparent impact to sediment quality.	The last sentence will be revised to read: "…surface sediment results indicate that there is no apparent impact to surface sediment quality."
5	B Terrestrial	The Tribe agrees that the OU B T remedy is not functioning as intended.	Comment Noted.
6	B Terrestrial	The Tribe supports the Navy's recommendation to stabilize Section 4 of the shoreline. However, prior to implementing this action, it is suggested that the project team consider the USGS groundwater study finding that indicates there is the potential for direct discharge of contaminated groundwater from this area to determine the scope of the issue to be addressed. The Tribe expects that planning for this action will be done in consultation with the project	This recommendation will be divided into two sub-recommendations and revised to read, "A. Develop a plan to stabilize the shoreline along Segment 4, while considering actions needed in light of the USGS' finding that groundwater discharges to surface water in this area. Involve both the OU B Marine and Terrestrial teams in planning for action along Segment 4. (December 2018) B. Implement the plan to stabilize the shoreline along Segment 4. (December 2020)"

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Operable Unit	Comment	Proposed Response
		team. The Tribe notes that all anthropogenic material (vs just that necessary to the stabilization effort) from Segment 4 and Charleston Beach should be removed and properly disposed during the same field mobilization.	
7	B Terrestrial	The Navy's RTC to the Suquamish interview states that source control work is planned following additional investigation and development of an EE/CA and action memo. Table 8-1 only recommends source control evaluation, with a milestone date of 2020. The EE/CA, action memo and implementation of source control need to be added to Table 8-1. Given that this is recognized as the largest known ongoing source of mercury to the marine environment, recommend that these actions be given priority and implemented as soon as possible.	The source control recommendation will be revised to include two sub recommendations: "A. Perform a source control evaluation, focused on transport of mercury through the storm drain system and direct discharge of groundwater to OU B Marine, and prepare an EE/CA and Action Memorandum to address mercury source control (December 2019). B. Implement source control actions selected in the Action Memorandum (December 2020)."
8	B Terrestrial	Regarding the Tribe's comment on the lack of internal Navy communication and coordination in implementing and tracking ICs, LUCs and O&M procedures designed to protect the remedies, the Navy asked that the comment be "reformulated". Here is the reformulated comment, which was also submitted upon	The Navy will add detail to Item No. 1 in Table 5-1, as requested in the third paragraph of this comment. The Navy will revise the completion date of this recommendation/follow-up action to "Ongoing". Additionally, the Navy add a refined version of this recommendation to Section 8 to carry this action forward as follows: Applicable to OU A, OU B T, and OU NSC – Develop and add a new section to the annual BNC Terrestrial Remedy Inspection Report to describe

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Operable Unit	Comment	Proposed Response
		review of the BNC draft 2016 Remedy Inspection Report: In the Third Five Year Review, the Navy identified the need for a more responsive program to address and document pavement and storm drain repair and maintenance work identified during annual inspection reports. The recommended action was to develop and implement a reliable BNC-wide program for executing repair work for pavement and storm drains in a timely manner after maintenance requirements are identified and to clearly document completed repairs and catch basin cleaning. The milestone date was December 2013. Please discuss the progress, or lack thereof, in implementing a BNC-wide plan. Although the Navy has provided an update on this issue in Section 5, the notes do not address how maintenance and repair recommendations are prioritized, coordinated and tracked between different departments, including NAVFAC NW, Public Works and Water and Environmental Planning. In order to evaluate the effectiveness of ICs and O&M, there has to be	ongoing and completed maintenance and repairs to pavement and storm water system. Further background on the current status of pavement and storm drainage system is provided below: **Pavement.** The recent remedy inspection reports have inaccurately depicted pavement condition at BNC as failing or in overall bad condition. • There is over 11 million square feet of paved area at BNC. • The vast majority (92%) was assessed as in good condition in 2016. • Less than 3% was assessed as in poor condition: o within OU NSC, active construction in two areas that accounted for a large portion of the total poor condition pavement, and o within OU A, a substantial change in the overall percentage of poor pavement was reported in 2016 because linear defects were lumped together and reported as an approximately 19,000 square foot area. However, overall the pavement condition within OUA is good condition. o a baseline pavement condition assessment was not completed when the terrestrial RODs were signed o During this five year review period, there has been an overall decrease (0.3%/28,005 ft2) in poor condition pavement from 2.8% in 2012 to 2.5% in 2016. o The 2016 Annual Remedy Inspection Report documented that overall 0.2% of the pavement was repaired in 2016. • The Navy continually evaluates the need for pavement repair at BNC

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Operable Unit	Comment	Proposed Response
		accountability and the ability to document actions taken. This issue and specific steps for improving the process should be carried forward in Sections 7 and 8, listed as a "General" recommended action along with the climate change updates.	and prioritizes pavement repairs as a function of condition and operational needs. • Pavement condition is assessed and documented annually during the annual remedy inspection. • Findings are passed on to Public Works for prioritization and repair. **For Storm Drainage:** • The recent remedy inspection reports have made overly broad conclusions regarding the maintenance of the stormwater system at BNC based on inspection of less than 4% of the over 4100 drain inlets. • Naval Base Kitsap Bremerton Stormwater Pollution Prevention Plan (Navy July 2016) details stormwater pollution control measures, including catch basin cleaning and maintenance requirements. • Implementation of the provisions of this plan is required as a condition of NPDES Permit Number WA-000206-2. • The six industrial stormwater inspection zones (all the terrestrial OUs fall within these zones) are inspected monthly. • Per the SWPPP, catch basins are inspected regularly by Shipyard Stormwater Program personnel and NAVFAC NW inspects and cleans catch basins at least yearly. • The SWPPP also includes record keeping and internal reporting requirements, comprehensive site compliance evaluation requirements. • Per the NPDES Permit, Code 106.3 generates a Comprehensive Site Compliance Evaluation(s) (CSCE) report at least once per calendar year as required by the NPDES permit. This report summarizes the scope, major observations, dates, and personnel completing the inspections. The report requires the signature by the "senior executive officer responsible for overall

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Operable Unit	Comment	Proposed Response
			environmental control". • The current SWPPP includes the comprehensive site compliance evaluations from 2013 through 2016. These evaluations include internal and external audit findings and recommendations for improvement. Recommendations in each year's compliance evaluation are tracked by the Stormwater Manager and reported on in the following year's evaluation. • NAVFAC RPM initiates work orders for catch basin cleaning through the Water & Environmental Planning Department to NBK Bremerton Public Works Department for locations identified during the annual remedy inspection. • NAVFAC recently completed (February 2017) cleaning and field inspecting over 44,000 lf of storm water piping in the community areas of BNC (outside the OUs but within BNC)and in all of OU NSC. The condition assessment report with repair recommendations will be finalized in early October 2017.
9	B Terrestrial	The Tribe does not agree that the issues listed in Section 7.6 related to the terrestrial OUs do not have the potential to affect protectiveness. It is recommended that the Navy develop specific actions and milestones to address these issues in Section 8.	Following further review of the OU A and OU B Marine RODs and supporting historical documents, the Navy has concluded that the anthropogenic materials observed along the intertidal area adjacent to OU A were present in/on the beach at the time the ROD was signed and OU A and OU B Marine RAOs are being met. Therefore, Item 2 in "Other Findings" will be removed. Items 1 and 3 do not affect protectiveness because these recommendations only make adjustments to monitoring and maintenance elements of the terrestrial remedies. The remedy requirements to perform long-term groundwater monitoring, and to regularly inspect the shoreline armoring remain in place and functioning. Adjustments to the monitoring strategy

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Operable Unit	Comment	Proposed Response
			are typically recommended in five-year reviews and rarely constitute issues affecting protectiveness Routine maintenance of the shoreline erosion protection is coordinated between NAVFAC NW, NBK –Bremerton Public Works and NAVFAC EXWC.
10	B Marine	The Tribe agrees that the remedy is not functioning as intended.	Comment noted.
11	B Marine	The Tribe has not relinquished treaty rights in any part of Sinclair Inlet. Remedial decisions for OU B Marine must be protective of treaty-protected rights and resources as reasonably anticipated future uses. Tables 3-1 and 4-1 need to be revised. Table 3-1 should also be revised to identify risks related to mercury, which were known but not directly addressed at the time of the ROD.	The Navy will modify Table 3-1 to list mercury as a "primary threat," citing the Suquamish consumption study. In addition consistent with EPA (Keeley) Comment No. 23, the following changes will be made to Table 4-1: The Navy will add to the Reasonably Anticipated Future Use column of Table 4-1 the following text: "Suquamish Tribe's Usual and Accustomed Fishing Area[1]". The Navy will also revise the footnote to Table 4-1 to read as follows: [1] Sinclair Inlet is an exclusive portion of the Suquamish Tribe's adjudicated Usual and Accustomed fishing area that is reserved under the 1855 Treaty of Point Elliott. The Tribe's treaty reserved fishing rights are firmly established as a matter of federal law and are co-located with the Navy's facilities in Sinclair Inlet. The Tribe harvests several species of finfish within Sinclair Inlet and intends to harvest shellfish that is safe to consume in the future. The Navy and Tribe work on a government-to-government basis to respectfully and fairly address each party's federal interests without interference.."

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Operable Unit	Comment	Proposed Response
			The Navy will add natural recovery to the remedy components listed for OU B Marine in Table 4-1.
12	B Marine	The document needs to be clarified to consistently state that a mercury remedy will address upland source control as well as risks posed by contaminated sediments and bioaccumulation in marine organisms. In some places it reads as if only source control will be implemented.	The Navy will modify the text as follows: Page iii, Line 11, "…addresses mercury source control as well as risks posed by mercury in sediments and bioaccumulation in marine organisms." Page iv, Line 3, "…addresses mercury source control as well as risks posed by mercury in sediments and bioaccumulation in marine organisms." Page 7-3, Lines 1-2, "However, mercury source control, as well as risks posed by mercury in sediments and bioaccumulation in marine organisms at BNC, must be addressed for the OU B Marine remedy to be considered functional (see additional discussion in Section 7.1.3.1)" Page 7-4, Line 15, "…addresses mercury source control as well as risks posed by mercury in sediments and bioaccumulation in marine organisms." Page 7-20, Line 18, "However, mercury source control, as well as risks posed by mercury in sediments and bioaccumulation in marine organisms at BNC, must be addressed for the OU B Marine remedy to be considered functional." Page 7-20, Line 29, "…addresses mercury source control as well as risks posed by mercury in sediments and bioaccumulation in marine organisms."

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)

Document dated: April 2017

#	Operable Unit	Comment	Proposed Response
13	B Marine	The project team has agreed that additional sampling is needed to verify achievement of the PCB sediment MCUL and to confirm that sediment quality continues to improve through natural recovery. The need for additional sampling beyond the next event has yet to be determined. The next LTM event should be identified in Table 7-11, with a recommendation and milestone date added to Table 8-1.	The Navy respectfully disagrees that the confirmatory monitoring event for PCBs should be elevated to an Issue and formally tracked as a Recommendation. The monitoring requirement established by the remedy is in place and functioning. Adjustments to the monitoring strategy are typically recommended in five-year reviews and rarely constitute Issues affecting protectiveness. The OU B Marine Team has agreed to the confirmatory monitoring event for PCBs, the schedule has been established, and the funding has been programmed by the Navy. The following text will be added to the end of Section 7.1.2.2 to clarify that future OU B Marine sampling decisions will follow the decision framework; "The OU B Marine Team has put a decision framework process in place. The Decision Framework will be developed during the next review period and will include methods to assess OU B Marine non-LTM data and to guide future sampling and remedy selection."
14	B Marine	In Section 6.4.3.2, the OU A (thick layer) cap and the ENR (thin layer) cap are described as being susceptible to loss of material due to wave and tidal erosion. This issue needs to be evaluated in the context of remedy performance in Section 7.1.2. Has cap thickness, especially the thick layer containment cap, been impacted to the point where protectiveness may be affected and/or maintenance is required?	The existing text in Section 6.4.3.2 of the draft five-year review is from the 2012 OU B Marine Monitoring Report. Based on this comment, the Navy reviewed the history of the capping and sediment transport study information in more detail and has concluded that the 2012 OU B Marine monitoring report is somewhat misleading with regard to ENR and thick cap performance. Based on the Navy's review, Section 6.4.3.2.2 will be revised to read as follows: "The cap and ENR remedial measures involved placement of clean sediment from the CAD pit excavation, along with surficial layers of imported gravel and quarry spalls in adjacent intertidal areas. Both the newly-placed sediment material and underlying sediment are sandy silt, and some gradual consolidation was expected to occur in the cap area following

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Operable Unit	Comment	Proposed Response
			construction. Previous surveys found a decrease in elevation of portions of the nearshore cap of up to 4 feet. The 2010 and 2012 survey results show that an additional decrease in seafloor elevation of 1 to 2 feet has occurred in some portions of the nearshore cap. Differences in elevations in the thick cap areas (and in the ENR area) may be due to consolidation, vertical accuracy of the individual surveys, equipment differences, differing vertical datums, horizontal accuracy of surveys, or use of different survey controls points. Survey results need to be revalidated to identify the reason or reasons for the differences in elevation to determine if protectiveness has been affected in the thick cap areas. In the ENR area, the post-construction survey and the four subsequent surveys with a few minor exceptions track within 2 feet of each other. Inter-survey differences of this magnitude are considered to be within the range of expected variability. Loss of surface material in the ENR area could interfere with the goal of clean placed material gradually mixing with the native sediment. However, only a few locations are 2 feet lower than in the post-construction survey. Most of these locations are closely adjacent to the area planned for full capping and were actually covered with 4 to 8 feet of clean cover sediment. Changes in the seafloor elevation in such locations may be at least partially a result of consolidation of the surface cover". Additionally, Section 7.1.2.1 will be revised to read as follows: "The physical construction components of the OU B Marine remedy were completed by March 2004 (see Section 4.2.3). To validate that these physical components are functioning as intended by the ROD, a review and

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Operable Unit	Comment	Proposed Response
			revalidation of the bathymetric survey data from the post-construction survey through the 2012 survey in the CAD pit, ENR and thick cap areas should be completed. In addition, mercury source control at BNC must be addressed for the OU B Marine remedy to be considered functional (see additional discussion in Section 7.1.3.1)." Table 7-11 will be updated to include the following issue under OU B Marine: "Bathymetric survey data from the post-construction survey through the 2012 survey showed elevation changes and the reasons for these changes are not clearly understood". Table 8-1 will be updated to include the following recommendation under OU B Marine: "Complete a review and revalidation of the bathymetric survey data from the post-construction survey through the 2012 survey in the CAD pit, ENR and thick cap areas to validate if the physical components are functioning as intended by the ROD."
15	B Marine	In Section 6.4.3.5, include a comparison to natural background levels, as presented and discussed in the monitoring report.	The Navy will add the equivalent of Table 3-1 and Figure 3-1 from the 2014/2015 Phase 2 Data Report. The Navy will also add the following sentence from the 2014/2015 Phase 2 Data Report on Line 29 of the five-year review, "However, sample CB-6 exceeded the natural background values shown in Table 3-1 for cadmium, copper, lead, and silver, and samples CB-1 and CB-3 also exceeded natural background for lead."
16	B Marine	In Section 7.2.1.2, provide a citation for the section of the ROD that confirms the	This statement will be removed.

#	Operable Unit	Comment	Proposed Response
		statement that achievement of the MCUL for PCBs in sediment will lead to removal of the site from the NPL.	
17	B Marine	The Tribe does not agree with the Navy's evaluation that the process and data used to establish the MCUL for PCBs equates with the process or data requirements for establishing regional background as provided for in the 2013 revisions of the WA SMS. This section needs to be re-evaluated with input from Ecology.	The Navy will substantially revise Section 7.2.1.2 of the five-year review starting with paragraph 4, as follows: "The OU B Marine ROD (Navy et al., 2000) identified RAOs for sediment and associated minimum cleanup levels (MCULs), action levels, and long-term cleanup goals for PCBs and a combined action level for col-located PCBs and mercury. The way in which the cleanup levels and cleanup goals for PCBs and mercury may be interpreted in light of the revised SMS is the focus of the following discussion. **PCBs.** The RAO for addressing PCBs in sediment was based on the human health risk assessment finding that unacceptable risks were posed to subsistence seafood consumers, primarily from the presence of PCBs in tissues of bottom-dwelling fish. However, no risk-based cleanup goals were calculated for PCBs in sediment or tissue in the ROD. Instead, the long-term cleanup goals in the ROD for sediment (1.2 mg/kgOC) and tissue (0.023 mg/kg wet weight) were established based on the 90th percentile of sediment and tissue reference area concentrations, inferred at the time to represent natural background (add per footnote: In OU B Marine ROD Section 9.3.3 both sediment and fish tissue reference-area concentrations included the parenthetical "i.e., natural background"). This was done as it was expected that risk-based sediment concentrations would be below natural background, which is the case for most bioaccumulative

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Operable Unit	Comment	Proposed Response
			carcinogenic chemicals such as PCBs. Whether to change the sediment PCB cleanup goal of 1.2 mg/kg OC was one of three issues resolved and documented in the May 2009 Joint Resolution Statement (JRS) by the Dispute Resolution Committee (DRC), consisting of representatives from the Navy, EPA, and Ecology. The DRC concluded that no change in the Sinclair Inlet cleanup goal was warranted and that the goal represents ideal clean conditions and may be at or below background levels for Sinclair Inlet. The rationale in the JRS was based on "a preliminary review of an August 2008 set of PCB aroclor concentrations in sediment at 70 non-urban locations throughout Puget Sound". These data are identified in the DRC Navy support documentation as the "DMMP Bold data". The JRS infers that the Bold data evaluation results are consistent with the cleanup goal of 1.2 mg/kg OC, stating "If the [2008] sampling was representative of background, these detections indicate an approximate 96% confidence that the true background is below 2.95 mg/kg OC and an approximately 94% confidence that it is below 1.12 mg/kg OC." It is recognized that per Ecology's Sediment Cleanup User's Manual (SCUM) II, Ecology has determined that a collective data set (referred to as Bold Plus) is appropriate to establish natural background in Puget Sound, and that the Bold Plus data includes not only the 2008 Bold data, but data from approved samples. However, based on review of the new SMS rule and the DRC's conclusion that the 1.2 mg/kg OC cleanup goal represents ideal clean conditions and may be at or below background,There has been no change in the approach used to establish the OU B Marine cleanup goals for PCBs in sediment that would affect the protectiveness of the selected remedy.

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Operable Unit	Comment	Proposed Response
			The ROD also defined a minimum cleanup level (MCUL) of 3 mg/kgOC for PCBs in OU B Marine sediments, defined as representing a site-specific concentration limit to protect human health and the environment, conditioned by site-specific circumstances (e.g., sensitive habitats, engineering feasibility, and cost). The MCUL of 3 mg/kgOC was based on modeling results for natural recovery, following active remediation using the action levels defined in the ROD. The action level for dredging (12 mg/kgOC) was selected because it was (1) lower than the calculated cost-effectiveness threshold of 14 mg/kgOC, (2) consistent with the Washington State SQS (benthic) criterion, and (3) generally fell within the range of other regional marine sediment cleanup action levels. A PCB action level of 6 mg/kg OC was selected to identify areas of sediment in which enhanced natural recovery actions would be considered (as accomplished by thin-layer capping). Combined with incidental removal of PCBs accomplished by the planned navigational dredging and considering the effects of natural recovery, remediation of PCBs at these action levels predicted attainment of the MCUL of 3 mg/kg OC within 10 years. The MCUL is defined in the ROD as the primary measurable objective for cleanup of PCBs in OU B Marine sediments. Achievement of the MCUL in shallow sediment (0-to 10-cm depth) signals compliance with the RAO to reduce the concentration of PCBs in sediments to below the minimum cleanup level in the biologically active zone within marine OU B, as a measure expected to reduce PCB concentrations in fish tissue. With regard to source control, shoreline areas have been stabilized to minimize the potential for erosion of contaminated fill material into the marine environment, and ICs have been implemented to maintain the

#	Operable Unit	Comment	Proposed Response
			integrity of the shoreline stabilization measures. Remedial actions have been implemented in the terrestrial areas of BNC to reduce the potential for chemical transport and control the threat of recontamination of the adjacent marine environment from contaminant transport through the stormwater system; infiltration of soil and groundwater into the stormwater system; infiltration of surface water into site soil; and erosion of shoreline soil. However, the 2013 revisions to the SMS clarify Ecology's expectations for demonstrating control of upland sources that have the potential to re-contaminate areas of sediment remediation (WAC 173-204-500[4]). **Mercury**. The 2000 ROD did not select a cleanup goal specific to mercury in sediment. Rather, the ROD selected a combined action level of 6 mg/kgOC PCBs and 3 mg/kg mercury in sediment to achieve the RAO for mercury to selectively remove sediment concentrations of mercury co-located with PCBs. The Washington State SMS SQS for mercury at the time the ROD was signed was 0.41 mg/kg and the MCUL was 0.59 mg/kg. Currently, the SCO is the SQS of 0.41 mg/kg and the sediment cleanup level remains at 0.59 mg/kg. There has been no change in ARARs for mercury in sediment since the signing of the ROD that would affect the selected remedy. Mercury is now a COC for OU B Marine based on the findings of a supplemental risk evaluation (Navy, 2010d). The Navy and the OU B Marine stakeholder team are working to address mercury–related human health risks associated with subsistence-level consumption of Sinclair Inlet marine species. In early 2017, this team completed the framework document (Navy, 2017d) and SMIR (Navy, 2017c). Currently, this team is completing tasks that will enable a focused feasibility study for mercury to be

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Operable Unit	Comment	Proposed Response
			completed including mercury source control investigation. The focused feasibility study may include development of site-specific cleanup goals for mercury in sediment and/or tissue to address human health risks from the consumption of mercury in Sinclair Inlet seafood (see also discussion in Section 7.2.2)."
18	B Marine	Please clarify whether the review of ARARs considered the recently promulgated (December 2016) changes to marine water quality criteria for the protection of human health.	The impact of these ARARs changes on remedy protectiveness will be evaluated as part of the planned addendum that will address the protectiveness of OU B Terrestrial, with a milestone date of December 2020. The following changes will be made: New 2nd sentence in 7th paragraph of ES: "Surface water quality standards (Ecology 2017) were revised since the last five-year review but after the review period of this five-year review. This ARARs revision will be evaluated as part of the planned addendum that will address the protectiveness of OU B Terrestrial. A finding will be added to Section 7 and a recommendation to Section 8 to evaluate how changes to WQC may impact protectiveness, with a timeline attached. Timeline December 2020.
19	B Marine	The Tribe agrees with the development of an IC plan for OU B Marine. The plan should describe what measures are required or are in place to protect the physical integrity of the CAD pit cap and the OU A thick layer containment cap.	The Navy will revise the milestone date for the OU B Marine IC plan to March 2018 – so that IC inspections can be performed during the planned 2018 OU B Marine LTM sampling event. The Navy believes that the detailed content of the IC Plan should be established through the OU B Marine technical team meetings, and not within this five-year review.

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

Comments from: Mahbub Alam, Cleanup Project Manager and John Evered, Cleanup Project Manager
Comments dated: May 30, 2017

#	Page No./ Line No.	Comment	Proposed Response
1	General	Charleston Beach Remedy – Ecology is very frustrated and concerned at this issue since the remedy repair has been in the works for more than a decade and yet incomplete with uncertain path forward. The temporary placement of gravelly material probably does little to the habitat restoration or enhancement rather it may exacerbate the situation with addition of new gravel every year or two. Ecology requests that the Navy makes this project a priority for funding and complete the remedy repair at the earliest with stakeholder's input.	Completing the Charleston Beach remedy repair is a formal recommendation of this five-year review.
2	General	BNC Wide Program for Pavement and Storm Drain System – Ecology believes recommendation number one from 3rd Five-Year Review is incomplete and is a work in progress. It recommends to carry forward the recommendation with more specific language and documentation for repair work.	Please see the Navy's detailed response to this issue in our response the Suquamish Tribe's Comment No. 8.
3	General	Source Control for the Terrestrial COCs – At present, there is little information on what and how much terrestrial COCs are being transported and discharged through the storm drain and other	The Navy agrees that source control is critical to successful sediment remediation. Source control at BNC is managed through existing environmental management plans including the SWPPP, the Water Pollution Prevention and Control Plan (PSNS&IMFINST P5090.30C), the Spill Prevention

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
		discharge systems (e.g., dry dock discharge) in the Sinclair Inlet. Ecology would like to see a recommendation in the Five-Year Review to develop a data driven source control program in measuring the effectiveness of the remedy as stipulated in OU BT ROD.	Control and Countermeasure (SPCC) Plan, the Integrated Contingency Plan, and the Hazardous Materials Control and Management (HMC&M) Plan. The Navy proposes no change to text in response to this comment.
4	General	Use of Natural and Regional Background terms – Ecology requests that the references made regarding natural and regional background be altered to reflect the definitions within the Sediment Management Standards.	Please see the Navy's response to Suquamish Tribe's Comment No. 17.

Comments from: Mahbub Alam, Cleanup Project Manager, BNC Terrestrial
Comments dated: May 25, 2017

#	Page No./ Line No.	Comment	Proposed Response
1	Table 5-1	**Carry Forward Recommendation Number One in Table 5-1:** Ecology believes recommendation number one is incomplete and is a work in progress. Section 12.2.6 of the OU B-T ROD stated,	Please see the Navy's detailed response to this issue in our response the Suquamish Tribe's Comment No. 8.

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
		"*The persistence of the remedy, the effectiveness of the remedy in meeting the RAOs, and the effectiveness of the inspection and maintenance measures will be reviewed and evaluated as part of the periodic reviews.*" Ecology could not find such explicit evaluation performed under the Five-Year Review. We would like to carry forward the recommendation with more specific language and documentation for repair work. The reasoning behind this recommendation are: • Stated in Page 5-2, "*The 2016 Annual Remedy Inspection Report has documented only 2.54% poor pavement overall (within paved areas of OU A, OU B Terrestrial, and OU NSC).*" Ecology finds that percentage of poor pavement condition "only 2.54%" may not be a good indicator to show whether the IC remedy is still limiting rainwater infiltration. "2.54% poor" does not mean that only 2.54% of rain volume is infiltrating at the site rather, most likely, more than 2.54% of rain are infiltrating due to presence of	

#	Page No./ Line No.	Comment	Proposed Response
		preferential pathway. This can at best be used to track and compare progress from previous years. • Stated in Page 5-2, "*A listing of the catch basins noted with high levels of solids during the annual O&M inspection are forward on to the NBK Bremerton Public Works Department through Water & Environmental Planning Department to be cleaned/cleared.*" Ecology is concerned that stakeholders are not provided with follow up documentation showing whether repairs were completed in a reasonable timeframe per recommendation of the annual remedy inspection report. A more concerted effort between different Navy components especially NBK environmental and NAVFAC NW is necessary for ROD implementation. • Stated in Page 5-2, "*Solids from stormwater system catch basins that are accessible for cleaning are removed at least annually by NBK Bremerton*	

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
		Public Works Department." Ecology would like to see the documentation of this work per section 12.2.6 of the OU B-T ROD. Currently, there is no performance measure whether removing solids annually from accessible catch basins meets the effectiveness of the remedy maintenance in meeting the RAOs.	
2	Page 5-3/ Table 5-1	Charleston Beach Remedy: Page 5-3 in Table 5-1 stated, "The Navy completed the 100% design of a remedy repair." While Ecology and other stakeholders reviewed and commented on the 90% design, they have not seen the 100% design and response to comments. Apparently, stakeholders learnt the contract has been terminated and the future of the remedy repair is uncertain. Ecology is very frustrated at this issue because it has been in the works for more than a decade and yet incomplete with uncertain path forward. Ecology is also concerned that adding fish mix (not sure it is a good term for some gravel placement) temporarily	Please see the Navy's response to Ecology's General Comment No. 1

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
		every year or couple of years does little to the habitat enhancement/restoration rather it may exacerbate the habitat situation with new gravel placement. In addition, it is unacceptable that landfill materials are exposed and being transported in the marine environment causing damage to human health and environment. Ecology demands that the Navy makes this project a priority for funding and complete the remedy repair at the earliest with stakeholder's input. The Navy needs to provide a definite schedule and commitment for funding.	
3a		**High Level of COCs in BNC Terrestrial Wells:** LTM data show many terrestrial wells in OU A, OU B and OU NSC are above remediation goal. For example: • Regarding OU A ground water monitoring wells, Page 6-3, Line 28 stated, "For wells 203 and 241, arsenic concentrations continue to be above the ambient concentration; however, recent concentrations measured in these two wells are similar to those	It is important to review the groundwater monitoring results in the context of the risk assessments performed prior to selection of the remedies at the terrestrial OUs, and the goals of the groundwater monitoring as stated in the RODs, which are the controlling legal documents for CERLCA actions in the terrestrial OUs at BNC. Overall, the terrestrial RODs selected remedies meant to be protective of the marine environment, with protection of the direct contact and ingestion pathways for soil and groundwater addressed through engineering and institutional controls. Restoration of groundwater beneath BNC to drinking water standards was not a goal or an expected outcome of the terrestrial RODs. The groundwater monitoring data are meant to verify that the acceptable risk conditions present at the time of the RODs are stable over time and remain protective of surface water, not that groundwater restoration towards a cleanup goal is progressing. For

#	Page No./ Line No.	Comment	Proposed Response
		concentrations detected at the time the ROD was executed." To note Arsenic concentrations in well 203 are significantly above the remediation goal (sometimes more than 300 times the remediation goal). Mann-Kendall trend analysis showed no trend with stable condition. In addition, tidal mixing occurs in the well, therefore, true groundwater concentration is much higher. Ecology believes further investigation is necessary whether this Arsenic plume is affecting surface water quality ARAR to protect human health and environment. In addition, As Concentration trend does not provide for a reasonable restoration timeframe. Nickel, Zinc, and Copper also continue to exceed RGs and do not provide for a reasonable restoration timeframe.	this reason, the five-year review recommends discontinuing trend analysis, which implies monitoring progress towards a cleanup goal, in favor of comparison to a historical range of typical concentrations. This recommended monitoring change will be considered by the BNC Terrestrial team. At OU A, the fate and transport of the elevated groundwater COC concentrations cited in this comment were evaluated through numerical modeling and through analysis of seep samples concluded to be representative of groundwater discharging to surface water (OU A ROD, page 6-28). As stated in the OU A ROD, page 8-4, regarding the groundwater to surface water pathway, "Evaluations of fate and transport processes involving this pathway were performed during development of the FS and proposed plan. These evaluations indicated that under current site conditions, the mass flux of contaminants in OU A groundwater in the marine water does not significantly affect ambient concentrations in Sinclair Inlet." The ROD concluded that (emphasis in original), "The implication is that marine sediments likely were affected by waste disposal practices in the past but ***currently*** those chemicals are not being transported at appreciable levels to Sinclair Inlet by groundwater flow from terrestrial areas of the site." Samples of marine sediment and tissue were collected in support of the OU A investigations, and bioassays were performed. These marine data were to be assessed as part of OU B Marine. The OU A ROD deferred final assessment of the risks to human health via the subsistence shellfish harvester pathway to the OU B Marine ROD (OU A ROD, page 7-13), but did conclude that unacceptable risks existed offshore of OU A for subsistence

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
			shellfish harvesters (OU A ROD, page 8-1). The OU A ROD also committed to additional assessment of the groundwater to surface water pathway as part of OU B. The RODs for OU B did not require any additional action for groundwater at OU A. Based on these assessments, the OU A ROD included an RAO to "Reduce the transport of chemicals to groundwater or the marine environment." An RAO was not established to restore groundwater beneath OU A to drinking water standards, because the groundwater was concluded to be non-potable. The remedy components selected to meet the groundwater RAO were, "Upgrading the pavement cap over approximately 3.7 acres," and "Conducting a groundwater monitoring sampling and analysis program." As reiterated in Section 7.6.1 of the fourth five-year review, the purposes of groundwater monitoring stated in the OU A ROD were to: • Verify that groundwater contaminants are not significantly affecting marine waters in Sinclair Inlet. • Detect potential releases to the marine environment. • Determine whether contaminant levels in groundwater are being reduced through capping, placement of riprap, and natural processes. The fourth five-year review did not identify any changes in site conditions or new information to call into question the OU A ROD conclusion that "The implication is that marine sediments likely were affected by waste disposal practices in the past but ***currently*** those chemicals are not being

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
			transported at appreciable levels to Sinclair Inlet by groundwater flow from terrestrial areas of the site."
3b		• Regarding OU BT wells, Page 6-5, Line 3 stated, "*Several of the monitoring wells exhibit COC concentrations that consistently exceed the compliance criteria. At these monitoring wells, however, most COC concentrations are not significantly different from those at the time the ROD was executed, when it was "concluded through analyses of primary fate and transport mechanisms that site groundwater is sufficiently protective of the marine environment" (Navy et al., 2004a).* Ecology reviewed this reference and found no evidence of any fate and transport model that describes the site groundwater is sufficiently protective of marine environment. Copper, Zinc, Mercury, Nickel concentrations in the ground water appear to fail to comply with surface water quality ARARs. Mann-	The OU B Terrestrial ROD explicitly did not establish cleanup levels for soil or groundwater. Instead, comparison criteria were established for groundwater to "verify predictions that site groundwater is protective of the marine environment." As stated in the OU B Terrestrial ROD, page 6-10, "Mathematical modeling and other analyses reported in the OU B RI report have predicted that even with the drainage relief systems out of operation, which is considered the most conservative scenario, direct groundwater discharges are not a threat to the marine environment." These conclusions are expanded upon in Section 6.5.5 of the OU B Terrestrial ROD. Key conclusions of the evaluation of groundwater fate and transport in the ROD are the following: • Potential impacts to marine water and marine sediments from direct groundwater discharges are very limited, and groundwater discharges are not likely to result in exceedances of surface water standards or sediment quality standards within Sinclair Inlet • Site groundwater is sufficiently protective of the marine environment and the recently implemented remedy for OU B Marine that active remediation of groundwater is not warranted The OU B Terrestrial further concluded that groundwater beneath OU B Terrestrial was not a current or future source of drinking water and is not

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
		Kendall trend analysis results show increasing trend for Copper, Zinc, and Mercury at LTMP-1.	potable, and therefore restoration of the aquifer to drinking water standards was not established as an RAO. Regarding cleanup levels, the OU B Terrestrial ROD concluded the following: "No cleanup levels have been established for this site. The RAOs are based on the need to contain contaminated terrestrial media (i.e., accumulated stormwater system sediment and debris, soil, and groundwater) and limit transport to the adjacent marine environment. The RAOs do not identify the need to remediate stormwater system sediment, soil, groundwater, or surface water based on risks due to direct exposure to those media." Because the ROD found that site groundwater was sufficiently protective of the marine environment at the time of the ROD, and conditions have not worsened since that time, the five-year review concludes that the remedy remains as protective as at the time of the ROD. The historical range of data reported for OU B Terrestrial wells since the time of the ROD is provided in Tables 7-13 through 7-15 of the five-year review.
3c		• OU NSC monitoring well 392R continue to exceed remediation goals for both TPH-D and TPH-O. Mann-Kendall trend analysis results show increasing trend for both of these hydrocarbon fractions. In addition, well 392/392R occasionally exhibited free product. Ecology believes petroleum	The Mann-Kendall trend analysis for TPH-D does not show an increasing trend – Latest trend report (2016 Data Summary and Trend Analysis Report) shows no trend exists at the 80% confidence level and the concentration is stable. The TPH concentrations measured recently in this well do not call into question the protectiveness of the remedy because the current concentrations are less than those observed at the time of the ROD, when risks were found to be acceptable, and petroleum hydrocarbons were not

#	Page No./ Line No.	Comment	Proposed Response
		hydrocarbons may have been discharging into the inlet above MTCA cleanup standards.	considered to be discharging to Sinclair Inlet above MTCA cleanup standards. The OU NSC ROD, page 8-2, states, "The fate and transport modeling of chemicals in the OU NSC groundwater indicated that, under present site conditions, the mass flux of contaminants in groundwater discharging into the marine water does not appear to significantly affect ambient concentrations in Sinclair Inlet. This is because OU NSC groundwater is diluted with Sinclair Inlet water and other groundwater as it enters Drydock 6. This indicates that OU NSC groundwater probably does not represent a significant risk to the marine environment." OU NSC groundwater was determined to be non-potable in the ROD. The OU NSC ROD also committed to additional assessment of the groundwater to surface water pathway as part of OU B. The RODs for OU B did not require any additional action for groundwater at OU NSC. The historical range of data reported for OU NSC wells since the time of the ROD is provided in Table 7-17 of the five-year review. No text changes are planned to address this comment in the FYR.
3d		In addition to failure to meet these remediation goals (surface water quality ARARs), these terrestrial COCs continue to transport in marine environment through ground water and stormwater. Since PCBs and mercury are the only COCs stipulated in the OU B marine ROD, no further	Navy respectfully disagrees with Ecology's use of the term "remediation goals" associated with OU B Terrestrial groundwater and Ecology's interpretation of the Salt Water Main Break data. As stated in the OU B Terrestrial ROD, page 6-10, "Mathematical modeling and other analyses reported in the OU B RI report have predicted that even with the drainage relief systems out of operation, which is considered the most conservative scenario, direct groundwater discharges are not a threat

<table>
<tr><th>#</th><th>Page No./ Line No.</th><th>Comment</th><th>Proposed Response</th></tr>
<tr><td></td><td></td><td>evaluations were made under the LTM for other COCs including several metals that continue to exceed the remediation goals in ground water. A 2015 salt water main break prompted the Navy to sample sediments near the three discharge locations. Results from this sampling indicated the following (Navy, 2016):
<table>
<tr><th>Contam-inant</th><th>Number of detections/ samples</th><th>Number of samples exceed SCO[1]</th><th>Number of samples exceed CSL[2]</th></tr>
<tr><td>Arsenic</td><td>18/18</td><td>9</td><td>6</td></tr>
<tr><td>Copper</td><td>18/18</td><td>4</td><td>4</td></tr>
<tr><td>Lead</td><td>18/18</td><td>3</td><td>3</td></tr>
<tr><td>Mercury</td><td>18/18</td><td>15</td><td>15</td></tr>
<tr><td>Zinc</td><td>18/18</td><td>8</td><td>4</td></tr>
<tr><td>Total PCBs (OC normalized samples only)</td><td>15/15</td><td>15</td><td>1</td></tr>
</table>
[1]Sediment Cleanup Objective;
[2]Cleanup Screening Level

As it can be seen from the above Table that the terrestrial COCs are making its way to</td><td>to the marine environment.” There are no groundwater remediation goals for OU B Terrestrial. Please see additional discussion of the groundwater to surface water pathway in the response to comment 3b.

As documented in the Goals and Objectives for Decision Framework Process for PCBs and Mercury in OU B Marine (Navy, 2017d), the Navy and stakeholders are in the process of developing a “Decision Framework” to guide future decision-making for OU B Marine, reflecting the results of long-term monitoring, findings from ongoing assessment of mercury contamination, and new information from other investigations and studies. As with other non-LTM data, the Salt Water Main Break Data will be considered in the decision framework process. The Decision Framework will include assessment of all non-LTM data, inclusive of metals other than mercury, despite the fact that the formal title only references PCBs and mercury.

Please also refer to the Navy’s response to Suquamish Tribe’s Comment No. 8 for a related stormwater discussion.

No text changes are planned to address this comment in the FYR.</td></tr>
</table>

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
		the marine environment causing exceedances to the sediment management standards beyond mercury and PCBs. Ecology believes recontamination is likely occurring in the inlet from other upland COCs due to inadequate upland source control. Ecology would like the Navy to investigate ways to limit contaminant migration from the uplands to the marine environment (remedial action objective of terrestrial RODs) so that human health and environment are protected. Ecology would like to see a recommendation in the five year review for a data driven source control program so that progress can be measured quantitatively over a period of time.	
4		**Current Regulatory Level for Protection of Surface Water:** Ground water cleanup levels for protection of surface water as shown in Table 7-4, 7-5, 7-7, 7-8, & 7-10 need correction. The regulatory level was based on MTCA method B SW. However, the current regulatory level for many of these COCs have changed due to new	See Response to Suquamish Tribe Comment #18 above.

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
		Washington surface water quality criteria for protection of human health (some criteria are state adopted and some are EPA promulgated effective 12/28/2016). Ecology recommends to correct these current regulatory levels. Refer to the EPA website for the new criteria (https://www.epa.gov/wqs-tech/water-quality-standards-regulations-washington#fed). Changes in these Tables would also lead to changes in the text as necessary.	
5	7-9/1	**Reevaluation of Site Cleanup Levels/Remediation Goals Based on New Information:** Page 7-9, Line 1 stated, "*At OU A, groundwater monitoring is currently only required for arsenic, copper, lead, nickel and zinc and no longer required for the other COCs shown in Table 7-4 in accordance with the recommendations of the first five-year review (Navy, 2002e).*" The Draft Fourth Five-Year Review discussed protectiveness for organic COCs for which ROD remediation goals were based on Practical Quantitation Limit	The Navy believes that this comment is meant to reference the water quality criteria for human health value of 0.00017 µg/L PCBs. This value is below the current PQL for standard analytical methods. PCBs were removed from the OU A monitoring program because PCBs were not detected above the PQL available during post-ROD monitoring, which is not significantly different than the PQL available today (0.01 ug/L). As stated on Page 7-9, Lines 29-33, organic COCs were removed from the OU A analyte list with the approval of EPA and Ecology. The PQL available today for PCBs is not significantly different from the PQL available at the time of that decision. Therefore, resuming monitoring for PCBs in groundwater at OU A would not provide additional information that would affect the protectiveness determination for OU A. Per NIRIS, OU A wells MW204, MW206, MW241, PS03-MW03 were sampled 2/20/02. All ND at RLs between 0.039 and 0.041 ug/L.

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
		(PQL). Ecology finds this was not the case for PCBs. PCBs were removed from groundwater monitoring at OU-A and OU-NSC site based on laboratory reporting limit of 0.2 ug/L in January 2000 (ROD PQL is 0.02 ug/L for Aroclor 1260). The current regulatory level for total PCBs is 0.000007 ug/L (newly promulgated surface water quality ARAR for human health protection in WA State effective 12/28/16). Ecology recommends PCB monitoring in the groundwater with improved analytical techniques to determine the protectiveness of the remedy.	
6	6-4/Line32	**Attenuation From Compliance Monitoring Wells to Ground Water Discharge Points:** Page 6-4, Line 32 stated, "*The estimation method assumes that constituent concentrations in groundwater will be reduced by the ratio of groundwater salinity to that of Sinclair Inlet surface water salinity.*" This methodology does not make sense. For example, if a well is not affected by salinity, the chemical constituent concentration would be	The sentence following the quoted sentence provides further explanation that the Navy believes addresses Ecology's concern in this comment. COC concentrations in shoreline wells LTMP-1, LTMP-2, LTMP-3, and LTMP-5 are not attenuated, because these wells are located immediately adjacent to the shoreline. The attenuation methodology was approved by Ecology through approval of the original LTM plan in 2004. However, this five-year review acknowledges that the attenuation methodology should be re-evaluated (Page 7-23, Lines 30-31) as part of optimizing the monitoring approach.

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
		reduced to zero or close to zero. This would seem that there is no chemical discharges to the Sinclair inlet. In reality, the ground water is ultimately being discharged, may be in a different fashion, such as, a drydock pumped ground water discharge. Ecology made similar comment on the 2017 Draft Trend Analysis Report and the Navy responded to discuss this in the future. Ecology recommends to add this as an issue in the Table 8-1 for further action.	
7	7-4/9	**Remedial Action Performance of OU BT:** Page 7-4, Line 9 stated, "*Whole water mercury concentrations in discharges associated with Outfall 15 are unknown and could potentially represent an important source of particulate-bound mercury to sediment.*" Ecology believes this is just one of many source control needs at the site. In order to minimize the potential for recontamination to the remediated sediment, site stormwater discharge needs to be characterized for all COCs. This is essential for source	Neither the OU B Marine nor OU B Terrestrial RODs include requirements for characterizing stormwater. The Navy proposes no change to the document based on this comment.

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
		investigation and tracing and for measuring progress. Ecology strongly recommends to carry forward a recommendation to characterize site stormwater and make source control management decision based on the results of the stormwater data.	
8	7-16/10-14	**PQL Based RGs and Protection of Human Health and the Environment:** Page 7-16, Line 10-14 stated, "*As current laboratory techniques have not significantly changed since these five COCs were dropped from the groundwater monitoring program, and because the COCs were not detected above the lower quantitation limits while sampling was still being performed during the groundwater monitoring program, RGs remain protective of human health and the environment*." Similar languages are presented in other parts of the document such as in page 7-9, line 34-37. It is difficult to say RGs remain protective of human health and the environment when they are based on PQL. Ecology recommends to rephrase the sentence that	Lines 10 -14 will be revised to read as follows: "As current laboratory LOQs (lower than ROD PQLs) have not significantly changed since these five COCs were dropped from the groundwater monitoring program, there is no ARAR revision for these COCs in groundwater that would affect the protectiveness of the remedy." The current PQLs are shown in Tables 7-4, 7-8, and 7-10.

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
		it is unknown whether RGs are protective of human health and the environment when they are based on PQL.	
9	7-16/31-34	**Revised TPH values in MTCA Method A and Protectiveness Determination:** Page 7-16, Line 31-34 stated, "*Similarly, a value of 500 µg/L is more appropriate than the ROD RG of 1,000 µg/L if monitoring for heavy oil or mineral oil; however, there has been no monitoring for heavy oil or mineral oil at OU NSC. The changes in the MTCA Method A groundwater cleanup values for the TPH compounds since the ROD do not affect the protectiveness of the remedy as long as the results of monitoring are compared to MTCA A values.*" Under the PMP monitoring, well 392R in OU NSC is sampled for TPH-O and results consistently exceeds 500 ug/L value (See Figure 6-4). Mann Kendall Trend Analysis shows increasing trend. Ecology would like to know how this is not affecting protectiveness determination.	We will revise the text beginning on Page 7-16, Line 29 to read, "Similarly, a value of 500 µg/L is more appropriate than the ROD RG of 1,000 µg/L when evaluating monitoring results for heavy oil or mineral oil. The changes in the MTCA Method A groundwater cleanup values for the TPH compounds since the ROD do not affect the protectiveness of the remedy because the current concentrations are less than those observed at the time of the ROD (see Table 7-17 of the five-year review), when risks were found to be acceptable. However, monitoring results should be compared to the current MTCA A values when making decisions regarding monitoring (such as changes to the monitoring frequency). The current Petroleum Management Plan includes the current MTCA Method A value for comparison".
10	Figure 2-1	**Figure 2.1 Chronology of Events:** Correct the statement in this Figure that showed	The Final Charleston Beach Remedy Repair Design is dated October 30, 2015. No revision to Figure 2-1 is necessary in response to this comment.

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
		Charleston Beach Remedy Repair Design is complete in 2015.	

Comments from: John Evered, Cleanup Project Manager
Comments dated: May 30, 2017

#	Page No./ Line No.	Comment	Proposed Response
1	General	General comment regarding the adoption of EPA method 1668 to analyze PCB congeners: Although Ecology still asserts that performing congener analysis will provide lower reporting limits and a more accurate scientific understanding of the current PCB risk at the site, Ecology acknowledges that at this time it is suitable to carry forward the established analysis method in to the next round of PCB long term monitoring. This will allow for continuity during future trend analyses. If, however, following the confirmatory round of PCB monitoring, concentrations are shown to be increasing then this assumption will have to be re-evaluated.	Comment noted. No changes to the text are proposed in response to this comment.
2	Page 4-2, section 4.1.2/27	This paragraph describes the history of the mitigation work performed at the Charleston Beach area, and that a design	Please refer to the Navy's detailed response Suquamish Tribe's Comment No. 2, which addresses this same issue.

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
		for a permanent remedy repair was completed during this five year review period. It is Ecology's understanding however that there are currently no plans to enact the remedy repair per the finalized design, and the process will be started again when funding is available. Ecology requests that this section be updated to reflect the current project status, including a description of any constraints that may affect implementation during the upcoming five year review period.	
3	Page 4-6, section 4.2.2.1/21	This paragraph implies that all of the samples collected during this five year review period were made up from skin-off fillets of 20 fish, although in the 2014 Phase 2 long term monitoring only 117, rather than 200, English Sole were collected resulting in only six samples. Ecology requests that either this deviation from the original work plan be described in the five year review or the reference to samples being made up of 20 fish be removed.	The Navy will revise this sentence to read, "English sole are collected using a trawl net, with samples made up from skin-off fillets."
4	Page 4-8, section 4.2.3/9	Please provide additional details on the database that is,	Page 4-8, Lines 8-10 restate what was stated in the Third Five-Year Review. No changes are planned to this document in response to this comment.

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
		"…being assembled through the OU B marine monitoring program and used to assess the long term performance of the remedy". Is this an informal term for all of the OU B long term monitoring data, a reference to Ecology's EIM database or a separate effort initiated by the Navy?	
5	Page 4-9, section 4.2.4/33	The information regarding methyl mercury toxicity and biomagnification in finfish in this paragraph is repeated in an earlier paragraph, line 7 of the same page. Please either remove or combine with the paragraph starting on line 3.	The Navy will combine this discussion as suggested.
6	Page 6-24, section 6.6.2.2/9	The report states, "The respondent cited the cleanup level development process under the 2013 revision of the SMS as part of the rationale for requesting aroclor analysis." Ecology was requesting congener analysis, not aroclor. Please revise accordingly.	"Aroclor" will be replaced with "congener" on Page 6-24, Line 9.
7	Page 7-3, section 7.1.2.2/20	Insert the word risk to read:	"Risk" will be inserted after "human health" to clarify the fourth paragraph of Section 7.1.2.2.

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
		"….actions for total mercury in sediment to reduce human health risk from mercury contamination."	
8	Page 7-3, section 7.1.2.2/21	Ecology believes that although discussions related to a framework that will assess non LTM data have been held by the project team, the details of how this will be achieved has by no means been finalized as is implied in the document. Please revise this paragraph to state that this issue has been identified and the project team will work during the next review period to finalize details.	The first sentence of the 5th paragraph of Section 7.1.2.2 will be replaced with the following text: The OU B Marine Team has put a decision framework process in place. The Decision Framework will be developed during the next review period and will include methods to assess OU B Marine non-LTM data".
9	Page 7-11, section 7.2.1.2/2	Please remove or revise the following sentence: "MTCA allows for use of background values when the MTCA risk based cleanup goal is below natural background for persistent organic compounds (e.g. PCBs)." Although the SMS does allow for the use of natural background values when addressing bioaccumulative chemicals of concern, Ecology has determined that a collective data set known as the Bold plus data set is appropriate to establish natural background at Puget Sound cleanup sites. As stated on line 1 the long term PCB clean up goal was based upon concentrations	This statement will be removed, and the Navy will revise this section of the five-year review as shown in the response to Suquamish Tribe's Comment No. 17.

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
		from a reference area selected by the project team, not through use of the Bold Plus dataset. The statement on line 2 is misleading as it implies incorrectly that the concentration the SMS defines as the default background concentration is the Sinclair Inlet reference value of 1.2 mg/kgOC, and that no risk based cleanup concentration was calculated because the value would be lower than the value from the reference site. In order to make this determination a comparison would have to be made to a value calculated from the Bold data using appropriate statistical evaluation. For information, established natural background concentrations are shown in table 10.1 of the Sediment Cleanup User's Manual (SCUM II), which derived values (90/90 UTL) from the Bold Plus dataset and are expressed in a ppt (ng/kg) TEQ basis.	
10	Page 7-11, section 7.2.1.2/22	Please remove or revise the statement that the reference area concentration is analogous to the SMS definition of regional background. Per WAC 173-204-560(5) regional background is defined as the concentration of a contaminant within a department (Ecology) defined geographic	The Navy will revise this section of the five-year review as shown in the response to Suquamish Tribe's Comment No. 17.

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
		area that is primarily attributable to diffuse sources, such as atmospheric deposition or storm water, not attributable to a specific source or release. To date, no regional background studies have been completed within Sinclair Inlet.	
11	Page 7-33, Table 7-11 – Issues, and Page 8-2, Table 8-1 – Recommend-ations and Follow Up Actions	Ecology believes that the need to perform an additional round of confirmatory PCB monitoring should be reflected in these two tables, in an additional item number under the OU B Marine heading of the table. This issue and follow up action would affect both current and future protectiveness in both table 7-11 and 8-1.	Please refer to the Navy's detailed response Suquamish Tribe Comment No. 13, which addresses this same issue.

Comments from: Bonnie Arthur, EPA Region 10
Comments dated: May 30, 2017

#	Page No./ Line No.	Comment	Proposed Response
1	Executive Summary, page iii, lines #24-- 28	Please include specific action items to address data gaps regarding protectiveness determinations (described in the following text) in the revised 5YR: "protectiveness determinations will be made for the site as whole and individual OUs no later than 12/31/2020."	We will revise the source control recommendation to read to include two sub recommendations with separate milestone dates: "A. Perform a source control evaluation, focused on transport of mercury through the storm drain system and direct discharge of groundwater to OU B Marine, and prepare an EE/CA and Action Memorandum to address mercury source control (December 2019).

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
			B. Implement source control actions selected in the Action Memorandum (December 2020)." We will revise the quoted sentence from the protectiveness statement to read, "The protectiveness determinations for the site as a whole and individual OUs will be updated based on the results of source control actions no later than March 2021."
2	Executive Summary, page iii, lines #29-- 30	EPA does not agree that OU A is short---term protective based on our current understanding of erosion issues, documented in meetings and this 5YR.	Please see the Navy's response to Suquamish Tribe's Comment No. 1.
3	Page v, Table ES--1	EPA does not agree that the OU A remedy is short term protective because landfill materials are exposed and presenting a continuing source of contamination.	Please see the Navy's response to Suquamish Tribe's Comment No. 1.
4	Five Year Review Summary Form, page vii	A detailed action plan must be included in the revised 5YR to address the following: "complete a consultation with the stakeholder group regarding plans for implementation of remedy repair." This action plan may include remedy repair or an ESD. The Navy has already taken numerous beach replenishment actions to prevent erosion.	Please see the Navy's response to Suquamish Tribe's Comment No. 2.

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
5	Page 4---2, lines #36---37	Please correct the following text regarding OU A as the Navy informed EPA, Ecology and the Suquamish Tribe at a May 9, 2017 meeting that the current remedy repair task order was "terminated for convenience."	Please see the Navy's response to Suquamish Tribe's Comment No. 2.
6	Page 4---10, line #22	This text documents the length of storm drain piping and seawall that was inspected. Please include a plan to inspect the remaining portions.	This section describes the original remedy implementation, not current or ongoing work. No revision to the text is proposed to address this comment.
7	Table 5---1	Please clarify why there is no possible contaminant pathway from OU A to OU B Marine.	Please see the Navy's response to Suquamish Tribe's Comment No. 4.
8	Page 7---2, lines #6---9	Please correct the text regarding whether habitat loss associated with the planned remedy repair for OU A was considered in the design process. Mitigation was specifically discussed in EPA's 11/21/2013 "OU A Remedy Repair" comments on the 90% design.	Please see the Navy's response to Suquamish Tribe's Comment No. 2.
9	Page 7---2, lines #3---14	The following text should be clarified and modified as it incorrectly summarizes EPA's understanding of progress at OU A: "The Navy produced the 100% design including resolution of stakeholder comments with the exception of comments related to mitigation."	Please see the Navy's response to Suquamish Tribe's Comment No. 2.

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
		First, EPA did not receive a response to comments to evaluate whether comments were satisfactorily resolved. Second, at the May 9, 2017 meeting Navy informed EPA, Ecology and the Suquamish Tribe that the current remedy repair is to be terminated for convenience. The text states that mitigation was a new unplanned component of the agreed to design and implementation. Please modify the text as there were many instances where mitigation was discussed. For example, mitigation was discussed in EPA's 11/21/2013 "OU A Remedy Repair" comments on the 90% design. During this Five Year Review process, the Navy must work with the project team to develop an acceptable action plan to correct, what appears to be a failing remedy, at OU A (Charleston Beach). The Navy has already taken numerous short-term beach replenishment actions to prevent erosion. Please provide the habitat analysis referenced in line #5.	
10	Page 7---2, lines #15---17	Significant erosion has been documented over the past years allowing landfill material to present a continuing source of	Please see the Navy's response to Suquamish Tribe's Comment No. 1 and Comment No. 3.

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
		contamination. As stated in the following text: the "presence of debris indicates that the OU A remedy is not meeting RAOs due to anthropogenic debris consistent with landfill material in intertidal zone." Please provide a figure depicting the extent of this landfill material in the intertidal zone per EPA's 5/23 request and an action plan to correct this condition.	
11	Page 7---4, lines #9---13	Please describe an action plan to address the following mercury investigations: "…mercury concentrations in discharges associated with Outfall 15 are unknown and could potentially represent an important source of particulate-bound mercury to sediment. To date, only filtered Hg releases have been assessed. An understanding of the magnitude of particulate release is needed to develop an effective approach for Outfall 15 drainage basin source control".	We will revise this text to read, ""…mercury concentrations in discharges associated with Outfall 15 are unknown and could potentially represent an important source of particulate-bound mercury to sediment. Filtered mercury releases have been assessed and reported by the USGS, and a report that includes an assessment of whole water releases is underway. This on-going work is necessary to develop an understanding of the magnitude of particulate release, to allow development of an effective approach for Outfall 15 drainage basin source control" We will also revise the source control recommendation to add milestone dates as follows, "Perform a source control evaluation, focused on transport of mercury through the storm drain system and direct discharge of groundwater to OU B Marine, and prepare an EE/CA and Action Memorandum to address mercury source control (December 2019). B. Implement source control actions selected in the Action Memorandum (December 2020)."

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
12	Table 7---11	Please update text regarding OU A (see comment # 9 above.	Please see the Navy's response to Suquamish Tribe's Comment No. 1 and Comment No. 2.
13	Table 8---1; Item # 2 (OU A)	Specific action items to implement the final remedy repair must be discussed and accepted by the project team as part of the Five Year Review meeting process.	The Navy will revise this recommendation to read, "Revise the remedy repair design at Charleston Beach to account for habitat loss and climate change. Complete a consultation with the stakeholder group regarding plans for implementation of the remedy repair at Charleston Beach and implement the final plan." By including this Recommendation in the five-year review, the Navy commits to consulting with the stakeholder group regarding the remedy repair design and implementation. Setting and tracking milestones for meeting this recommendation will be the subject of on-going stakeholder team meetings subsequent to this five-year review.
14	Section 9.0, page 9---1, lines #7---8	EPA does not agree that the remedy implemented at OU A is protective in the short term because landfill materials are exposed and present a continuing source of contamination.	Please see the Navy's response to Suquamish Tribe's Comment No. 1 and Comment No. 3.

Comments from: Karen Keeley, EPA Region 10
Comments dated: May 30, 2017

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
1	P 1---1, para 3	From Allison Hiltner: Please expand the list of guidance to the following, and ensure that this guidance was followed in preparing the Five---Year Review (FYR): 1. United States Environmental Protection Agency (USEPA), 2001. Comprehensive Five---Year Review Guidance, OSWER Directive 9355.7---03B---P. June 2. USEPA, 2010. Interim Final Institutional Controls: A Guide to Planning, Implementing, Maintaining, and Enforcing Institutional Controls at Contaminated Sites (OSWER 9355.0---89, EPA 540---F--- 00---005) 3. USEPA, 2011. Enforcing Five---Year Review Requirements under Federal Facility Requirements. Memorandum. July 21 4. USEPA 2011. Program Priorities for Federal Facility Five---Year Review.	**Reference 1** is already cited in the five-year review, in the cited paragraph, and is the EPA guidance cited by Navy policy on conducting five-year reviews (May 2011). **Reference 2** – This guidance states, "This document provides guidance to the Regions on how EPA generally intends to plan, implement, maintain, and enforce institutional controls as part of a cleanup project. The guidance is designed to help promote consistent national policy on these issues. It does not, however, substitute for CERCLA, RCRA, or EPA's regulations, nor is it a regulation itself. Thus, it does not impose legally binding requirements on EPA, States, or the regulated community, and may not apply to a particular situation based upon the circumstances. EPA, State, tribal, and local decision-makers retain the discretion to adopt approaches on a case-by-case basis that differ from this guidance where appropriate. Any decisions regarding a particular facility will be made based on the applicable statutes and regulations." This reference describes the means and methods for planning and implementing ICs, including the legal instruments and documents that can be used to enact, monitor, and enforce ICs. As written, the five-year review includes the IC review elements recommended in this guidance document (predominately Section 8.3 of the reference). However, because this document is not a required guidance document governing five-year reviews under Navy policy, and is not a legal driver for the review, the Navy declines to add this reference as a citation in Section 1. This reference provides recommended content coverage for IC plans, however, and therefore the Navy will cite this document as part of the recommendation for developing an IC Plan for OU B Marine, and updating the terrestrial IC Plan.

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
		Memorandum to Superfund National Policy Managers Regions 1---10. August 1. 5. USEPA, 2011. Recommended Evaluation of Institutional Controls: Supplement to the "Comprehensive Five---Year Review Guidance," OSWER Directive 9355.7---18. September. 6. USEPA, 2012a. Correction to the Memorandum "Program Priorities for Federal Facility Five---Year Review" Memorandum to Superfund National Policy Managers, Regions 1---10. February 22. 7. USEPA, 2012b. Memorandum to National Superfund Program Managers: Clarifying the Use of Protectiveness Determinations for Comprehensive Environmental Response, Compensation and Liability Act Five---Year Reviews. September 23.	**Reference 3** – This reference clarifies the enforcement of five-year review timelines and other five-year review requirements under federal facilities agreements, but does not establish guidance or requirements for the content of five year reviews beyond the USEPA 2001 guidance. The timelines and other requirements detailed in this reference are covered by Navy policy (May 2011). Therefore, the Navy will not include this document as a controlling reference for the content of the five-year review. **Reference 4** – This memo describes new management controls, necessary Remedial Project Manager actions, changes to the CERCLIS five-year review module, and Federal Facility Agreements. This reference does not establish guidance or requirements for the content of five year reviews beyond the USEPA 2001 guidance. The timelines and other management requirements detailed in this reference are covered by Navy policy (May 2011). Therefore, the Navy will not include this document as a controlling reference for the content of the five-year review. **Reference 5** – This guidance document states, "This guidance supplement provides policy guidance to the staff of U.S. EPA on conducting five-year reviews for remedies that include ICs. The guidance is designed to help promote consistent national policy but it does not substitute for CERCLA or EPA's regulations, nor is it a regulation itself. Thus, it does not impose legally binding requirements on EPA, states, or the regulated community, and may not apply to a particular situation based upon the circumstances." As written, the five-year review includes the IC review elements recommended in this guidance document. However, because this

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
		8. USEPA, 2012c. Assessing Protectiveness at Sites for Vapor Intrusion Supplement to the "Comprehensive Five---Year Review Guidance" OSWER Directive 9200.2---84. November. 9. USEPA, 2013. Sample Federal Facility Land Use Control Checklist with Suggested Language (LUC Checklist). [if relevant] 10. OSWER Directive 9355.6---12. January 4. USEPA, 2015a. Ground Water Technical Considerations during the Five---Year Review Process. EPA---542---F---15---010. April.	document is not a required guidance document under Navy policy, and is not a legal driver for the review, the Navy will not cite this reference. **Reference 6 –** This reference makes a correction to reference 4 regarding the interpretation of five-year review due dates. The timelines and other management requirements detailed in this reference are covered by Navy policy (May 2011). Therefore, the Navy will not cite this document as a controlling reference for the content of the five-year review. **Reference 7 -** This reference provides general guidance for the use of specific protectiveness determinations and recommends language to be used when drafting protectiveness statements. The information in the memorandum supplements EPA's 2001 five-year review guidance. Because this memorandum supplements the primary five-year review guidance cited by Navy policy (2011), the Navy agrees to also cite this guidance in Section 1 of the five-year review. As written, the five-year review conforms to the recommendations in this guidance memorandum. **Reference 8 –** This reference provides recommendations for conducting five-year reviews for the vapor intrusion component of remedies. The information in the memorandum supplements EPA's 2001 five-year review guidance. Because this memorandum supplements the primary five-year review guidance cited by Navy policy (2011), the Navy agrees to also cite this guidance in Section 1 of the five-year review. The Navy recognized vapor intrusion as an issue during the second five-year review for BNC, and addressed vapor intrusion through studies subsequent to that review. This fourth five-year review includes an assessment of that past work, and so conforms to the recommendations in this guidance.

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
			Reference 9 – This reference provides a checklist and suggested language for describing and documenting land use controls in RODs at Federal Facilities. This reference is not directly relevant to the five-year review and the Navy will not include a citation of this document. **Reference 10** – This groundwater forum issue paper highlights technical considerations and resources for conducting five-year reviews at CERCLA sites with contaminated groundwater. This issue paper is not guidance, and is focused on supporting EPA RPMs. While this document may be a supporting resource to EPA, the Navy does not see a need to cite this as a controlling reference for the content of the five-year review.
2	General	Throughout the report (text/tables/figures), it must be clear that ICs are required for OU B Marine for the thick sediment cap offshore of OU A. As required by Section 12.2.9 (Institutional Controls) of the 2000 ROD for OU B Marine: *"Any remedy that results in hazardous substances remaining on site above levels that allow for unlimited use and unrestricted exposure requires some form of institutional controls to ensure that human health and the environment are protected."*	The Navy acknowledges that the OU B Marine ROD is not entirely consistent with regard to where ICs are required. In the case of the thick cap area offshore of OU A, the Navy agrees that it is appropriate to include ICs for this area even though ICs are not explicitly required for this area in the OU B Marine ROD.

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
3	P iii, Line 1	While text on this page suggests that the remedy is functioning as intended at OU A, Table ES---1 states that the remedy is not functioning as intended by the ROD. Also, Section 7.4, Line 11, indicates that the OU A remedy is not functioning as intended.	We will correct this line by deleting "OU A," and will specifically state that the remedies for OU A, OU B Terrestrial, and OU B Marine are not functioning as intended by the RODs.
4	P iii, Line 2	Specifically state whether the remedy (per the ROD) is functioning as intended for OU B Marine and Terrestrial. Per the table, the answer is No.	We will add the specific statement for OU B Marine and Terrestrial, as requested.
5a	P iv, Line 3	Revise text as follows: "The Navy is engaged with stakeholders to develop a mercury remedy for OU B Marine that will include addressing mercury source control.	To be consistent with text in Section 7.1.2.2, lines 2 and 3 will be revised to read as follows: "The Navy is engaged with stakeholders to develop a focused feasibility and identify a remedy for OU B Marine that addresses mercury source control and considers additional remedial actions for total mercury in sediment to reduce human health risk."
5b	P iv, Line 5	From text that is in Section 6.4.3.2 of the FYR, insert the following: In addition, it appears that the cap area offshore of OU A, in addition to likely settling and consolidation, may also be susceptible to loss of material due to wave and tidal erosion.	Please see the Navy's response to the Suquamish Tribe's Comment No. 14.
6	P iv, Line 6	What are the ICs that are controlling human exposure? Are there fishing restrictions or direct contact (beach walking) restrictions? Specify the	This sentence will be deleted from the Executive Summary.

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
		general ICs you are referring to.	
7	P vi	Five---Year Review Summary Form. Insert a new recommendation for OU B Marine to evaluate the likelihood of loss of material in the sediment cap offshore of OU A, as described in Section 6.4.3.2: "*It appears that the OU A cap area offshore of OU A, in addition to likely settling and consolidation, may also be susceptible to loss of material due to wave and tidal erosion.*"	Please see the Navy's response to Suquamish Tribe's Comment No. 14.
8	Fig 1---2	Does this figure accurately show that the sediments offshore of OU A are included within OU B Marine? It looks to like there is a small triangle on the southwest end of OU A that looks like sediment (and it shows up in OU A but all OUA sediments are in OU B now).	We will adjust the OU A boundary on this figure to more clearly show intertidal area to be within OU B Marine.
9	Fig 2---1	The orange line needs to have "Beach replenishment" connected to the dot with a line (it doesn't show up because of the 2010 vertical line). Green line – spell out SMIR.	Figure 2-1 will be revised to incorporate both comments.
10	P 4---3, Line 21	Correct term is explanation of significant "differences"	Text will be corrected.
11	P 4---4, Line 31	In this sentence, it appears that you mean the "covered area" [not the	We will replace "capped" with "covered."

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
		"capped area"] adjacent to the CAD pit on SOAL --- ENR is a 'cover' which is different from engineered sediment caps. Earlier text in this section indicates that the SOAL area was 'covered.' If the SOAL is capped, then that should be clear throughout the report.	
12	Section 4.2.1	In this section, or another relevant section, please include a figure that shows the sediment cap and ENR area offshore of OU A (e.g., using Figure 2---1 or F3, F4 and F6 from Figure 3---6 from the 2012 Monitoring Report), the segments of the OU A shoreline where erosion is occurring (Segments 45 and 46 per this report), and the areas where the beach erosion has occurred in the intertidal and adjacent upland areas at Charleston Beach (see Section 4.1.2) where 'beach enhancements' have occurred. Without a figure it's hard to determine if these areas overlap each other.	New figures have been added to the five-year review to detail elements of OU A and the ENR, thick cap and CAD pit areas of OU B Marine.
13	P 4---3, Line 32	Revise text: Approximately 57,000 cubic yards of clean sediment from the excavation of the CAD pit were used to form a full cap with a thickness in	The Navy will adjust this language to match the OU B Marine construction completion report.

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
		excess of four feet *[note: language is from 2012 LTM]* in approximately x acres, and to form the surrounding enhanced natural recovery (ENR) layer offshore of OU A. Add a citation to the figure that shows this capped area near OU A.	The Navy will add the Figure requested in EPA (Keeley) Comment No. 48 to Section 4 and refer to it on line 29 of page 4-3 (at the end of the first sentence in Section 4.2.1).
14	P 4---4, Line 29---30	ICs must also be in place for the thick sediment cap that was placed in four grids (or 3 grids depending on which map is used from the 2010 LTM) offshore of OU A.	Please see the Navy's response to EPA (Keeley) Comment No. 2.
15	P 4---5 Line 11	Words missing in this bullet: "Sampling of and fish tissues"	Text will be revised to read "Sampling of fish tissues".
16	P 4---5, Line 6	Replace 'remediation goals (RGs)' with remedial action objectives (RAOs). This term, RAO, would cover the sediment cleanup level, as well as the tissue cleanup goal.	The text will be revised to include replacement text contained in this comment.
17	P 4---5, Line 15	Revise text to clarify Charleston Beach sediment samples were collected in 2014 (subtidal) and 2015 (intertidal).	Text will be corrected to read as follows: "Charleston Beach sediment sampling (subtidal 2014 and intertidal 2015)".
18	P 4---5, Line 24	Add a citation in text and a reference to the 2013 Sinclair Inlet Marine Monitoring Sampling and Analysis Plan dated 6---24---2013. Add a citation in the text and a reference to the Sample Plan Alteration Form for the 2014	The Navy will add the requested citations to the text.

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
		Marine Long---term Monitoring Plan, which details significant changes to the monitoring plan.	
19	P 4---5, Line 26	Change RG to RAO. Cleanup levels are different than 'goals.'	The Navy respectfully disagrees with the requested change. The five-year review should use terminology consistent with the ROD, which uses the term "clean-up goals."
20	P 4---6, Line 25	Revise text on number of fish per composite. In 2015 sampling effort, there were three 20---fish composites and three 19---fish composites.	In accordance with the response to Ecology (Evered) Comment No. 3, the Navy will revise this sentence to read, "English sole are collected using a trawl net, with samples made up from skin-off fillets."
21	P 4---7, Line 27	Revise text to clarify that the six sediment samples were also analyzed for seven metals.	The Navy will add that the sediment samples were analyzed for seven metals.
22	P 4---21, Line 14	Revise text to clarify the signage --- "with prominent signage controls" that restrict access? That identify exclusion zone?	The Navy will add "that read 'U.S. Navy Restricted Area Use of Force Authorized'" to the end of line 14.
23	P 4---25, Table 4---1, OU B Marine	Revise the Reasonably Anticipated Future Use to include the ecological use of the waterbody and Tribal U&A component of OU B Marine. The Selected Remedy (Section 12.1), and other portions of the ROD for OU B Marine, states: "Under Alternative SD7, the dredging, disposal, capping, and enhanced natural recovery measures will immediately remove the sediments containing the highest PCB	See response to Suquamish Tribe Comment #11 above. The Navy agrees that IC effectiveness should be included in Table 4-1 and will make this change for all OUs.

#	Page No./ Line No.	Comment	Proposed Response
		concentrations from the biologically active portion of the marine environment. Shoreline stabilization will minimize the potential for future erosion of COCs from soil to the marine environment. Further long---term risk reduction is expected as a result of natural recovery of sediments throughout Sinclair Inlet." Also, "The objectives of the long---term monitoring program are…To confirm predicted natural recovery of sediments in marine OU B. – "Surface sediments in Sinclair Inlet will be monitored to verify long---term protection of the environment and to assess the natural recovery of sediment." Based on this language, it seems that natural recovery should be listed as part of the remedy in Table 4---1. Revise text to include IC effectiveness in the final column. ICs are typically in different documents than O&M or LTM plans/reports.	
24	P 4---33, Table 4---6	For OU B Marine, the third column refers to "see additional notes below" but there do not appear to be any	These notes were removed from the footnotes of the table in favor of placing them in text. The Navy will change this reference to the appropriate section in the text.

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
		specific additional notes for OU B Marine.	
25	P 4---33, Table 4---6	For OU B Marine, please revise text to clarify what is meant by "Dredging Management" for the CAD pit.	We will change "Dredging Management" to "Dredging and Construction Restrictions," consistent with the OU B Marine ROD.
26	P 4---33, Table 4---6	For OU B Marine, what is the "Excavation Management" IC for OU B Marine. I do not recollect seeing this discussed in prior text. Maybe this is referring to the shoreline stabilization measures at Site 1?	Yes, excavation management is applicable to the shoreline at Site 1 which is part of OU B Marine. The excavation management footnote will be revised to refer to only the Site 1 portion of OU B Marine.
27	P 4---33, Table 4---6	For OU B Marine, footnote "a" refers to an undated O&M and IC Plan. Revise text to include a date for that plan. Also, from earlier text, I thought the OU B Marine ICs were removed from the "O&M and IC Plan" for overall BNC? Per page 4---4 "The IC plan was combined with the O&M plan into a single, updated plan in 2016 (Navy, 2016b). During this update, the ICs related to the CAD pit and capped areas of OU B Marine were removed from the plan, to focus the plan on terrestrial and shoreline areas." It further states "there is currently no published IC plan that includes ICs for 37 the CAD pit and other capped areas, and no periodic	The shoreline at Site 1 is covered, along with the entire shoreline, by the O&M and IC Plan. A separate IC Plan covering the intertidal and subtidal portions of OU B Marine is needed. The Navy will include a reference for the O&M and IC Plan, and clarify in the footnote that for OU B Marine, only Site 1 is covered by the current (2016) plan.

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
		reporting on IC effectiveness is performed." Maybe these are the notes that go below the table.	
28	P 4---33, Table 4---6	Revise footnote "b" to reference Navy, 2008a.	The 2008 Navy instruction will be added to the reference list.
29	P 4---33, Table 4---6	For OU B Marine, add information regarding the ICs that are needed for the four grids associated with OU A (which ultimately became part of OU B) that have a thick cap and thus need an IC.	Please see the Navy's response to EPA (Keeley) Comment No. 2.
30	P 4---33, Table 4---6	Correct references in this table. The references provided in the FYR do not include Navy 2001, which is cited in footnote "c" of this table.	The 2001 Navy instruction will be added to the reference list.
31	P 4---33, Table 4---6	Correct citations and references. Footnotes d and f both reference Navy 2007a (which in the references is the 'excavation MOA').	The footnote f. will be corrected to reference the MOA with the City of Bremerton.
32	P 6---14, Line 32	Please revise the header "OU A Cap/ENR Area" to "Cap/ENR Area Offshore of OU A" to ensure the reader doesn't confuse this cap/ENR area as being part of OU A. This is consistent with the 2000 ROD for OU B Marine.	This revision will be made to the text.
33	P 6---15, Line 7	Revise text: "It appears that the ~~OU A~~ cap area offshore of OU A, in addition to likely settling and consolidation, may	The Navy will edit the text to refer to the capped area offshore of Area A. Also, see the Navy's response to the Suquamish Tribe's Comment No. 14.

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
		also be susceptible to loss of material due to wave and tidal erosion."	
34a	P 6---18, Line 10	Revise text as follows: The Navy and stakeholders have agreed that a confirmatory round of monitoring will be conducted in 2018 to validate the 2014 monitoring results and additional monitoring efforts will be evaluated as part of the implementation of the Decision Framework.	Text will be revised as suggested.
34b	P 6---18, Line 25	Revise text to include the following, which is from another section in this report: *"However, ICs for OU B Marine were not included in the latest IC plan."*	The Navy will make this addition to the text as requested.
35	P 6---19, Line 21	Revise section to include a subsection for "OU B Marine Inspection Results." Clarify rationale for not doing a site inspection for submerged sediments of OU B (you can't see anything…). However, it did seem that there were some inspections of 'sloughing' material that was ending up on OU B Marine sediments so wouldn't those inspections be referenced here? Also, Section 6.5.5 stated: *"The inspections at OU B Marine consisted of inspection of the floating boom security signage,".*	We will add a sentence to Section 6.5.2 stating that, "Shoreline inspections for OU B Terrestrial included inspection of Site 1, which is part of the OU B Marine." The inspection of the floating boom security signage and the evaluation of periodic monitoring results with regard to the integrity of the CAD pit are currently mentioned in the first paragraph of Section 6.5.5.

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
36	Table 5---1, 6a, OU B Marine	Incorporate a reference to the report for the Phase 1 LTM (Navy, 2016g) because the mercury sediment data collected in Phase 1 were also used in the SMIR.	Reference for the 2014 Phase I LTM report will be added to Table 5-1.
37	Section 6.1	Add Bonnie Arthur, EPA	Bonnie Arthur will be added to the list of five year review team members in Section 6.1
38	P 6---19, Line 8	Revise text to clarify that Segments 45 and 46 are associated with OU A, and Segment 4 is associated with OU B T. However, confirm whether there really was erosion in Segment 46, since Table 6---10 states: "An area within Segment 46 was observed to be devoid of armor rock, although no erosion was observed." See other comments on this topic.	Please see the Navy's response to EPA (Keeley) Comment No. 42.
39	Figure 6---8	Label the CAD pit in the figure. The areas with a thick layer cap are not visible near OU A/Charleston Beach (perhaps the overlay showing the contour lines can be removed in this area?). If you incorporate the new figure referenced below, you don't need to make this change.	We will add the Figure requested in EPA (Keeley) Comment No. 48 to Section 4 and refer to it on line 29 of page 4-3 (at the end of the first sentence in Section 4.2.1).
40	Table 6---10, OU A	The inspections for OU A should include a reference to this information from Section 7.1.1.1 of the FYR: "The	The Navy will revise the text and table to consistently document the shoreline areas with findings from the 2016 inspection, as shown on Figure 6-10.

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
		shoreline along Segment 45 [and 46?] of the BNC shoreline, Charleston Beach, is not sufficiently resistant to erosion and requires ongoing beach replenishment to limit erosion of constituents in fill material to Sinclair Inlet."	
41	Table 6---10, OU A	Is there 'exposure gauge' information for 2016?	The Navy will add the erosion gauge information for 2016 from the annual report: • Gauge A – 6.5" of exposure • Gauge C – 3.75" of exposure As requested by the stakeholders, the Navy made additional measurements at these gauges in 2017. These additional data will also be added: • Gauge A – 12" of exposure • Gauge C – 1.5" of exposure This information will be added to Table 6-10.
42	Table 6---11, OU B T	The Segments mentioned in the 'Shoreline' column in this table do not appear to match the "two areas of particular concern (Segments 45 and 46 and Segment 4)" identified in Lines 8 through 14 on P 6---19. Please confirm that all segments that need to be stabilized are included consistently in the FYR.	The Navy will revise the text and table to consistently document the shoreline areas with findings from the 2016 inspection, as shown on Figure 6-10.

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
43	P 7---1, Section 7.1.1.1	This section references erosional issues for "Segment 45" – it seems these erosional issues for Segment 45 should be described in Table 6---10 for OU A, and that Line 30 should also reference Segment 46 since it is listed as an issue on Page 6---19, Lines 8 through 14.	See response to EPA (Keeley) Comment No. 42.
44	Table 8---1	For OU A, add a recommendation to address this issue, which is identified in the report in section 7.1.1.1: "In addition to the Charleston Beach erosion issue, anthropogenic debris consistent with landfill material is within the intertidal zone. The presence of this debris indicates that the OU A remedy is currently not meeting the RAOs regarding preventing exposure of landfill materials."	Please see the Navy's response to Suquamish Tribe's Comment Nos. 1 and Comment No. 3.
45	Table 8---1	For OU B Marine, add a recommendation to address this issue, which is identified in the FYR: "In addition, it appears that the cap area offshore of OU A, in addition to likely settling and consolidation, may also be susceptible to loss of material due to wave and tidal erosion."	Please see the Navy's response to Suquamish Tribe's Comment No. 14.
46	References	For the Navy, 2016g, the final report that I have is dated March 10, 2016 (not	The Navy will revise the date to February 3, 2016.

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
		Feb 2, 2016).	
47	Appendix A, Data Excerpted from Salt Water Main Break Report, Table A---3 etc..	Please include the figure showing the station locations for this effort. This is a good data summary it is helpful to have the corresponding figure (which I realize is in the original report).	The Navy will add the requested figure.
48	New Table	EPA recommends incorporating Figure 2---1 of the 2014 Phase 1 LTM report – the figure is color and it is much easier to see the Marine OU B remedial action.	The Navy will add the requested figure to Section 4 and refer to it on line 29 of page 4-3 (at the end of the first sentence in Section 4.2.1).

Comments from: Karen Keeley, EPA Region 10
Comments dated: August 3, 2017

#	Page No./ Line No.	Comment	Proposed Response
49		Please add citations for the 2007 Action Memorandum and Pier D 401c certification to the OU A discussion in the FYR.	The Navy will add the requested citations.

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
50		EPA recommends adding a list of the areas that will be subject to institutional controls into the recommendation for the OU B Marine IC Plan development.	The Navy disagrees that this detail is needed in the five-year review. The details will be included in the IC plan itself.
51		ICs should be included for the area at OU A where COC concentrations in sediment samples exceed the SMS criteria.	The need for ICs in this area will be discussed by the BNC Terrestrial team during revision to the BNC Terrestrial IC and O&M Plan. The Navy proposes no changes to the five-year review based on this comment.
52		Revise Recommendation three to read, "Revise the remedy repair design at Charleston Beach to account for climate change and compliance with ARARs, including performance of a habitat analysis…."	The Navy will include the phrase, "…including performance of a habitat benefit analysis" in this recommendation.
53		EPA disagrees with the Navy's protectiveness statement for the Charleston Beach area of OU A. Based on recently identified historical documents, indicating the 3 ft of material must be maintained as a 'sediment cap,' as well as other key factors (Ecology 401 WQC, CERCLA Action Memo, etc.), EPA believes that the OU A remedy is not protective.	The Navy respectfully disagrees with EPA's interpretation of the requirements in the cited documents, and concludes that the remedy for OU A is protective in the short term.

Document Title: DRAFT Fourth Five---Year Review Puget Sound Naval Shipyard (PSNS) Superfund Site (Bremerton Naval Complex)
Document dated: April 2017

#	Page No./ Line No.	Comment	Proposed Response
54		EPA recommends that the language in the FYR, including text in Table 4-1 and information in figures, be very clear that the upper intertidal area of OU A (where landfill material was excavated and clean material was placed over the newly-exposed area) is still part of OU A. Previous versions indicated that these sediments were part of OU B.	The text, tables, and figures of the Draft Final FYR are clear with regard to the boundaries of OU A and the portion of the intertidal area that is within OU A. The Navy has added new figures 4-1 and 4-2 to the document to clarify these boundaries.