Naval Facilities Engineering Command

FINAL

3 August 2015

Third Five-Year Review

Jackson Park Housing Complex/ Naval Hospital Bremerton

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 Jackson Park Housing Complex/Naval Hospital Bremerton (JPHC/NHB), Bremerton, Washington, the U.S. Navy (Navy) has completed the third 5-year review of the remedial actions at Operable Unit (OU) 1, OU 3-Terrestrial (3T) JPHC, and OU 3T NHB conducted pursuant to Section 121(c) of the Comprehensive Environmental Response, Compensation, and Liability Act and the National Oil and Hazardous Substances Pollution Contingency Plan (40 Code of Federal Regulations Part 300). The purpose of this 5-year review is to ensure that the remedial actions selected in the Records of Decision (RODs) for OU 1, OU 3T JPHC, and OU 3T NHB at JPHC/NHB remain protective of human health and the environment. A 5-year review is required for this site because the remedies allow contaminants to remain in place at concentrations that do not allow unlimited site use and unrestricted exposure. This third 5-year review was prepared in accordance with U.S. Department of Defense, Navy, and U.S. Environmental Protection Agency guidance.

Construction is complete for all of the remedies selected in the original OU 1 ROD, and significant progress has been made in implementing the revised remedy for the NEX Gas Station Leak Area, which was selected in the OU 1 ROD Amendment No. 1. Construction is complete for the Upland Zone of OU 3T JPHC, and land use controls (LUCs) have been implemented. All on-site activities in the Intertidal Zone of OU 3T JPHC have been completed, and construction will be considered complete when the remedial action completion report is finalized in 2015. LUCs required in the OU 3T NHB ROD, which was executed on September 29, 2014 after this 5-year review period, will be implemented in 2015. The RODs for OU 2 and OU 3M have not been completed. Therefore, remedies have not been selected for these two OUs. The Navy has completed implementation of four of the six recommendations from the second 5-year review and is continuing to work toward completion of the remaining two recommendations. The current status of the OUs and the protectiveness statements are included in Table ES-1.

Table ES-1
Summary of OU Status and Protectiveness Determination

<table>
<tr><th>OU</th><th>Site</th><th>Status</th><th>Protectiveness Determination</th><th>Protectiveness Statement</th></tr>
<tr><td rowspan="5">1</td><td>101</td><td rowspan="3">Remedy construction complete, ongoing remedy maintenance, LUC monitoring, and long-term monitoring</td><td rowspan="5">Protectiveness deferred</td><td rowspan="5">A protectiveness determination for the remedy at OU 1 cannot be made until further information is obtained through the following actions:
• Performing mercury sampling at seeps/outfalls at Site 101-A
• Investigating the extent of shallow soil exceeding Record of Decision remediation goals and evaluating whether contamination in shallow soil identified during the focused Phase II site investigation could pose unacceptable risks to human health
• Performing indoor air, subslab vapor, and crawlspace sampling at the NEX Gas Station Leak Area and comparing results to screening levels to evaluate whether there are unacceptable vapor intrusion risks to human health
It is expected that these actions together with the 5-year review addendum will take until approximately March 2017 to complete.</td></tr>
<tr><td>101-A</td></tr>
<tr><td>103</td></tr>
<tr><td>110</td><td>Remedy construction complete, ongoing remedy maintenance, and LUC monitoring</td></tr>
<tr><td>NEX Gas Station Leak Area</td><td>Remedy design complete and remedy implementation initiated</td></tr>
<tr><td>2</td><td>NA</td><td>RI/FS complete</td><td>NA</td><td>NA</td></tr>
<tr><td>3T JPHC</td><td>NA</td><td>All on-site activities and LUCs complete</td><td>Will be protective</td><td>The remedy at OU 3T JPHC is expected to be protective of human health and the environment upon completion. The substantive elements of the remedy (LUC implementation and anomaly removal) have been completed. Once the remedial action completion report for the Intertidal Zone is complete, the remedy is expected to be protective of human health and the environment.</td></tr>
<tr><td>3T NHB</td><td>NA</td><td>Record of Decision complete[a]</td><td>Will be protective</td><td>The remedy at OU 3T NHB is expected to be protective of human health and the environment upon completion. Remedy implementation consists of formalizing existing LUCs in a LUC Management Plan. The existing LUCs currently address site risks.</td></tr>
<tr><td>3M</td><td>NA</td><td>RI/FS in progress</td><td>NA</td><td>NA</td></tr>
</table>

[a]ROD for OU 3T NHB was executed on September 29, 2014 after this 5-year review period (see Section 10).

Notes:
Green highlighted text indicates remedial action will be protective.
Yellow highlighted text indicates that the protectiveness determination has been deferred.
JPHC - Jackson Park Housing Complex

Table ES-1 (Continued)
Summary of OU Status and Protectiveness Determination

LUC - land use control
M - marine
NA - not applicable
NEX - Naval Exchange
NHB - Naval Hospital Bremerton
OU - operable unit
RI/FS - remedial investigation/feasibility study
T - terrestrial

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name (from WasteLAN): Jackson Park Housing Complex (USNAVY)		
EPA ID (from WasteLAN): WA3170090044		
Region: 10	**State:** WA	**City/County:** Kitsap

SITE STATUS	
NPL Status: Final	
Multiple OUs? Yes	**Has the site achieved construction completion?** No

REVIEW STATUS
Lead agency: Other Federal Agency **If "Other Federal Agency" was selected above, enter Agency name:** United States Navy
Author name (Federal or State Project Manager): Raymond A. Kobeski
Author affiliation: Naval Facilities Engineering Command Northwest
Review period: 8/1/2009–7/31/2014
Date of site inspection: July 22, 2014
Type of review: Statutory
Review number: 3
Triggering action date: August 2010
Due date *(five years after triggering action date)*: August 2015

Issues/Recommendations	
OU(s) Without Issues/Recommendations Identified in the Five-Year Review:	
OU 3T JPHC, OU 3T NHB	
Issues and Recommendations Identified in the Five-Year Review:	
OU: 1	**Issue Category:** Monitoring
	Issue: During the focused Phase II SI performed by Forest City as part of their due diligence inquiries, cyanide was detected at concentrations exceeding the ROD RG in groundwater in the vicinity of Building 100 at Site 101-A and could be migrating to surface water at concentrations above the ROD RG. The OU 1 ROD established the cyanide RG based on the marine water quality criterion, which is below the PQL. Therefore, the absence of cyanide above its RG cannot be verified in the seeps and outfalls at Site 101-A (OF-716 and SP-715).

Five-Year Review Summary Form (Continued)

<table>
<tr><td></td><td colspan="4">Recommendation: Prior to each seep sampling event, determine the best available cyanide PQL and compare to the cyanide RG (1 µg/L). Ensure that the laboratory uses the best analytical method for achieving the current cyanide PQL (5 µg/L in 2015 using EPA Method 335.4) and that monitoring results are compared to the best available PQL at the time of monitoring.</td></tr>
<tr><td>Affect Current Protectiveness</td><td>Affect Future Protectiveness</td><td>Implementing Party</td><td>Oversight Party</td><td>Milestone Date</td></tr>
<tr><td>Yes</td><td>Yes</td><td>Federal Facility</td><td>EPA</td><td>5/31/2016</td></tr>
<tr><td rowspan="3">OU: 1</td><td colspan="4">Issue Category: Monitoring</td></tr>
<tr><td colspan="4">Issue: During the focused Phase II SI performed by Forest City as part of their due diligence inquiries, mercury was detected in seep/outfall samples collected from OF-716 and SP-715 at Site 101-A above the original ROD RG, and monitoring for metals in seeps and outfalls at the site has been discontinued.</td></tr>
<tr><td colspan="4">Recommendation: Restart mercury monitoring at Site 101-A (OF-716 and SP-715).</td></tr>
<tr><td>Affect Current Protectiveness</td><td>Affect Future Protectiveness</td><td>Implementing Party</td><td>Oversight Party</td><td>Milestone Date</td></tr>
<tr><td>Yes</td><td>Yes</td><td>Federal Facility</td><td>EPA</td><td>5/31/2016</td></tr>
<tr><td rowspan="3">OU: 1</td><td colspan="4">Issue Category: Monitoring</td></tr>
<tr><td colspan="4">Issue: The mercury RG that was established post-ROD, based on the PQL at the time of the change, is above the current PQL.</td></tr>
<tr><td colspan="4">Recommendation: Revise the mercury RG to the original ROD RG (0.025 µg/L), and ensure that the laboratory uses the best analytical method for achieving the current PQL (0.0005 µg/L in 2015 using EPA Method 1631).</td></tr>
<tr><td>Affect Current Protectiveness</td><td>Affect Future Protectiveness</td><td>Implementing Party</td><td>Oversight Party</td><td>Milestone Date</td></tr>
<tr><td>Yes</td><td>Yes</td><td>Federal Facility</td><td>EPA</td><td>5/31/2016</td></tr>
<tr><td rowspan="2">OU: 1</td><td colspan="4">Issue Category: Institutional controls</td></tr>
<tr><td colspan="4">Issue: During the focused Phase II SI performed by Forest City as part of their due diligence inquiries, petroleum hydrocarbons were detected at concentrations greater than the focused Phase II SI screening criteria (RGs have not been established in the OU 1 ROD for the detected chemicals) and cPAHs were detected at concentrations greater than the ROD RG in deep soil in the vicinity of former UST-2 and UST-2A (near the north end of Root Court) and/or at the south end of Root Court.</td></tr>
</table>

Five-Year Review Summary Form (Continued)

	Recommendation: Control excavation and construction in the Root Court area (see Figure 8-1) with deep soil contamination (TPH and cPAHs) above ROD RGs and/or focused Phase II SI screening criteria (if no ROD RG is established) and incorporate the areas into the LUC Management Plan.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA	12/31/2015
OU: 1	**Issue Category:** Changed site conditions			
	Issue: During the focused Phase II SI performed by Forest City as part of their due diligence inquiries, cPAHs and/or arsenic were detected at concentrations greater than the ROD RGs in shallow soil in the vicinity of NE Rankin Road and adjacent to the bunkers.			
	Recommendation: Evaluate whether contamination in shallow soil (arsenic, lead, cPAHs, and explosives) identified during the focused Phase II SI in the vicinity of NE Rankin Road and the bunkers (see Figure 8-1) could pose unacceptable risks to human health.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
Yes	Yes	Federal Facility	EPA	8/31/2016
OU: 1	**Issue Category:** Institutional controls			
	Issue: One soil cover area (street waste disposal area) is not identified in the LUC Management Plan.			
	Recommendation: Control excavation and construction in the soil cover area (street waste disposal area in Figure 4-2) and incorporate this area into the LUC Management Plan.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA	12/31/2015
OU: 1	**Issue Category:** Changed site conditions			
	Issue: The extent of shallow soil exceeding the ROD RGs in the vicinity of NE Rankin Road and adjacent to the bunkers is not known.			
	Recommendation: Investigate the extent of shallow soil exceeding the ROD RGs in the vicinity of NE Rankin Road and the bunkers (see Figure 8-1) and incorporate areas exceeding RGs into the LUC Management Plan.			

Five-Year Review Summary Form (Continued)

Affect Current Protectiveness	Affect Future Protectiveness	Implementing Party	Oversight Party	Milestone Date
Yes	Yes	Federal Facility	EPA	8/31/2016
OU: 1	**Issue Category:** Monitoring			
	Issue: A large number of chemicals were detected in the 2009 marine tissue collected to support the OU 2 BERA. These detections imply that there are potential data gaps in the human health marine tissue analyte list that could impact the assessment of human health risks.			
	Recommendation: Complete the marine tissue data gaps analysis and finalize the analyte list for potential future rounds of marine tissue monitoring.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA	12/31/2015
OU: 1	**Issue Category:** Monitoring			
	Issue: Unresolved questions remain regarding whether ordnance compounds are present in marine tissue, whether risks to human health from these compounds are unacceptable, and whether arsenic concentrations in marine tissue present a risk to human health above background risks.			
	Recommendation: Evaluate the results of the 2014 marine tissue monitoring and complete the HHRA to resolve whether ordnance compounds are present in marine tissue, whether risks to human health from these compounds are unacceptable, and whether arsenic concentrations in marine tissue present a risk to human health above background risks.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA	12/31/2015
OU: 1	**Issue Category:** Monitoring			
	Issue: Potential vapor intrusion risk in the NEX convenience store, Building 30, and residential homes located upgradient and cross gradient of the source area were identified as a data gap in the FFS.			

Five-Year Review Summary Form (Continued)

<table>
<tr><td></td><td colspan="4">Recommendation: Perform indoor air, subslab vapor, and crawlspace sampling at the NEX Gas Station Leak Area and compare to screening levels. If concentrations of COCs exceed the screening levels, assess whether the remedial design for the NEX Gas Station Leak Area should be modified to mitigate vapor intrusion risks.</td></tr>
<tr><td>Affect Current Protectiveness</td><td>Affect Future Protectiveness</td><td>Implementing Party</td><td>Oversight Party</td><td>Milestone Date</td></tr>
<tr><td>Yes</td><td>Yes</td><td>Federal Facility</td><td>EPA</td><td>12/31/2015</td></tr>
</table>

<table>
<tr><th colspan="3">Protectiveness Statement(s)</th></tr>
<tr><td>Operable Unit: 1</td><td>Protectiveness Determination:
Protectiveness deferred</td><td>Addendum Due Date:
3/31/2017</td></tr>
<tr><td colspan="3">Protectiveness Statement:
A protectiveness determination for the remedy at OU 1 cannot be made until further information is obtained. Further information will be obtained by performing mercury sampling at seeps/outfalls at Site 101-A; investigating the extent of shallow soil exceeding ROD RGs and evaluating whether contamination in shallow soil identified during the focused Phase II SI could pose unacceptable risks to human health; and performing indoor air, subslab vapor, and crawlspace sampling at the NEX Gas Station Leak Area and comparing results to screening levels to evaluate whether there are unacceptable vapor intrusion risks to human health.</td></tr>
<tr><td>Operable Unit:
3T JPHC</td><td>Protectiveness Determination:
Will be protective</td><td>Addendum Due Date:
Not applicable</td></tr>
<tr><td colspan="3">Protectiveness Statement:
The remedy at OU 3T JPHC is expected to be protective of human health and the environment upon completion. The substantive elements of the remedy (LUC implementation and anomaly removal) have been completed. Once the RACR for the Intertidal Zone is complete, the remedy is expected to be protective of human health and the environment.</td></tr>
<tr><td>Operable Unit:
3T NHB</td><td>Protectiveness Determination:
Will be protective</td><td>Addendum Due Date:
Not applicable</td></tr>
<tr><td colspan="3">Protectiveness Statement:
The remedy at OU 3T NHB is expected to be protective of human health and the environment upon completion. Remedy implementation consists of formalizing existing LUCs in a LUC Management Plan. The existing LUCs currently address site risks.</td></tr>
</table>

Signature sheet for the Jackson Park Housing Complex/Naval Hospital Bremerton third 5-year review report.

T. A. Zwolfer
Captain, USN
Commanding Officer
Naval Base Kitsap

9/11/2015
Date

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APPENDICES

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FIGURES

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TABLES

ABBREVIATIONS AND ACRONYMS

ARAR	applicable or relevant and appropriate requirement
AWQC	ambient water quality criteria
bgs	below ground surface
BERA	baseline ecological risk assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	chemical of concern
cm/s	centimeter per second
COPC	chemical of potential concern
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CSL	cleanup screening level
CSM	conceptual site model
DCE	dichloroethene
DDESB	Department of Defense Explosives Safety Board
DMM	discarded military munitions
DMM-HE	discarded military munitions with high explosive
DoD	U.S. Department of Defense
DPE	dual-phase extraction
DRO	diesel-range organics
Ecology	Washington State Department of Ecology
EOD	explosive ordnance disposal
EPA	U.S. Environmental Protection Agency
ESA	environmental site assessment
FFS	focused feasibility study
FS	feasibility study
Forest City	Forest City Residential Management
GRO	gasoline-range organics
HHRA	human health risk assessment
HI	hazard index
IRIS	Integrated Risk Information System
JPHC	Jackson Park Housing Complex
kg	kilogram
LTM	long-term monitoring
LUC	land use controls
M	marine
MEC	munitions and explosives of concern
µg/kg	microgram per kilogram

ABBREVIATIONS AND ACRONYMS (Continued)

µg/L	microgram per liter
mg/kg	milligram per kilogram
mg/kg-d	milligram per kilogram per day
mg/L	milligram per liter
MLLW	mean lower low water
mm	millimeter
MPPEH	material potentially presenting an explosive hazard
MSL	mean sea level
MTCA	Model Toxics Control Act
MW	monitoring well
NAD	Naval Ammunition Depot
NAVFAC NW	Naval Facilities Engineering Command Northwest
Navy	U.S. Navy
NBK	Naval Base Kitsap
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEX	Navy Exchange
NHB	Naval Hospital Bremerton
NOSSA	Naval Ordnance Safety and Support Activity
NPL	National Priorities List
O&M	operation and maintenance
ORC	Oxygen Release Compound
OU	operable unit
PCB	polychlorinated biphenyl
pCi/L	picocurie per liter
PCP	pentachlorophenol
PQL	practical quantitation limit
RACR	remedial action completion report
RAO	remedial action objective
RBC	risk-based screening concentration
RBSL	risk-based screening level
RDX	royal demolition explosive (cyclotrimethylene trinitramine)
RG	remediation goal
RI	remedial investigation
ROD	Record of Decision
RPM	remedial project manager
RRO	residual-range organics
SI	site investigation
SQS	sediment quality standard
SVE	soil vapor extraction

ABBREVIATIONS AND ACRONYMS (Continued)

SVOC	semivolatile organic compound
T	terrestrial
TCE	trichloroethene
TCRA	time-critical removal action
TPH	total petroleum hydrocarbons
TPH-G	total petroleum hydrocarbons as gasoline
URS	URS Corporation, Inc.
UST	underground storage tank
UXO	unexploded ordnance
VOC	volatile organic compound
WQS	Water Quality Standards

1.0 INTRODUCTION

This report presents the results of the third 5-year review performed for the Jackson Park Housing Complex/Naval Hospital Bremerton (JPHC/NHB) National Priorities List site. JPHC/NHB is located in eastern Kitsap County, approximately 2 miles northwest of Bremerton, Washington (Figure 1-1). The period covered by this 5-year review is August 1, 2009 through July 31, 2014.

The purpose of a 5-year review is to evaluate 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 5-year reviews are documented in 5-year review reports, which identify any issues found during the review and provide recommendations to address them. This report was prepared using U.S. Department of Defense (DoD), U.S. Navy (Navy), and U.S. Environmental Protection Agency (EPA) guidance (USDoD 2012 and 2014, U.S. Navy 2011a and 2013a, and USEPA 2001, 2012, and 2014a).

The Navy, the lead agency for JPHC/NHB, is preparing this 5-year review report pursuant to Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP; 40 Code of Federal Regulations [CFR] Part 300). CERCLA Section 121 states the following:

> If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.

The Naval Facilities Engineering Command Northwest (NAVFAC NW) has conducted this third 5-year review of the remedial actions implemented at JPHC/NHB. The review was initiated in August 2014 using data generated between August 2009 and July 2014. The triggering action for this review was the second 5-year review, executed by the Navy in February 2011. The first 5-year was executed in August 2005. Contaminants have been left at JPHC/NHB above levels that allow for unlimited use and unrestricted exposure. CERCLA requires 5-year reviews when hazardous substances, pollutants, or contaminants will remain on site. Because RODs documenting the remedies implemented at JPHC/NHB were signed after October 17, 1986 (the effective date of the Superfund Amendments and Reauthorization Act), this 5-year review is considered a statutory, rather than a policy, review.

There are three operable units (OUs) at JPHC/NHB:

- OU 1 (Figure 1-2) consists of the terrestrial portions of the site and addresses human health risks from terrestrial chemical sources in soil and groundwater and ingestion of shellfish from Ostrich Bay. OU 1 at JPHC/NHB consists of four sites (101, 101-A, 103, and 110), and the Navy Exchange (NEX) Gas Station Leak Area (formerly known as the Benzene Release Area).

- OU 2 addresses the potential chemical impacts on marine sediments in Ostrich Bay and any associated ecological risks to the marine environment.

- OU 3 addresses potential explosive hazards that may be present on former Naval Ammunition Depot (NAD) Puget Sound property or in Ostrich Bay. OU 3 has been further subdivided to allow separate considerations of all munitions issues by geographical area and environment, both terrestrial (T) and marine (M). The three OU 3 subunits are the following:

  - OU 3T JPHC, which consists of terrestrial (or “upland”) areas, including the entire housing complex, and all areas of the site between the 0-foot mean lower low water (MLLW) and the mean higher high water

  - OU 3T NHB, which consists of terrestrial areas within the NHB property boundaries above mean higher high water

  - OU 3M, which consists of subtidal areas of Ostrich Bay to the east of OU 3T JPHC below 0-foot MLLW where contamination is located

This report covers the remedies selected in the signed RODs for OU 1 (U.S. Navy, Ecology, and USEPA 2000), OU 3T JPHC, and OU 3T NHB (U.S. Navy and USEPA 2011 and 2014a) and the signed ROD Amendment No. 1 for OU 1 NEX Gas Station Leak Area (U.S. Navy and USEPA 2013a). Although the ROD for OU 3T NHB was executed on September 29, 2014 after this 5-year review period, the Navy has decided to include a preliminary review of this OU in this 5-year review. Separate RODs, currently under development, will be issued for OU 2 and OU 3M.

This 5-year review is streamlined to minimize duplicating information that has been presented in previous 5-year reviews. The intent is to focus on the actions, monitoring, and issues over the last 5 years and recommendations and protectiveness for the next 5 years. To facilitate these objectives, information from the previous 5 years is briefly summarized and a reference is included where the reader may obtain more detailed information. In addition, frequently referenced documents are included in Appendix A as a CD.

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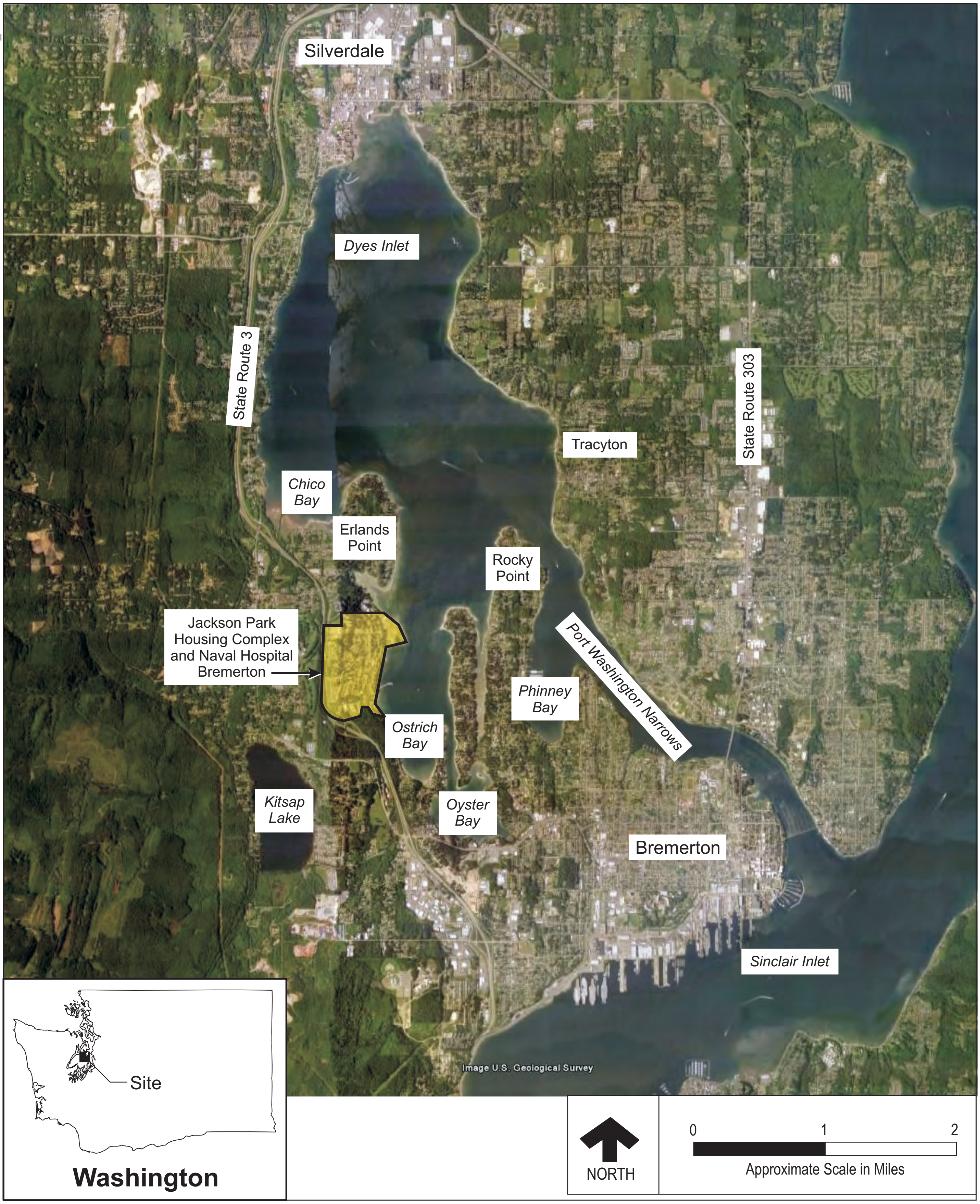
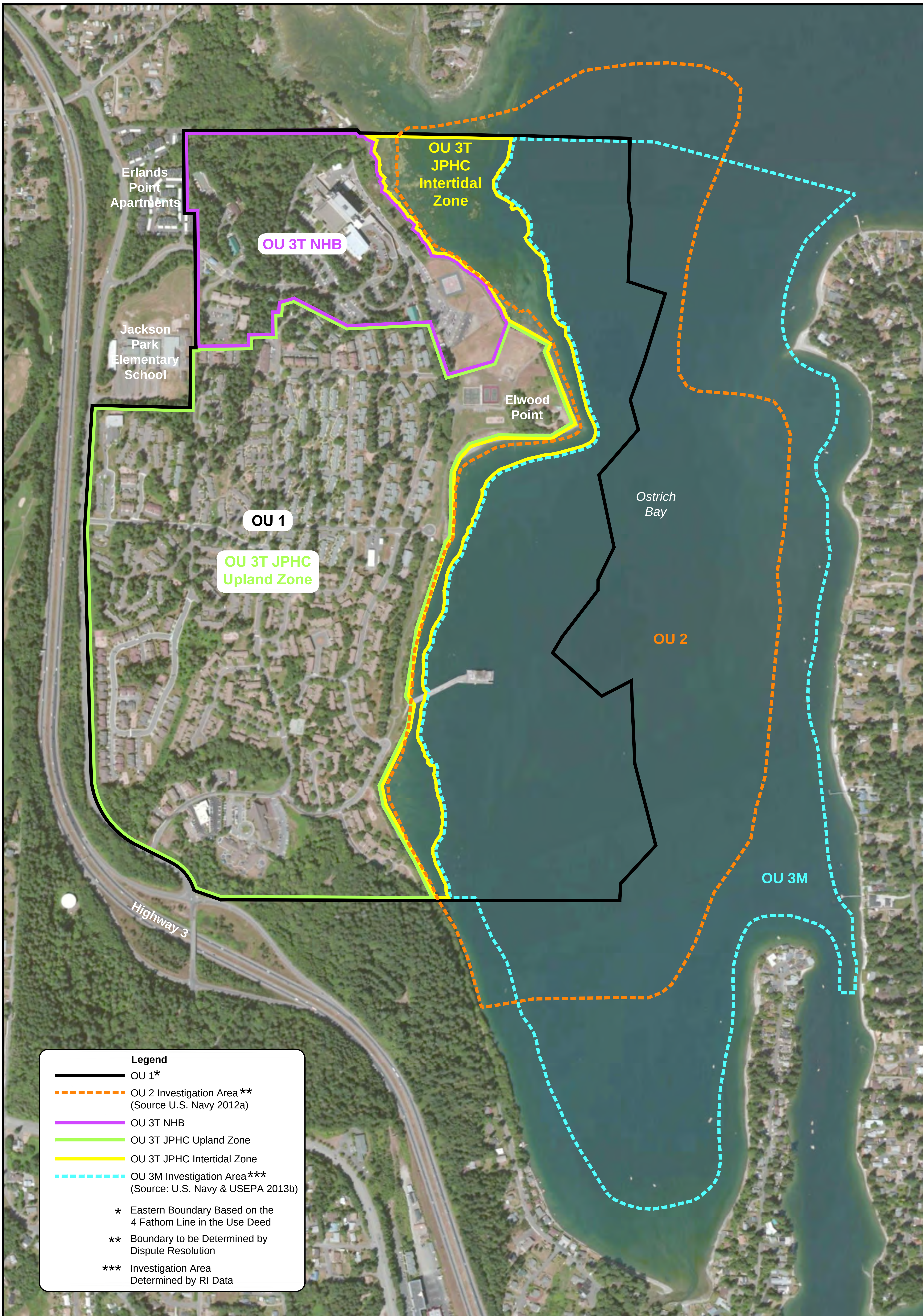


U.S. NAVY	**Figure 1-1** **JPHC/NHB Vicinity Map**	JPHC/NHB THIRD FIVE-YEAR REVIEW



U.S. NAVY	0 300 600 SCALE IN FEET	**Figure 1-2** **JPHC/NHB Operable Units**	JPHC/NHB THIRD FIVE-YEAR REVIEW

J:\GIS\Projects\NAVY\jacks_pk\IDIQ\DO 89\3rd 5-YR Review\Fig 1-2 Operable Units.dwg
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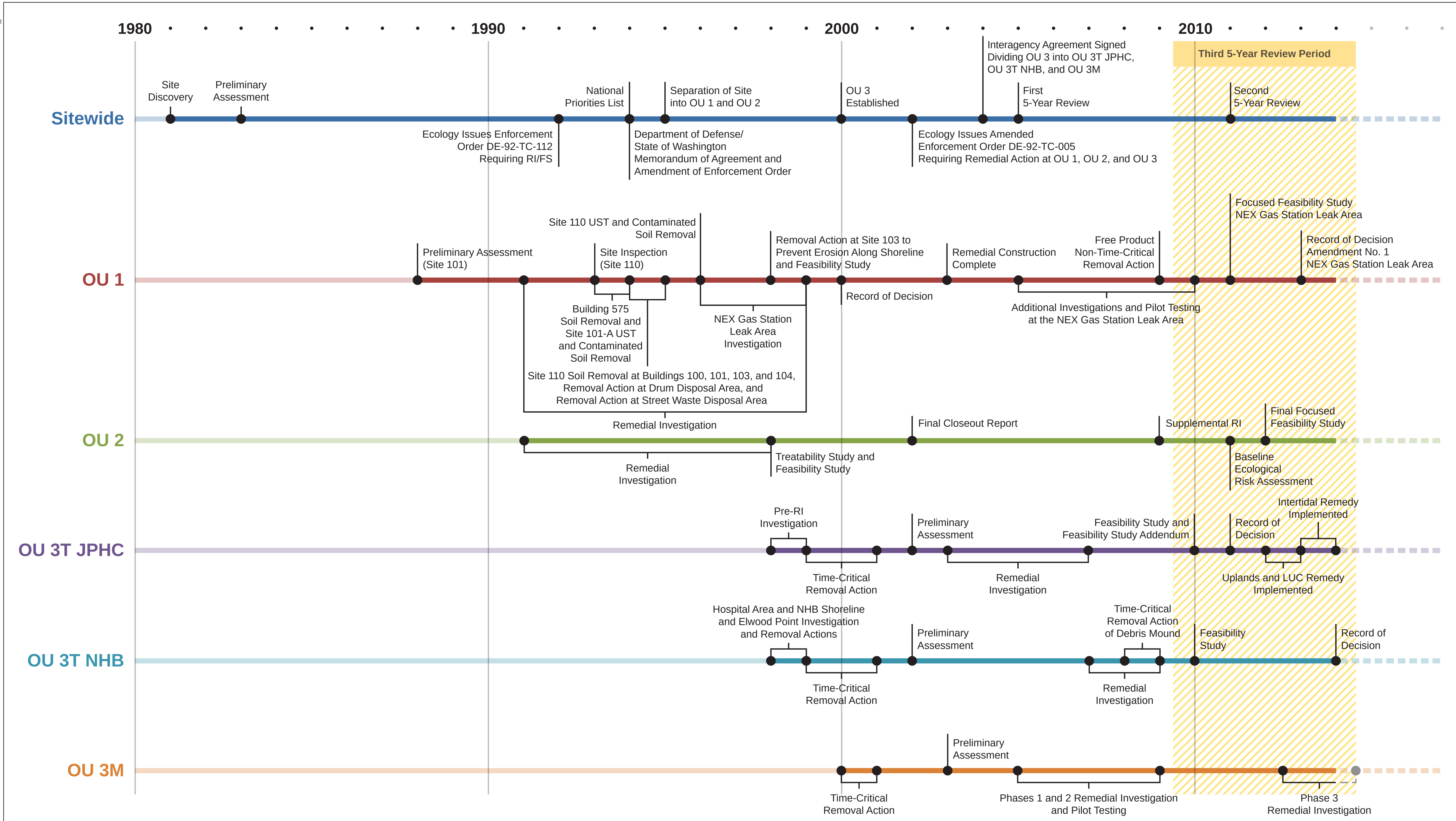
2.0 SITE CHRONOLOGY

This section summarizes dates of major events such as the initial discovery of contamination, enforcement documents, National Priorities List listing, RODs, remedial and removal actions, construction completion, and prior 5-year reviews. The chronology of major site events for JPHC/NHB is summarized by OU on Figure 2-1 and in Table 2-1. Additional information can be obtained by reviewing Section 2 of the first and second 5-year reviews (U.S. Navy 2005c and 2011b), which were completed in 2005 and 2011, respectively. These documents are included as attachments in Appendix A for easy reference. Information on major site events occurring after the signing of the ROD is provided in subsequent sections of this report.



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U.S. NAVY	JPHC/NHB THIRD FIVE-YEAR REVIEW	**Figure 2-1** **JPHC/NHB Chronology of Events**

Table 2-1
JPHC/NHB Chronology of Events

Event	Date
Sitewide	
Discovery	1981
Preliminary assessment (U.S. Navy 1983)	1983
Ecology issued Enforcement Order DE-92-TC-112 requiring remedial investigation and feasibility study	February 18, 1992
Memorandum of agreement between State of Washington and DoD	February 3, 1994
Amendment of Ecology enforcement order to include provisions of the memorandum of agreement	May 2, 1994
Placed on National Priorities List	1994
Separation of site into OU 1 and OU 2	1995
OU 3 established	2000
Ecology issued amended Enforcement Order DE-92-TC-005 requiring remedial action at OU 1, OU 2, and OU 3	March 27, 2002
Interagency agreement (corrected) signed that divided OU 3 into OU 3T JPHC, OU 3T NHB, and OU 3M (U.S. Navy and USEPA 2004)	November 1, 2004
First 5-year review (U.S. Navy 2005c)	2005
Second 5-year review (U.S. Navy 2011b)	2011
OU 1	
Preliminary assessment (Site 101) (U.S. Navy 1988)	1988
Remedial investigation (U.S. Navy 1994a, 1995, and 1998c)	1991–1999
Site inspection (Site 110) (U.S. Navy 1994c)	1993
Various removal actions	1993–1998
NEX Gas Station Leak Area investigation (U.S. Navy 1998a)	1996–1999
Feasibility study (U.S. Navy 1998b)	1998
Record of Decision (U.S. Navy, Ecology, and USEPA 2000)	August 10, 2000
Remedy construction complete	2003
Additional investigations and pilot testing at NEX Gas Station Leak Area (U.S. Navy 2006a, 2007a, 2009a, and 2011d)	2005–2010
Free-product non-TCRA (U.S. Navy 2009c)	2009
NEX Gas Station Leak Area focused feasibility study (U.S. Navy 2011d)	2011
OU 1 Record of Decision Amendment No. 1, NEX Gas Station Leak Area (U.S. Navy and USEPA 2013a)	September 20, 2013
OU 2	
Remedial investigation (U.S. Navy 1994a, 1994b, and 1998c)	1991–1998
Treatability study and feasibility study (U.S. Navy 1998d and 1998e)	1998
Final closeout report (data summary for decision making) (U.S. Navy 2002g)	2002
Supplemental remedial investigation (U.S. Navy 2010c and 2010d)	2009
Baseline ecological risk assessment (U.S. Navy 2011c)	2011
Focused feasibility study (U.S. Navy 2012a)	2012
OU 3	
Munitions clearances and removal actions	1959–1998

Table 2-1 (Continued)
JPHC/NHB Chronology of Events

Event	Date
OU 3T JPHC	
Pre-remedial investigation	1998–1999
TCRA (munitions) in shoreline areas as part of OU 1 remedy implementation	1999–2001
Preliminary assessment (U.S. Navy 2002a)	2002
Phase 1 remedial investigation (U.S. Navy 2005b)	2003–2004
Phase 2 remedial investigation (U.S. Navy 2010a and 2010b)	2007
Feasibility study and feasibility study addendum (U.S. Navy 2010a and 2010b)	2010
Record of Decision (U.S. Navy and UEPA 2011)	July 28, 2011
Uplands remedy component implementation and RACR completion	2012–2013
Intertidal remedy component implementation	2013–2014
LUC remedy component implementation completed	2013
OU 3T NHB	
Pre-remedial investigation and removal actions	1998–1999
TCRA (munitions) in shoreline areas as part of OU 1 remedy implementation	1999–2001
Preliminary assessment (U.S. Navy 2002a)	2002
Remedial investigation (U.S. Navy 2010e)	2007–2009
TCRA of debris mound (U.S. Navy 2010f)	2008–2009
Feasibility study (U.S. Navy 2010e)	2010
Record of Decision (U.S. Navy and USEPA 2014a)[a]	September 29, 2014
OU 3M	
TCRA (U.S. Navy 2010g)	2000–2001
Preliminary assessment (U.S. Navy 2003b)	2003
Phase 1 remedial investigation (U.S. Navy 2010g)	2005–2006
Phase 2 remedial investigation and pilot testing (U.S. Navy 2010g)	2009
Phase 3 remedial investigation	2013–2015 (tentatively)

[a]Although the ROD for OU 3T NHB was executed on September 29, 2014 after this 5-year review period, the Navy has decided to include a preliminary review of this document in this 5-year review.

Notes:
DoD - U.S. Department of Defense
Ecology - Washington State Department of Ecology
JPHC - Jackson Park Housing Complex
M - marine
NEX - Navy Exchange
NHB - Naval Hospital Bremerton
OU - operable unit
RACR - remedial action completion report
T - terrestrial
TCRA - time-critical removal action

3.0 BACKGROUND

JPHC/NHB is located in eastern Kitsap County, approximately 2 miles northwest of Bremerton, Washington (Figure 1-1). The JPHC/NHB properties are bounded to the north by the community of Erlands Point, to the west by State Route 3, to the south by an undeveloped wooded area, and to the east by Ostrich Bay. Ostrich Bay is part of the Puget Sound marine environment. The topography slopes from a maximum elevation of 180 feet above mean sea level at the west edge of the site down to a relatively flat shoreline area along Ostrich Bay. Much of JPHC/NHB is developed as high-density residential housing for Navy personnel and dependents. Drinking water for OU 1 is supplied by the City of Bremerton public water system.

NAD Puget Sound was established in 1904 and was active through 1959. Operations included assembly, transportation, storage, and demilitarization of military weapons and ammunition. The facility experienced its highest level of activity between World War I and the end of World War II. A more detailed site description and history are included in Section 3 of the second 5-year review (U.S. Navy 2011b), which is included in Appendix A, and in the final archive search report (U.S. Navy 2002b).

The facility was closed in 1959, but remained military property in caretaker status following closure. Construction of military housing on the site began in 1965, and the site was reassigned to the Puget Sound Naval Shipyard in 1975 and renamed JPHC. In 1977, approximately 50 acres of the site were transferred to the Naval Regional Medical Center for a new hospital (NHB), which became operational in 1980. Because of the construction of the military housing and hospital and facility maintenance and upgrades, extensive regrading of the terrestrial portions of the site has been performed. Portions of the former NAD Puget Sound were conveyed to the City of Bremerton for a park and school, the State of Washington for Route 3, and private developers for the Erlands Point Apartment Complex. Around 1981, a gas station was added to the NEX convenience store located within JPHC.

In 2014, the Navy and Forest City Residential Management (Forest City) entered into a public-private venture agreement. Under the public-private venture agreement, the Navy and Forest City entered into a ground lease. Although Naval Base Kitsap (NBK) retained ownership of the land, ownership of the majority of the structures was transferred to Forest City. JPHC is currently managed and operated by Forest City.

3.1 OPERABLE UNIT 1

OU 1 consists of four sites: Sites 101, 101-A, 103, and 110 (Figure 3-1). The NEX Gas Station Leak Area overlaps Sites 101 and 110, and was discovered after the feasibility study (FS) was completed. Table 3-1 summarizes the background information for OU 1, including physical characteristics, land and resource use, history of contamination, and any removal actions performed prior to the signing of the ROD. Table 3-2 summarizes the basis for taking remedial action at OU 1. A summary of the potential exposure pathways and receptors for OU 1 is included in Figure 3-2. More detailed site background information is included in the second 5-year review (U.S. Navy 2011b) and OU 1 FS report (U.S. Navy 1998b), which are included in Appendix A.

3.2 OPERABLE UNIT 2

OU 2 of the JPHC/NHB site consists of marine sediments in Ostrich Bay, and addresses potential ecological risks to aquatic and aquatic-dependent animals (Figure 1-2). (Note that human health risks are addressed under OU 1.) Ostrich Bay lies at the southern end of Dyes Inlet in Puget Sound, is approximately 0.5 mile wide, and varies in depth from tidally exposed areas near the shoreline to approximately 12 meters deep in the center. East of OU 2 is the Port Washington Narrows, a constricted inlet that enables tidal exchange with central Puget Sound. Erlands Point separates the bay from Dyes Inlet. Ostrich Bay is bordered on the west by the terrestrial portion of JPHC/NHB (OU 1 and OU 3T) and on the south and east by the City of Bremerton and is surrounded by suburban and rural development. The portion of Ostrich Bay that is OU 2 consists of federal and state owned and controlled property.

Ostrich Bay is also within the Suquamish Tribe’s usual and accustomed harvest area. The tribe has utilized the natural resources of Ostrich Bay, including fish and shellfish, for thousands of years and retains treaty-protected rights to harvest. Although current restrictions prohibit harvest, the tribe is actively involved in programs to restore beneficial uses to Ostrich Bay.

Potential sources of chemical contamination to OU 2 include past activities at JPHC/NHB and off-site sources in Dyes Inlet and the Port Washington Narrows. Potential sources of chemical contamination to Ostrich Bay from JPHC/NHB were identified as outfall drainage pipes from the upland areas, seeps from contaminated groundwater, storm drains, and surface soil runoff. With the exception of the NEX Gas Station Leak Area, these upland sources have been addressed by the remedial actions taken under RODs issued for OU 1 and OU 3T. Furthermore, with the execution of the OU 1 ROD Amendment No. 1, remedy implementation at the NEX Gas Station Leak Area has been initiated. In addition to the upland sources, the potential exists for the release of munitions constituents from military munitions items discarded in Ostrich Bay.

No removal action has occurred within OU 2. The remedial investigations (RIs), treatability studies, and FSs conducted prior to completion of the last 5-year review are described in Section 3 of the second 5-year review (U.S. Navy 2011b), which is included in Appendix A.

The baseline ecological risk assessment (BERA) focused on receptor species that have the highest potential exposures to site-related chemicals and that served to represent other species or groups of organisms that may also be exposed. These receptors of concern were selected based on the site habitat characteristics and pathways of exposure to site-related chemicals. Representative receptors of concern are the benthic invertebrate community, which is used to evaluate direct exposures of lower trophic benthic organisms to chemicals in site sediments; crabs to evaluate exposures of benthic invertebrates through bioaccumulation of sediment chemicals; starry flounder to evaluate exposures to higher trophic fish through bioaccumulation; great blue heron, osprey, and surf scoter (a diving duck) to evaluate risks to birds that consume sediment, benthic invertebrates, fish, and crabs; and river otter to evaluate risks to mammals that consume fish, clams, and crabs. The conceptual site model (CSM) for OU 2 is included in Figure 3-3.

The BERA identified minimal ecological risks from the chemicals of potential concern (COPCs) (arsenic, chromium, mercury, and zinc), although these limited risks have not been demonstrated to be directly linked to contamination in OU 2 sediments (U.S. Navy 2011c). The benthic invertebrate community is unlikely at risk based on bioassay results and comparisons of sediment data to the Washington State sediment quality standards (SQSs) and cleanup screening levels (CSLs). Arsenic in sediment poses an unlikely site-related risk to fish and crabs. Chromium poses an unlikely site-related risk to the surf scoter. Mercury poses a minimal risk to the surf scoter and river otter. Zinc poses a minimal risk to crabs. Because arsenic and chromium concentrations in sediment are at or below concentrations in sediment in the Puget Sound region (regional background), site-related risk from these metals is unlikely. Risks from organic chemicals and MCs in sediment are negligible.

Based on the results of the RIs, treatability studies, and BERA, a focused FS (FFS) was completed (U.S. Navy 2012a), which is included in Appendix A. The FFS identified the following preliminary remedial action objectives (RAOs) for the protection of aquatic and aquatic-dependent animals at OU 2:

- Demonstrate a reduction of risk for fish, diving ducks (surf scoter), and aquatic-dependent mammals (river otter) ingesting arsenic, chromium, and mercury in tissues of aquatic animals (prey organisms) and ingesting sediment.

- Demonstrate a reduction of risk for crabs based on whole crab body tissue concentrations of arsenic and zinc.

- Demonstrate a reduction of the concentrations of mercury and zinc in Ostrich Bay surface sediment to regional background concentrations (arsenic and chromium are already at regional background levels).

Based on these RAOs, four remedial action alternatives were identified and evaluated in the FS:

- Alternative 1 – No Action
- Alternative 2 – Monitored Natural Recovery
- Alternative 3 – Thin Layer Capping
- Alternative 4 – Containment with Reactive Capping Material

The Proposed Plan and ROD for OU 2 are currently under development.

3.3 OPERABLE UNIT 3

OU 3 has been divided into three subunits to allow separate considerations of all munitions issues by geographical area and environment, both terrestrial (T) and marine (M). The three OU 3 subunits are OU 3T JPHC, OU 3T NHB, and OU 3M (Figure 1-2). Because these OU 3 subunits overlap the areas defined by OU 1 and OU 2, information on the physical characteristics, land and resource use, and history of contamination previously presented for OU 1 and OU 2 is not repeated here. Sections 3.3.1 through 3.3.3 focus on the historical investigations and removal actions performed prior to the signing of the ROD and the basis for taking remedial action. The CSM for OU 3T JPHC and OU 3T NHB is included in Figure 3-4. A preliminary CSM has not yet been developed for OU 3M in the Phases 1 and 2 RI/FS work plans (U.S. Navy 2006b and 2009d). A third phase of work is currently underway at OU 3M to refine the CSM and define the OU 3M boundaries. Because the CSM presented in the Phases 1 and 2 work plans may be modified by the Phase 3 work, which is being conducted outside this 5-year review period, the CSM was not included in this 5-year review.

3.3.1 Operable Unit 3T JPHC

Historical Investigations and Removal Actions

Discarded military munitions (DMM)-related investigations and removal actions were conducted at JPHC between 1959 and 2007 (U.S. Navy and USEPA 2011). More than 50,000 separate anomaly locations were investigated. No area was identified as a possible DMM dump or burial site at JPHC. Rather, it is believed that all of the DMM items found originated from operations at NAD Puget Sound. The following is a summary of the historical investigations and removal actions:

- **Navy explosive ordnance disposal (EOD) operations, 1959–1998:** As part of facility operations and construction activity from 1959 to 1998, munitions clearance and response activities were conducted intermittently.

- **Pre-RI, 1998–1999:** The investigation included a surface clearance, geophysical survey to identify metallic anomalies that could represent munitions and explosives of concern (MEC), and excavation of 290 test pits and 5 trenches in selected subgrids. No DDM with high explosive (DMM-HE) item was found. Over 5,000 20- and 40-mm empty shell casings were found in a particular area of the shoreline (U.S. Navy 2002c).

- **Time-critical removal action (TCRA), 1999–2001:** Remediation activities started in the southern part of the shoreline at JPHC and progressed northward. The TCRA involved investigation of 2,475 identified metallic anomalies to a depth of 2 feet over 11.7 acres (including the ball field on the NHB property), removal and screening of the uppermost 1 foot of soil, and placement of a 1-foot soil cap over approximately 9 acres. Four DMM-HE items were recovered, and 4,589 other munitions-related items were also found, ranging from non-HE-containing DMM (e.g., small arms) to material potentially presenting an explosive hazard (MPPEH) scrap (U.S. Navy 2002d and 2002e). The site, except areas designated for pavement, was then covered with a 4- to 6-inch layer of topsoil and sod (U.S. Navy 2010a).

- **Surface clearance for OU 1 ROD removal action, 2002:** Surface clearance in an OU 1 ROD contaminated soil removal area identified 143 subsurface metallic anomalies. No DMM or MPPEH item was encountered during intrusive investigation of these 143 targets (U.S. Navy 2002d and 2002e).

- **Phase 1 RI, 2003–2004:** All accessible areas of JPHC (154 acres) were investigated using digital geophysical mapping and surface clearance by unexploded ordnance (UXO) technicians to remove metallic interference from approximately the top 2 inches (U.S. Navy 2005a). A total of 38,303 individual anomalies were investigated, including 6 DMM-HE, 1 DMM without HE, 1,701 small arms and MPPEH, 25,888 pieces of scrap metal, and 64 grains of smokeless powder. Anomalies deeper than 2 inches (10,643 total) were not investigated.

- **Phase 2 RI, 2004–2007:** An intrusive investigation was conducted to obtain more definitive data on the nature, extent, and distribution of DMM. Out of 75,005 potential targets, 9,460 individual anomaly locations were investigated by qualified UXO personnel to determine the presence or absence of DMM. Items recovered from the excavations included 23,913 anomalies totaling approximately 15,833 pounds of metal, 2 DMM-HE (40-mm projectile and 40-mm round), 3 DMM with no HE (20-mm practice round, marine marker flare, and parachute flare), 117 small arms items or smokeless powder grains, and 1,130 pieces of MPPEH (consisting of non-energetic materials such as ammo can lids and shell casings) (U.S. Navy 2010a, 2010b, and 2010e). The RI results are shown on Figure 3-5.

More detailed information on the historical investigations and removal actions are included in the RI/FS report (U.S. Navy 2010a) and ROD for OU 3T JPHC (U.S. Navy and USEPA 2011), which are included in Appendix A.

Basis for Taking Remedial Actions

The OU 3T JPHC ROD identified the following potential receptors who may be exposed to explosive hazards associated with contact with DMM: residents, commercial visitors, and tribal members. Residents include adults, children, site visitors, and recreational shellfish harvesters. Commercial visitors include construction workers, utility workers, and day care children and adults. Tribal members include site visitors and ceremonial, commercial, and subsistence shellfish harvesters. Potential DMM contact may occur during outdoor recreational activities, shellfish harvesting activities, and ground-disturbing activities associated with facility construction and maintenance (Figure 3-4).

An explosive hazard assessment, the functional equivalent of a risk assessment for chemical contamination, was performed for JPHC in 2008. The hazard assessment considered the potential receptors and exposure pathways discussed above. The MEC hazard assessment identified the site as having low potential for explosive hazards using data from the Phases 1 and 2 RIs (U.S. Navy 2007b and 2010a).

Naval Ordnance Safety and Security Activity (NOSSA) also performed a hazard assessment required by DoD Ammunition and Explosives Safety Standards (USDoD 2008). NOSSA and the DoD Explosives Safety Board (DDESB) determined that there is a low incidence of MEC at the site and the explosive safety risk at the site is low, provided that the program of MEC awareness is maintained. Following NOSSA's hazard assessment and DDESB review, NBK Instruction 8020.1A was issued, which includes both a MEC awareness program and an on-call construction support program. The NBK instruction has been updated since its initial inception (see Section 4.2.1).

3.3.2 Operable Unit 3T NHB

Historical Investigations and Removal Actions

DMM-related investigations and removal actions were conducted at NHB between 1959 and 2009 (U.S. Navy and USEPA 2011). DMM-HE finds at NHB are shown on Figure 3-6. The following is a summary of the historical investigations and removal actions:

- **Navy EOD operations, 1959–1995:** As part of facility operations and construction activity from 1959 to 1995, munitions clearance and response activities were conducted intermittently.

- **Pre-RI, 1995:** Two boxes were found in a wooded area 75 feet from the south wall of NHB. The items were identified as a World War II–vintage demolition kit and flare kit. The demolition kit is a DMM-HE item. The materials were determined to be too unstable to be moved off site by EOD Bangor and were disposed of by on-site detonation (U.S. Navy 2002b).

- **Pre-RI, Hospital Area Investigations, 1998–1999:** These investigations included surface sweeps, a geophysical survey, and intrusive investigations prior to construction of the clinic expansion and included areas outside of the clinic construction area. One DMM-HE (Mark 12 fuze), one DMM-pyrotechnic, nine DMM-small arms, and over 1,000 MPPEH were removed and properly disposed of (U.S. Navy 2002e).

- **Pre-RI, NHB Shoreline and Elwood Point Investigation and Removal Action, 1998–1999:** A surface sweep, electromagnetic survey, and intrusive investigation were performed at Elwood Point and the NHB shoreline north of Elwood Point. Anomaly clearance activities followed the investigations. One DMM-HE (2.25-inch nose cone with smokeless powder) and 99 MPPEH were removed (U.S. Navy 2002e).

- **TCRA/OU 1 ROD Implementation, 1999–2001:** Data from the 1998 geophysical survey conducted as part the NHB shoreline and Elwood Point investigation were used to select and investigate anomaly locations prior to ROD construction activities in the Elwood Point area. One DMM-HE (40-mm fuzed projectile) and more than 2,700 MPPEH were removed. However, the total number of MPPEH may include items found within the boundaries of OU 3T JPHC, because construction work was performed before the differentiation between OU 3T JPHC and OU 3T NHB.

- **Construction Safety Oversight, 2003–2007:** Construction safety oversight has been provided at NHB since November 2003. One DMM-HE item (Coast Guard 1-pounder casing with primer) was discovered in October 2005 about 300 feet northwest of the hospital building at a depth of about 6 inches (U.S. Navy 2010e).

- **RI and TCRA, 2007–2009:** A sitewide RI to evaluate the nature and extent of DMM-HE and TCRA of a former trash-burning mound (Former Waste Burning Area) were performed at OU 3T NHB. The area to be investigated included

50 feet on either side of present and historical roads, railways, and pathways, 50 feet around present and former building locations, the developed area surrounding the hospital and support buildings, and three distinct open areas identified on historical aerial photographs that might have been affected by NAD Puget Sound activities. Areas excluded from excavation included portions of Elwood Point that were investigated as part of the OU 1 ROD and TCRA activities, the woodland area where slopes exceeded 30 degrees, and areas under roads and buildings because they were cleared as part of the construction. The four principal activities performed during the RI include vegetation removal, surface clearance, geophysical investigation, and intrusive operations. During the vegetation removal and surface clearance activities, a former trash-burning mound containing canisters of flashless pellets was located on the eastern shoreline of NHB. As a result, a TCRA was implemented at the former trash-burning mound, and a total of 346 canisters containing flashless pellets (not DMM-HE) was removed from the mound, as well as over 6,500 MPPEH. Following the TCRA, the RI work resumed. During the RI, 11,997 subsurface electromagnetic anomalies were identified and 1,417 were selected for investigation. No DMM-HE was recovered. However, four DMM-pyrotechnics, three DMM-small arms, and over 1,500 MPPEH were recovered (U.S. Navy 2010e).

- **Wetland Delineation and Cultural Plant Survey, 2011:** In 2005, the Navy performed a wetland assessment on the NHB site and identified three wetlands: Wetland A, Wetland B, and Wetland C. A second wetland delineation and cultural plant survey was conducted in 2011 (U.S. Navy 2011e) to support the evaluation of remedial alternatives for the site (Figure 3-7). Wetland A is a small (approximately 103 square feet) palustrine (nontidal wetland dominated by trees, shrubs, and persistent emergent vegetation) forested wetland at the northeast corner of the NHB property. For security reasons, trees and shrubs around Wetland A were cut in the spring of 2005, exposing the soil to direct sunlight and resulting in drier conditions. Wetland B is located along an old railroad bed that was built to extend a standard-gauge railroad to Bangor. Wetland B covers approximately 15,000 square feet and extends along most of the length of the old railroad bed. The railroad was cut through higher surrounding land, and seepage from this surrounding area is probably the source of the wet soil conditions. Wetland B is a palustrine forested wetland. Wetland C is a Category I estuarine wetland (salt marsh) located along the northern half of the NHB shoreline. The on-site portion of Wetland C covers approximately 1.8 acres; the wetland extends off site to the north. Wetland C consists of both estuarine and freshwater wetlands. Category I wetlands are considered rare, unique, and highly productive natural resources requiring a high level of protection to maintain their function and economic as well as environmental value. During the cultural plant survey, 37 plants known to be used by the Suquamish Tribe for medicine, food, tools, or weaving were found at the site.

More detailed information on the historical investigations and removal actions are included in the RI/FS report (U.S. Navy 2010e) and ROD for OU 3T NHB (U.S. Navy and USEPA 2014a), which are included in Appendix A. As previously stated, the ROD for OU 3T NHB was executed on September 29, 2014, after this 5-year review period. However, the Navy has decided to include a preliminary review of this OU in this 5-year review.

Basis for Taking Remedial Actions

The OU 3T NHB ROD identified the following potential receptors who may be exposed to explosive hazards associated with contact with DMM: adult residents, commercial patrons, commercial workers, utility and road maintenance workers, and tribal users. Residents at OU 3T NHB are hospital workers that are generally assigned temporary housing at the Bachelor Enlisted Quarters. Commercial patrons are adult and child patients at the hospital and those accompanying patients. Commercial workers are adults who work at the hospital as professional and support staff. Utility and road maintenance workers are considered to be adults working under contract or are part of NBK Bremerton Public Works conducting a specific repair, upgrade, or new project at the site. Tribal users include site visitors who will harvest plants found in the wetland and upland buffer areas for the following uses: medicinal, food, tools, or baskets and clothing. Potential DMM contact may occur during outdoor recreational activities, plant harvesting activities, and ground-disturbing activities associated with facility construction and maintenance (Figure 3-4).

The exposure hazard and item of concern addressed at OU 3T NHB is the potential explosive hazard from DMM-HE. The Navy has conducted an extensive amount of work at the site over almost 30 years of investigation and removal. The results confirm that there is a low potential for DMM-HE at the site. Only five items of concern, DMM-HE, were found during actions conducted prior to the RI. No DMM-HE item was identified during the RI. Based on results of the RI, there does not appear to be a clustering of DMM items in any one area, which indicates that there was no intentional, systematic disposal or burial of DMM-HE at this site. Furthermore, clusters of items do not appear to be in the vicinity of the sites of the former buildings used during the active life of NAD Puget Sound, along transportation corridors (i.e., the former railroad lines), or in the open areas identified from historical air photographs.

However, DMM-HE may be present as a result of the site's past history as NAD Puget Sound. Based on the MEC hazard analysis, NOSSA evaluation, and the recorded incident rate (number of subsurface DMM-HE item locations divided by the number of investigated anomalies), there is a "low probability" for subsurface DMM-HE exposure at OU 3T NHB (U.S. Navy 2010e and U.S. Navy and USEPA 2014a).

3.3.3 Operable Unit 3M

OU 3 addresses potential explosive hazards that may be present in the subtidal areas of Ostrich Bay where contamination is present (Figure 1-2). Nearly all munitions stored, manufactured, demilitarized, or otherwise handled at NAD Puget Sound were brought to and shipped from the site via marine transport and handled on one of three piers established at the site: two associated with unloading and loading barges (Piers 1 and 2) and a third associated with movement via closed railroad cars. There is no indication, either in the written record or anecdotal, of any detonation of DMM at JPHC, NHB, or in Ostrich Bay.

Prior to performance of the Phase 2 RI, 22,132 DMM were recovered from Ostrich Bay, of which 11,192 were DMM-HE. No unexploded ordnance item was recovered. All but one of the subtidal items were recovered proximal to Pier 2 and former Pier 1. A summary of the investigations and munitions recoveries conducted in Ostrich Bay are presented below:

- **EOD Detachment Clearance, 1981:** Navy divers performed an investigation and removal near the Pier 2 and former Pier 1 locations. Recoveries were extensive and ranged from small arms ammunition to a single anti-submarine "Hedgehog" rocket. During this removal action, 9,818 DMM-HE were recovered from Ostrich Bay.

- **OU 1 ROD, 2000–2001:** A clearance was conducted in support of mooring dolphins, pilings, and railroad pier removals north and south of Elwood Point and along Pier 2 related to the removal of fender piles. DMM were located at Pier 2. No DMM located was associated with the investigations north and south of Elwood Point. During this removal action, 270 DMM-HE were recovered from the vicinity of Pier 2.

- **OU 3M TCRA, 2000–2001:** An investigation and clearance were undertaken by Pier 2 and the former Pier 1 location based on the DMM discoveries during the OU 1 fender pile removal. Numerous DMM items, including 733 DMM-HE, were recovered from the area around the piers. Work also included investigations in the central portion of Ostrich Bay to define the limit of DMM contamination.

- **Phase 1 RI, 2006:** A geophysical survey and diving were conducted during the summer of 2006. The survey encompassed the areas surrounding the piers, Elwood Point, and the likely shipping lanes into and out of Ostrich Bay. Over 600 targets were identified in the survey, of which 103 were selected by the Navy and EPA for subsequent investigation by Navy divers. One projectile casing containing a flash tube and propellant was located near the former railroad pier. No DMM-HE was recovered during the Phase 1 RI.

- **EPA Diving, 2008:** EPA divers swam transects as part of a biological survey of Ostrich Bay in January 2008, observing and documenting bottom conditions. One empty shell casing was observed. No DMM was reported by the EPA divers.

- **EOD Diving, 2008:** Navy divers swam transects in Ostrich Bay in April 2008 to investigate the EPA-observed shell casing and document bottom conditions closer to the piers. The shell casing was removed and determined to be munitions debris. No DMM was observed by the Navy divers during reconnaissance around the pier area.

- **Phase 2 RI and Pilot Study, 2009:** Three principle activities were accomplished during the Phase 2 RI—beach sweeps for DMM that may be present in the intertidal area on the south and east sides of Ostrich Bay to address data gaps concerning the nature and extent of DMM, a geophysical survey of portions of Ostrich Bay not surveyed as part of the Phase 1 RI (southern and eastern Ostrich Bay), and diving on additional selected targets to ensure that the data have been collected to adequately define the nature and extent of DMM. The pilot study included an evaluation of three sediment removal techniques and three sediment screening techniques. The RI and pilot study operation resulted in the recovery of 235 DMM items. No DMM, small arms ammunition, or MPPEH item was identified or recovered during the beach sweep operation.

More detailed information on the historical investigations and removal actions are included in the Phase 2 RI and pier area pilot FS after-action report (U.S. Navy 2010g), which is included in Appendix A. The Navy is currently conducting Phase 3 of the RI for OU 3M.

Legend

- Site Boundary Line
- Naval Hospital Property Line
- Public Private Venture Agreement Lease Boundary

U.S. NAVY

JPHC/NHB
THIRD
FIVE-YEAR REVIEW

0 200 400
SCALE IN FEET

Figure 3-1
Operable Unit 1 Site Divisions

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U.S. NAVY

JPHC/NHB
THIRD
FIVE-YEAR REVIEW

Figure 3-2
Operable Unit 1 Potential Exposure Pathways and Receptors

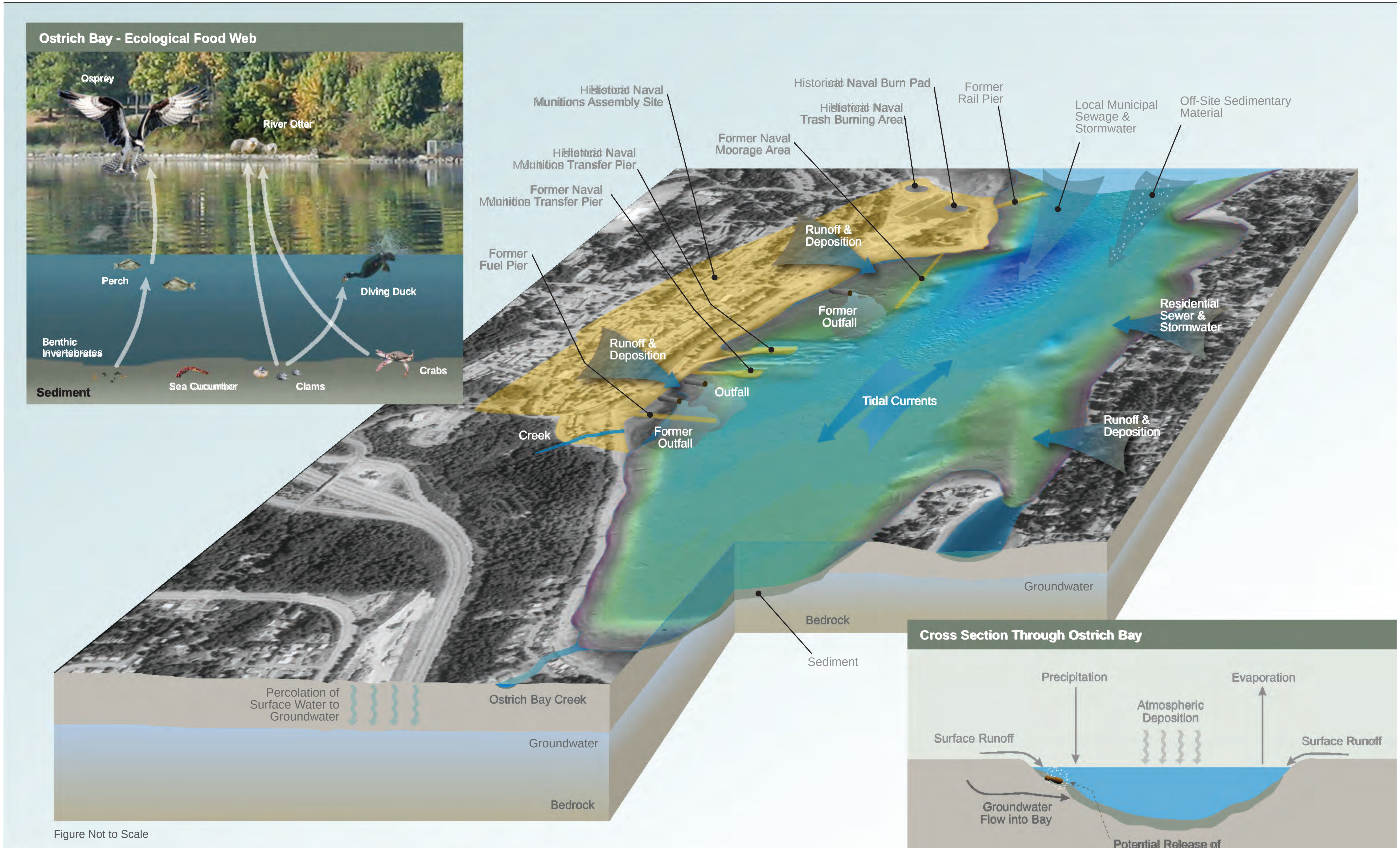


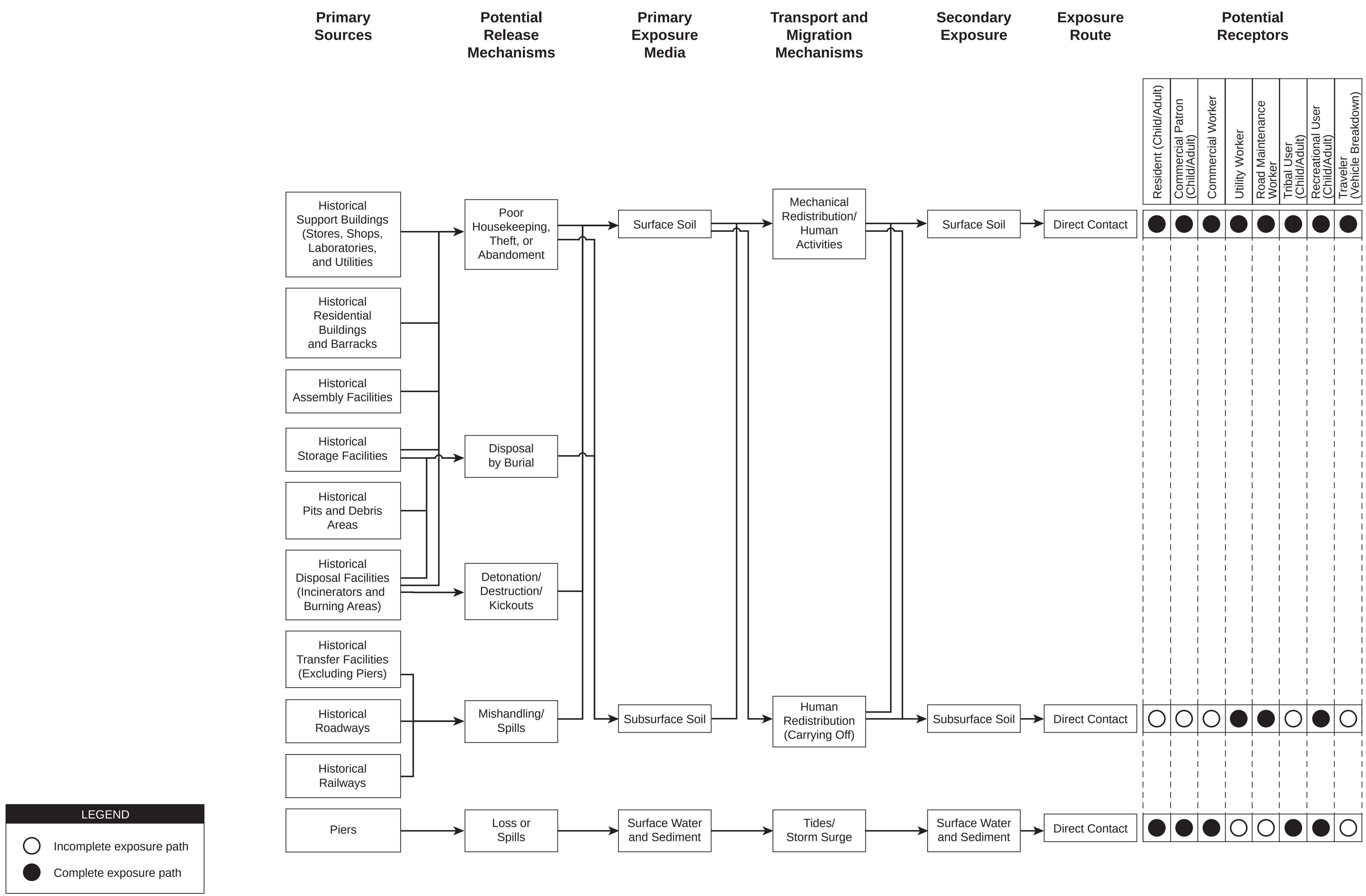
Figure Not to Scale

Source: Figure 2-4 U.S. Navy 2011c

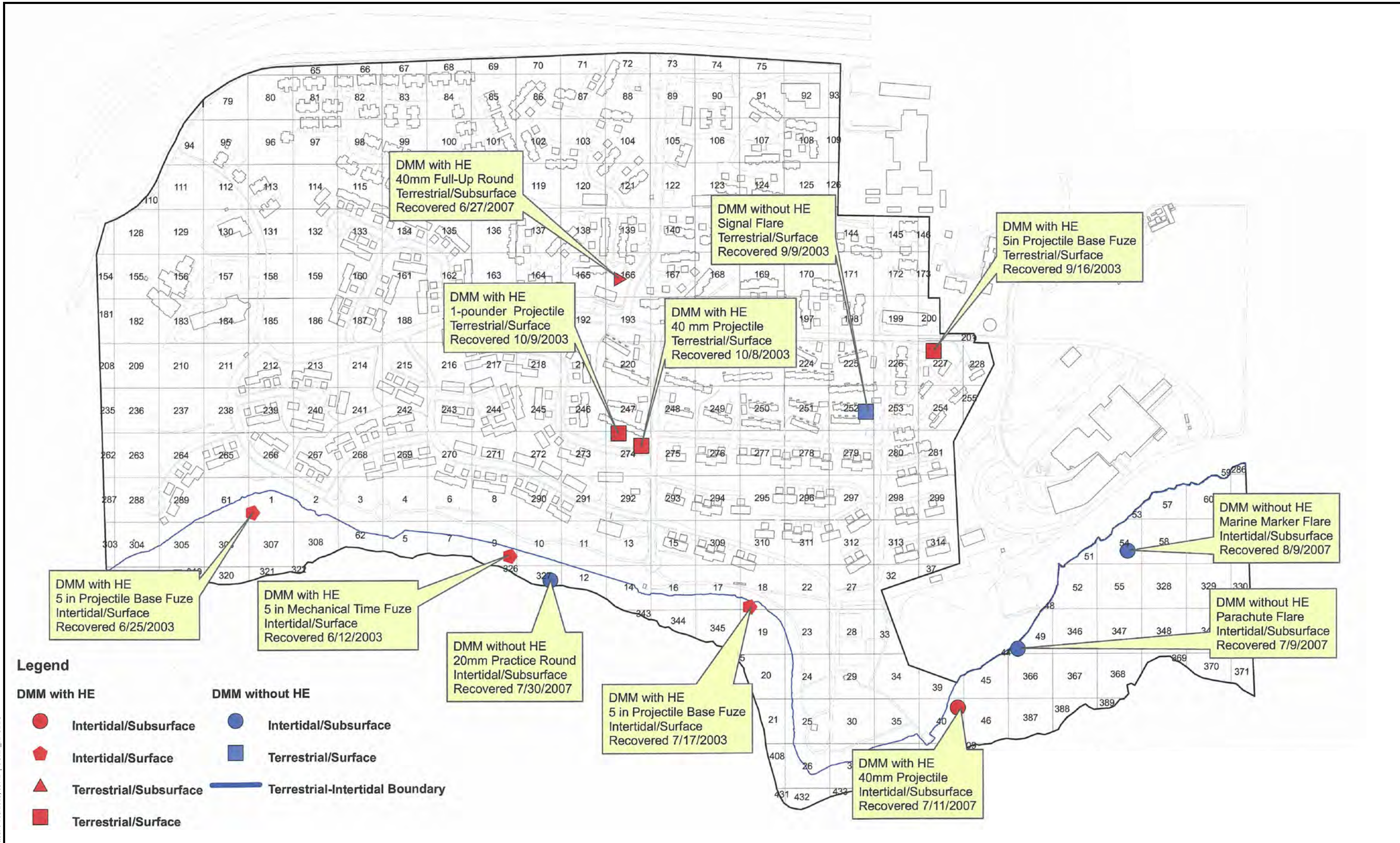
33762150_03.ai

U.S. NAVY	JPHC/NHB THIRD FIVE-YEAR REVIEW	**Figure 3-3** **Ecological Conceptual Site Model for OU 2**

33762150_04.ai



U.S. NAVY	JPHC/NHB THIRD FIVE-YEAR REVIEW	**Figure 3-4** **Potential DMM-HE Exposure Path Conceptual Site Model for OU 3T**



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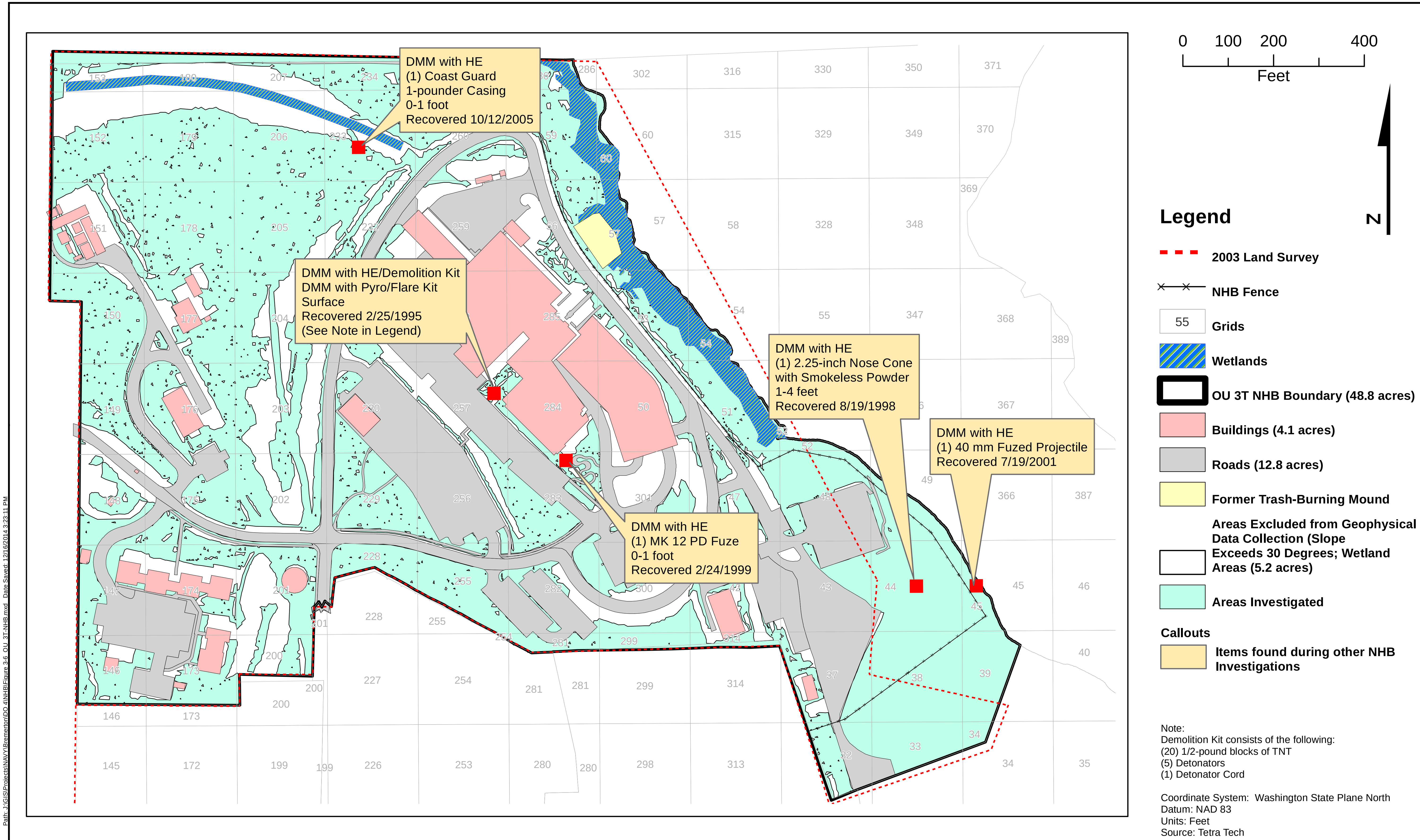
Source: U.S. Navy 2010a

U.S. NAVY	JPHC/NHB THIRD FIVE-YEAR REVIEW	0 200 400 SCALE IN FEET	Figure 3-5 OU 3T JPHC Remedial Investigation Results



U.S. NAVY

JPHC/NHB
THIRD
FIVE-YEAR REVIEW

Figure 3-6
DMM-HE Finds at OU 3T NHB

U.S.NAVY

0 50 100 200
SCALE IN FEET

Figure 3-7
Delineated Wetland Boundaries

JPHC/NHB
THIRD
FIVE-YEAR REVIEW

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Table 3-1
Background Information Summary for OU 1, JPHC/NHB

Site	Physical Characteristics	Land and Resource Use	History of Contamination	Removal Actions Performed
101	• Site is located primarily east of South Shore Road along Ostrich Bay up to Elwood Point. • Site consists of a strip of shoreline approximately 2,400 feet long by 200 feet wide. • Groundwater is present in the glacial outwash deposits (Vashon Recessional Outwash) and consists of a zone of perched water above the Vashon Till, a layer of relatively impermeable glacial till.	• The site is used for recreation and includes a bike/walking path and easily accessible beachfront areas. • Groundwater is not a potential source of drinking water, because there is insufficient yield to support drinking water wells.	• The historical industrial processes at Site 101 included ordnance production and destruction (demilitarization), storage of ordnance, and recycling and disposal of ordnance wastes. • Waste ordnance (explosive dry powders) was produced daily in the loading and sifting buildings. • Rooms in the loading and sifting buildings were rinsed with water daily to prevent the explosive powders from accumulating and forming an explosive atmosphere, and most liquid wastes were flushed into tile drains and discharged directly to Ostrich Bay. • Some waste liquids were removed from the waste stream and transported by truck to a recycling processing area on site. • Diesel and motor oil contamination in subsurface soils was found immediately east of Building 575 (originally referred to as Building 91) along South Shore Road.	A removal action was conducted from September 1993 through February 1994 and included the following: • Removing petroleum-contaminated soil in the area east of Building 575 • Removing the buried foundation of former NAD Building 122 • Confirmation soil sampling, which indicated levels of TPH below the MTCA cleanup level in two of six sampling locations • Leaving contaminated soils in place beneath Building 575 to ensure the structural stability of the building • Placing engineered backfill in the excavation, which was designed, together with the natural underlying glacial till, to decrease the likelihood that the small amounts of remaining contamination would migrate to groundwater
101-A	• Site is located in the southeast corner of JPHC. • Site consists of approximately 880 lineal feet of shoreline and 7 acres of adjacent uplands. • The shoreline area was backfilled during the construction of the Naval Magazine Puget Sound (early 20th century) and housing units (1970s). • Groundwater in the nearshore portion of the site is present in glacial outwash deposits (Vashon Recessional Outwash) and consists of a zone of perched groundwater above the Vashon Till, a layer of relatively impermeable glacial till.	• The site includes a construction debris fill area, which was used to dispose of structural debris from demolition of ordnance bunkers at Site 110. • The site includes a housing area around Root Court. • Groundwater is not a potential source of drinking water, because there is insufficient yield to support drinking water wells.	• The historical industrial processes at Site 101-A included ordnance production and destruction (demilitarization), storage of ordnance, and recycling and disposal of ordnance wastes. • Waste ordnance (explosive dry powders) was produced daily in the loading and sifting buildings. • Rooms in the loading and sifting buildings were rinsed with water daily to prevent the explosive powders from accumulating and forming an explosive atmosphere, and most liquid wastes were flushed into tile drains and discharged directly to Ostrich Bay. • An incinerator and a boiler house were present at Site 101-A.	A removal action was conducted in 1993 and included the following: • Removing six USTs and some associated pipes and fuel distribution lines • Removing all petroleum-impacted soils from beneath four of the tanks • Removing petroleum-contaminated soil above groundwater from the two remaining UST excavations, but not removing the soil beneath the water table containing petroleum hydrocarbons above the MTCA Method A cleanup level • Placing an engineered backfill on top of geotextile fabric designed to contain any remaining contamination by decreasing the permeability of the soil • Sampling groundwater in downgradient wells, which indicated no migration of petroleum hydrocarbons through the groundwater
103	• Site is located east and southeast of the hospital. • Site consists of a low, flat promontory referred to as Elwood Point and approximately 500 feet of shoreline east of the hospital. • Groundwater is present in the glacial outwash deposits (Vashon Recessional Outwash) and consists of a zone of perched water above the Vashon Till, a layer of relatively impermeable glacial till.	• The site includes a helicopter pad, recreation fields, playing courts, children's play structure, picnic area, and easily accessible beachfront areas. • Groundwater is not a potential source of drinking water, because there is insufficient yield to support drinking water wells.	• The historical industrial processes and facilities associated with Site 103 were locomotive maintenance, sand-blasting, military and civilian housing, barracks, a cafeteria, latrines, paint and oil storage, and a railroad transfer pier. • Ordnance wastes were burned on a concrete slab on the north side of Elwood Point (Former Ordnance Burn Area), and trash was burned in an area farther north along the shoreline of the site adjacent to the hospital (Former Waste Burning Area). • An incinerator was present at Site 103. • Landfilling took place from 1910 to 1959 and included sands, gravels, and artificial materials such as concrete and metal debris.	Because significant erosion was occurring along the north shore of Site 103 near the helicopter pad, a removal action was conducted in 1998 to temporarily prevent further erosion along the shoreline. This removal action included the following: • Excavating the bank back to a slope of approximately 3H:1V • Armoring the slope with rock • Covering the area with a gravel mix to act as a sacrificial material during storm events An independent remedial action was also conducted in 1998 (U.S. Navy 1998f) and included the following: • Removing a 19,000-gallon UST and associated piping and concrete

Table 3-1 (Continued)
Background Information Summary for OU 1, JPHC/NHB

Site	Physical Characteristics	Land and Resource Use	History of Contamination	Removal Actions Performed
				cradle in the vicinity of former Building 193, which was apparently part of the fuel delivery system supporting locomotive operations at the site • Removing approximately 300 cubic yards of fuel-impacted soil from the excavation • Confirmation soil sampling verifying that all impacted soils had been removed
110	• Site includes the majority of JPHC/NHB. • The southern portion is part of the JPHC property and the northern portion part of the NHB property. • The topography slopes from a maximum elevation of 180 feet above mean sea level at the west edge of the site down to a relatively flat shoreline area along Ostrich Bay. • Groundwater occurs in the Vashon Advance Outwash deposits (beneath the Vashon Till), a regionally important aquifer.	• The primary land use of JPHC is military housing development and includes areas that are used for a combination of residential, recreational, and commercial purposes. • A youth center for indoor activities, several play courts, and small child play structures are also located throughout the housing area. • The only commercial activity is the Mini Mart, a convenience store at the NEX gas station. • The primary land use at NHB is the 125-bed hospital, pharmacy, clinics, and support structures. • NHB also includes a heavily wooded recreational area in the northern and northwestern portions of the property and the Bachelor's Enlisted Quarters within two buildings in the southwestern portion of the NHB property. • Groundwater within the Vashon Advance Outwash aquifer is generally potable, except for areas impacted by contamination, close to the shoreline where brackish water may occur, or where saltwater intrusion may be induced during pumping. • Groundwater is not being used for drinking water at JPHC/NHB, nor is it likely to be used in the future.	• Historical activities at Site 110, including the JPHC and NHB portions of the site, primarily consisted of ordnance production and storage of ordnance and inert materials. • Seven NAD Puget Sound buildings were constructed on the NHB site: Buildings 82, 84, 87, 88, and 89 were constructed from 1936 to 1939 as storage magazines, and Buildings 118 and 121 were built in 1943 for inert materials storage and projectile regrooving, respectively. • A narrow-gauge railroad was extended to the buildings located at NHB from the southern portion of NAD Puget Sound between 1940 and 1943, the narrow-gauge railroad was converted to standard gauge in 1944, and a rail line connecting Elwood Point to Bangor was completed at the same time. • In 1959, all explosives were moved from the bunkers to NAD Bangor. • Six bunkers were originally used for ordnance storage at the site, of which four are currently being used for storage, and the remaining two have been demolished. • The rail system was removed by 1968. • Ordnance wastes were found in at least 13 of the structures (including the ordnance storage bunkers) that were removed during demolition activities in the early 1970s. • Buildings most heavily used for ordnance were steam cleaned prior to demolition.	Four removal actions were completed at Site 110 from 1994 through 1996, in addition to the removal action at Building 575 described above for Site 101. These removal actions included the following: • Excavating contaminated soils within the vicinity of Bunkers 100, 101, 103, and 104 and an area within the Jackson Park Elementary School yard, except for some soil exceeding the MTCA Method A cleanup level for arsenic that remains underneath paved areas in front of two of the bunkers (Buildings 100 and 101) • Removing all waste and contaminated soil from the drum disposal area discovered at the northeast corner of Olding Road and Elwood Point Road during new home construction at JPHC • Placing and grading a clean soil cover over the street (vactor) waste disposal area located at the edge of a ravine south of Wencker Circle also discovered during new home construction • Removing four USTs, located south of Olding Road in the vicinity of the Jackson Park Community Center, and all associated petroleum-contaminated soil Based on the removal actions that had taken place, the Navy and the State of Washington determined that a formal remedial investigation report and human health risk assessment were not warranted at Site 110.
NEX Gas Station Leak Area	• The NEX Gas Station Leak Area is located within Sites 101 and 110. • The area was formerly known as the Benzene Release Area and historically identified by two seeps that discharge through two pipes along the shoreline of Ostrich Bay. • The area is defined by benzene and petroleum contamination in soil and groundwater, extending from the NEX gas station	• See Site 101 and 110 above.	• In 1991, an unleaded gasoline release from a leaking pipe at the NEX gas station was discovered during tank pressure testing. • In 1995, during a UST replacement project, leakage was noted in the pump island and associated tank piping systems (U.S. Navy 2000). • The replacement project consisted of the excavation and removal of two 10,000-gallon gasoline USTs and installation of three new 10,000-gallon USTs southeast of the pump island. • Benzene and total petroleum hydrocarbons as gasoline were detected in soil samples collected from the excavation, but no soil was reportedly transported from the site.	• None

Table 3-1 (Continued)
Background Information Summary for OU 1, JPHC/NHB

Site	Physical Characteristics	Land and Resource Use	History of Contamination	Removal Actions Performed
	approximately 450 feet downgradient to Ostrich Bay. • Groundwater beneath the NEX Gas Station Leak Area exists both as perched groundwater, as described for Site 101, and deeper groundwater beneath the Vashon Till, as described for Site 110.		• Groundwater was not assessed at the time of the UST removal. • In 1996 during seep sampling at Site 101, benzene was detected at one shoreline outfall. • Additional seep and groundwater sampling were conducted from 1996 through 1999 (U.S. Navy 1998a and 2000). • Contaminated soil and groundwater were detected in the NEX Gas Station Leak Area at concentrations above the MTCA cleanup levels for unrestricted land use (MTCA Method A). • Fuel line tightness testing and visual inspection were performed on the replacement UST system in June 2000, and the results led to the conclusion that the petroleum contamination resulted from leakage prior to 1995 when the piping system and tanks were replaced.	• None

Notes:
JPHC - Jackson Park Housing Complex
MTCA - Model Toxics Control Act
NAD - Naval Ammunition Depot
NEX - Navy Exchange
NHB - Naval Hospital Bremerton
OU - operable unit
TPH - total petroleum hydrocarbons
UST - underground storage tank

Table 3-2
Basis for Remedial Action at OU 1

		Applicable Classes of Chemicals Identified in OU 1 ROD[a]				
Basis for Remedial Action	**Applicable Media**	**Site 101**	**Site 101-A**	**Site 103**	**Site 110**	**NEX Gas Station Leak Area**
Unacceptable risks to current and future residents	Soil	Metals and cPAHs	Metals and cPAHs	Metals, cPAHs, and PCBs	HHRA not performed	HHRA not performed
	Sediment	Metals	Metals	Metals		
	Marine tissue	Metals and SVOCs[b]	Metals and SVOCs[b]	Metals and SVOCs[b]		
Chemical concentrations above soil ARARs	Soil	None	Metals	Metals and petroleum hydrocarbons	Metals and cPAHs	Petroleum hydrocarbons
Chemical concentrations above marine surface water ARARs	Seeps and outfalls	Metals and petroleum hydrocarbons	Metals	Metals and chlorinated VOCs	NA	Petroleum hydrocarbons
	Nearshore groundwater	Metals	Metals, cyanide, and petroleum hydrocarbons	Metals and pesticides	NA	Petroleum hydrocarbons
Chemical concentrations above groundwater ARARs (drinking water standards)	Groundwater	NA	NA	NA	Metals	NA
Ecological hazards	Seeps and outfalls	Metals	Metals	Metals	Ecological risk assessment not performed	Ecological risk assessment not performed

[a]Specific COCs are identified in Section 4.1.
[b]Although not specifically identified as COCs, the Record of Decision specified that arsenic and ordnance compounds would be included on the analyte list for marine tissue monitoring.

Table 3-2 (Continued)
Basis for Remedial Action at OU 1

Notes:
ARAR - applicable or relevant and appropriate requirement
COC - chemical of concern
cPAH - carcinogenic polycyclic aromatic hydrocarbon
HHRA - human health risk assessment
NA - not applicable
NEX - naval exchange
OU - operable unit
PCB - polychlorinated biphenyl
SVOC - semivolatile organic compound
VOC - volatile organic compound

4.0 REMEDIAL ACTIONS

The RODs for JPHC/NHB and the OU 1 ROD Amendment No. 1 required remedial actions for OU 1, OU 3T JPHC, and OU 3T NHB. A Statement of Resolution of Informal Dispute (U.S. Navy and USEPA 2012) clarified the OU 3T JPHC ROD by identifying different requirements for before and after removal of remaining detected anomalies in the JPHC intertidal area. This section summarizes the RAOs, remedies, remedy components and implementation, and ongoing operation, maintenance, and monitoring requirements established in the RODs for each of the OUs. The RODs for OU 2 and OU 3M have not been completed. Therefore, these two OUs are not included in this section or any of the subsequent sections in this document.

Information previously presented in the second 5-year review is not repeated here. Therefore, additional information can be obtained by reviewing Section 4 of the second 5-year (U.S. Navy 2011b) and the RODs for each OU, which are included in Appendix A. This 5-year review focuses on remedies selected and implemented between August 2009 and July 2014, as well as operation, maintenance, and monitoring information for this same time period.

4.1 OPERABLE UNIT 1

The ROD for OU 1 and OU 1 ROD Amendment No. 1 required remedial action at Sites 101, 101-A, 103, and 110 and the NEX Gas Station Leak Area. Remedy selection, remedy implementation, and operation, maintenance, and monitoring are presented for each of these sites in the sections below. The operation and maintenance (O&M) costs for OU 1 are summarized for this 5-year review period in Table 4-1. The O&M costs are almost five times higher than estimated in the ROD. This is primarily the result of the additional work performed at the NEX Gas Station Leak Area required to refine the CSM, prepare the ROD amendment, and design and begin implementing the revised remedy. Additional costs were also incurred in addressing stakeholders concerns regarding marine tissue sampling.

4.1.1 Site 101

Remedy Selection

The reasonably anticipated land use, impacted media, chemicals of concern (COCs), remediation goals (RGs), RAOs, and description of the remedy components are summarized in Table 4-2. Further information on remedy selection can be obtained by reviewing Section 4.1 of the second 5-year review (U.S. Navy 2011b) and OU 1 ROD (U.S. Navy, Ecology, and USEPA 2000), which are included in Appendix A.

Remedy Implementation

The remedy for Site 101 was implemented from June 2000 through June 2001. During this time, a soil cover was placed over the areas of impacted surface soil from the shoreline to west of Shoreline Road, shoreline stabilization measures were installed, and shellfish harvesting restriction signs were placed at several locations. Further information on remedy implementation can be obtained by reviewing Section 4.1 of the second 5-year review (U.S. Navy 2011b), which is included in Appendix A.

Operation, Maintenance, and Monitoring

The operation, maintenance, and monitoring program for Site 101, specified by the OU 1 ROD, consists of fulfilling ROD-mandated monitoring requirements, managing the institutional controls program, and maintaining the remedies implemented for the site.

Monitoring

Long-term monitoring (LTM) of seeps and outfalls at Site 101 has been conducted since 2002, with semiannual sampling occurring the first year of sampling and annual sampling occurring thereafter, in accordance with the ROD. Sampling occurred in summer and fall of the first year and in summer of the following years. An additional sampling round was conducted in the fall of 2004 during an extreme low tidal cycle. Sampling of three seeps (SP-710, SP-711, and SP-713) and two outfalls (OF-709 and OF-712) were included in the monitoring program at Site 101, and samples from these locations were analyzed as follows:

- All samples were analyzed for total metals (arsenic, beryllium, mercury, and thallium), dissolved metals (copper, lead, nickel, silver, and zinc), and cyanide.
- Samples from OF-709 were analyzed for chlorinated volatile organic compounds (VOCs), including 1,1-dichloroethene (DCE), trichloroethene (TCE), and vinyl chloride.
- Samples from SP-710, SP-711, and OF-712 were analyzed for benzene.
- Samples from SP-710 and SP-711 were analyzed for gasoline-range organics (GRO) and diesel-range organics (DRO).

All Site 101 monitoring activities since the last 5-year review were performed in accordance with the 2008 and 2012 LTM work plans (U.S. Navy 2008b and 2012b), except as noted below. Five rounds of seep and outfall samples have been collected since the last 5-year review. However, samples have not been collected from location SP-711 since November 2004 because of insufficient flow at the seep, high salinity of the seep water indicating the seep water was not representative of site groundwater, or both. Therefore, in 2012, SP-711 was eliminated from the LTM program. Also, as recommended in the last 5-year review, monitoring of total and dissolved metals at locations OF-709, SP-710, SP-713, and OF-712 and monitoring of chlorinated VOCs at OF-709 were eliminated in 2012 because these classes of chemicals were either not detected, or were detected consistently below the RG (U.S. Navy 2011b). The current sampling schedule as of the last LTM work plan (U.S. Navy 2012b) is shown in Table 4-3. LTM locations are shown on Figure 4-1. The results of seep and outfall monitoring at Site 101 are discussed in Section 6.4.

Marine tissue monitoring has been conducted since 2002 as part of the LTM program for Site 101, as well as for sites 101-A and 103. Marine tissue, including clam and crab tissue, was sampled for antimony, arsenic, vanadium, 3,3′-dichlorobenzidine, pentachlorophenol (PCP), and ordnance compounds in 2002 and 2004 in accordance with the ROD and LTM work plan (U.S. Navy 2002f). Based on recommendations made in the first 5-year review (U.S. Navy 2005c), the marine tissue monitoring program was revised with a reduced sampling frequency of once prior to each 5-year review. As a result, marine tissue samples were collected once in 2009. In addition, monitoring for ordnance compounds in the background samples was also added to the monitoring program. To provide more detailed information regarding arsenic, the Navy also elected to add arsenic speciation to the analyte list for marine tissue sampling in 2009. As recommended in the last 5-year review, PCP, antimony, vanadium, and 3,3′-dichlorobenzidine were dropped from the analyte list during the 5-year review process because they were never detected in three rounds of post-ROD monitoring, or were detected below concentrations found in reference areas. The current sampling schedule is shown in Table 4-3, and the marine tissue monitoring locations (clams and crabs) are presented on Figure 4-1.

Using the 2009 marine tissue LTM data, the 2010 human health risk assessment (HHRA) identified health risks above target health goals to the Suquamish population for arsenic and dinitrotoluene isomers (U.S. Navy 2010j). However, the 2010 HHRA identified a lack of consistent, definitive detections of ordnance compounds and concluded that dinitrotoluene isomers are unlikely to be present because of environmental degradation. The 2010 HHRA also stated that arsenic concentrations detected in Ostrich Bay shellfish tissue are at background levels, and thus it is likely that ROD goals have been met. However, because of data uncertainties for the ordnance data, an additional round of monitoring with improved ordnance analytical methods was recommended in advance of the third 5-year review. The second 5-year review also recommended continuing the harvest restrictions until target health goals are achieved.

In response to these data uncertainties, the Navy completed a sampling and analysis plan for an additional round of marine tissue monitoring using improved analytical methods (U.S. Navy 2014a). Analytical data collected during the marine tissue monitoring will be used in the preparation of a revised HHRA. The 2014 tissue data will be analyzed for speciated arsenic and ordnance compounds, and analysis of ordnance compounds will use improved analytical methods. The additional round of monitoring and risk assessment will provide additional temporal data for speciated arsenic and ordnance compounds for clams and crabs at the site and reference area and confirm whether the ROD target health goals have been met for these analytes at the site. The information will be used to consider whether shellfish harvest restrictions at JPHC OU 1 can be lifted. Because of delays in finalizing the work plan, the marine tissue sampling was not performed until August 2014, after this 5-year review period. Work on the shellfish investigation report and the associated HHRA is currently being performed. These reports are scheduled to be completed in October 2015. An addendum to this 5-year review will be completed following completion of these reports.

As part of the HHRA, a data gaps evaluation will also be completed. The data gaps evaluation will evaluate the available marine data in Ostrich Bay, the completeness of the ROD COC analyte list, the species selected for chemical analysis, and tissue sampling locations. Available data under consideration include the marine tissue data collected in 2009 for the BERA (U.S. Navy 2011c). The evaluation will identify potential data gaps relating to human exposures to seafood (i.e., analyte list, species consumed, and sampling locations) and will be conducted in collaboration with EPA and the Suquamish Tribe. Although the HHRA has not been completed in this review period, a preliminary data gap evaluation of the analyte list was performed during this review period and is presented in Section 6.4.1.

Institutional Controls

COCs in the groundwater beneath Site 101 are required to meet ROD RGs at the point where groundwater enters the marine environment (point of compliance). Because of this, the Land Use Control (LUC) Plan (U.S. Navy 2005d) specifies that permanent restrictions be placed on use of shallow groundwater as a drinking water source. Compliance inspections have been implemented as part of the LUC Plan to ensure that the drinking water restrictions continue to function as planned.

Institutional controls regarding excavation and construction are required in the area of Site 101 where impacted soils are covered by a geotextile liner. In addition, institutional controls regarding excavation and construction are required in the shoreline area of Site 101 where a shoreline stabilization system is in place. Figure 4-2 (Areas A and E) shows the location of the controlled areas. Such LUCs have also been incorporated into the LUC Plan (U.S. Navy 2005d). Compliance inspections and maintenance of the areas shown on Figure 4-2 have been implemented as part of the LUC Plan to ensure that the excavation and construction restrictions continue to function as planned.

Remedy Maintenance

Remedy maintenance inspections for Sites 101, 101-A, and 103 commenced in the spring of 2004 in accordance with the ROD. The schedule for inspections and maintenance activities conducted from 2009 to 2014 is summarized in Table 4-4. All inspection and maintenance activities since the last 5-year review were generally performed in accordance with the Inspection and Maintenance Plan (U.S. Navy 2003a) and the revised Inspection and Maintenance Plan (U.S.

Navy 2008b). Although the Inspection and Maintenance Plan was revised in 2008, only minor changes were made to the inspection and maintenance program. To address newly planted vegetation, weekly watering was added for the summer of 2008 and as needed for 2009. The 2008 Inspection and Maintenance Plan also identified the locations of newly placed shellfish harvest restriction signs. Inspection and maintenance activities are discussed further in Section 6.4.4.

4.1.2 Site 101-A

Remedy Selection

The reasonably anticipated land use, impacted media, COCs, RGs, RAOs, and description of the remedy components are summarized in Table 4-2. Further information on remedy selection can be obtained by reviewing Section 4.2 of the second 5-year review (U.S. Navy 2011b) and OU 1 ROD (U.S. Navy, Ecology, and USEPA 2000), which are included in Appendix A.

Remedy Implementation

The remedy for Site 101-A was implemented from June 2000 through June 2002. During this time, a soil cover was placed over the Root Court cul-de-sac area, shoreline stabilization measures were installed, and shellfish harvesting restriction signs were placed at several locations. Further information on remedy implementation can be obtained by reviewing Section 4.2 of the second 5-year review (U.S. Navy 2011b), which is included in Appendix A.

Operation, Maintenance, and Monitoring

The operation, maintenance, and monitoring program for Site 101-A specified by the ROD consists of fulfilling ROD-mandated monitoring requirements, managing the institutional controls program, and maintaining the remedies implemented for the site.

Monitoring

LTM of seeps and outfalls at Site 101-A has been conducted since 2002, with semiannual sampling occurring the first year of sampling and annual sampling occurring thereafter, in accordance with the ROD. Sampling occurred in summer and fall of the first year and in summer of the following years. An additional sampling round was conducted in the fall of 2004 during an extreme low tidal cycle. Sampling of one seep (SP-715) and one outfall (OF-716) is included in the monitoring program at Site 101-A, and samples from these locations were analyzed as follows:

- All samples were analyzed for total metals (arsenic, beryllium, mercury, and thallium), dissolved metals (copper, lead, nickel, silver, and zinc), and cyanide.

- SP-715 was analyzed for GRO and DRO.
- OF-716 was analyzed for pesticides (chlordane).

All Site 101-A monitoring activities since the last 5-year review were performed in accordance with the 2008 and 2012 LTM work plans (U.S. Navy 2008b and 2012b). Five rounds of seep and outfall samples have been collected since the last 5-year review. As recommended in the last 5-year review, monitoring of the following analytical parameters were eliminated in 2012 because these classes of chemicals were either not detected, or were detected consistently below the RG: total and dissolved metals at locations SP-715 and OF-716, petroleum hydrocarbons at SP-715, and chlordane (pesticides) at OF-716 (U.S. Navy 2011b). The current sampling schedule as of the last LTM work plan (U.S. Navy 2012b) is shown in Table 4-3. LTM locations are shown on Figure 4-1. The results of seep and outfall monitoring at Site 101-A are discussed in Section 6.4.

Marine tissue monitoring has also been conducted since 2002 as part of the LTM program for Site 101-A. Marine tissue monitoring for Sites 101, 101-A, and 103 is discussed in Section 4.1.1 and is not repeated here.

Institutional Controls

COCs in the groundwater beneath Site 101-A are required to meet ROD RGs at the point where groundwater enters the marine environment (point of compliance). Because of this, the LUC Plan (U.S. Navy 2005d) specifies permanent restrictions to be placed on use of shallow groundwater as a drinking water source. Compliance inspections have been implemented as part of the LUC Plan to ensure that the drinking water restrictions continue to function as planned.

In addition, institutional controls regarding excavation and construction are required in the construction debris landfill, areas of petroleum-impacted subsurface soil, and Root Court cul-de-sac area. Figure 4-2 shows the areas of Site 101-A (Areas D, F, and G) that require LUCs. Compliance inspections and maintenance of the areas shown on Figure 4-2 have been implemented as part of the LUC Plan (U.S. Navy 2005d) to ensure that these areas remain undisturbed and the soil cap continues to function as planned.

Remedy Maintenance

Remedy maintenance inspections for Site 101-A are described in Section 4.1.1 and Table 4-4.

4.1.3 Site 103

Remedy Selection

The reasonably anticipated land use, impacted media, COCs, RGs, RAOs, and description of the remedy components are summarized in Table 4-2. Further information on remedy selection can be obtained by reviewing Section 4.3 of the second 5-year review (U.S. Navy 2011b) and OU 1 ROD (U.S. Navy, Ecology, and USEPA 2000), which are included in Appendix A.

Remedy Implementation

The remedy for Site 103 was implemented in 2000 and 2001. During this time, soil covers were placed to the south of the play courts and in the vicinity of the former ordnance burn area, shoreline stabilization measures were installed, the source of VOCs in groundwater was investigated through visual inspections during remedial activities and a geophysical investigation (no VOC source was located), creosote-treated pilings, fender piles, and a string of moorage dolphins were removed from Ostrich Bay, and shellfish harvesting restriction signs were placed at several locations. Further information on remedy implementation can be obtained by reviewing Section 4.3 of the second 5-year review (U.S. Navy 2011b), which is included in Appendix A.

Operation, Maintenance, and Monitoring

The operation, maintenance, and monitoring program for Site 103 specified by the ROD consists of fulfilling ROD-mandated monitoring requirements, managing the institutional controls program, and maintaining the remedies implemented for the site.

Monitoring

LTM of seeps and outfalls at Site 103 has been conducted since 2002, with semiannual sampling occurring the first year of sampling and annual sampling occurring thereafter, in accordance with the ROD. Sampling occurred in summer and fall of the first year and in summer of the following years. An additional sampling round was conducted in the fall of 2004 during an extreme low tidal cycle. Two seeps (SP-707 and SP-704) and one outfall (OF-705) were selected at Site 103 for sampling. However, SP-704 could not be located, and a replacement seep (SP-703) was located after two rounds of sampling had already occurred. Therefore, sampling of SP-703 began in 2003. All samples from these locations were analyzed for chlorinated VOCs (1,1-DCE, TCE, and vinyl chloride), pesticides (chlordane), total metals (arsenic, beryllium, mercury, and thallium), dissolved metals (copper, lead, nickel, silver, and zinc) and cyanide, except for two sampling oversights: The sample collected from SP-703 in 2003 was not analyzed for pesticides (chlordane), and samples collected from OF-705 in 2006 and 2008 were not analyzed for chlorinated VOCs (1,1-DCE, TCE, and vinyl chloride).

All Site 103 monitoring activities since the last 5-year review were performed in accordance with the 2008 and 2012 LTM work plans (U.S. Navy 2008b and 2012b), except as noted in the paragraph above and the following discussion. Five rounds of seep and outfall samples have been collected since the last 5-year review. However, samples have not been collected from location SP-707 since 2006 because of high salinity of the seep water, indicating that the seep water was not representative of site groundwater. Therefore, in 2012, SP-707 was eliminated from the LTM program. Also, as recommended in the last 5-year review, monitoring of total and dissolved metals and chlorinated VOCs at location SP-703 and chlordane (pesticides) at SP-703 and OF-705 were eliminated because these classes of chemicals were either not detected, or were detected consistently below the RG. The current sampling schedule as of the last LTM work plan (U.S. Navy 2012b) is shown in Table 4-3. LTM locations are shown on Figure 4-1. The results of seep and outfall monitoring at Site 103 are discussed in Section 6.4.

Marine tissue monitoring has also been conducted since 2002 as part of the LTM program for Site 103. Marine tissue monitoring for Sites 101, 101-A, and 103 is discussed in Section 4.1.1, and is not repeated here.

Institutional Controls

COCs in the groundwater beneath Site 103 are required to meet ROD RGs at the point where groundwater enters the marine environment (point of compliance). Because of this, the LUC Plan (U.S. Navy 2005d) specifies permanent restrictions to be placed on use of shallow groundwater as a drinking water source. Compliance inspections have been implemented as part of the LUC Plan to ensure that the drinking water restrictions continue to function as planned.

Institutional controls regarding excavation and construction are required in two areas of Site 103 where impacted soils are covered by a geotextile liner. Institutional controls regarding excavation and construction are also required in the shoreline area of Site 103 where a shoreline stabilization system is in place. Finally, residential development is not allowed on the site. Figure 4-2 shows the areas of Site 103 (Areas B, C, E, and I) that require LUCs. Compliance inspections and maintenance of the areas shown on Figure 4-2 have been implemented as part of the LUC Plan (U.S. Navy 2005d) to ensure that these restrictions continue to function as planned.

Remedy Maintenance

Remedy maintenance inspections for Site 103 are described in Section 4.1.1 and Table 4-4.

4.1.4 Site 110

Remedy Selection

The reasonably anticipated land use, impacted media, COCs, RGs, RAOs, and description of the remedy components are summarized in Table 4-2. Further information on remedy selection can be obtained by reviewing Section 4.4 of the second 5-year review (U.S. Navy 2011b) and OU 1 ROD (U.S. Navy, Ecology, and USEPA 2000), which are included in Appendix A.

Remedy Implementation

The remedy for Site 110 was implemented from June 2001 through June 2002. During this time, soils east of two residential buildings along Haven Road were excavated. Further information on remedy implementation can be obtained by reviewing Section 4.4 of the second 5-year review (U.S. Navy 2011b), which is included in Appendix A.

Operation, Maintenance, and Monitoring

The operation, maintenance, and monitoring program for Site 110 specified by the ROD consists of fulfilling ROD-mandated monitoring requirements, managing the institutional controls program, and maintaining the remedies implemented for the site.

Monitoring

Groundwater monitoring required in the OU 1 ROD was completed during the first 5-year review period. Because no sample exceeded the site-specific background value or RG, the first 5-year review recommended that monitoring upland groundwater at Site 110 outside the NEX Gas Station Leak Area be discontinued. Further information on groundwater monitoring can be obtained by reviewing Section 4.4 of the second 5-year review (U.S. Navy 2011b), which is included in Appendix A.

Institutional Controls

Institutional controls regarding excavation and construction are required in two areas in front of Buildings 100 and 101, where impacted soils are covered by asphalt pavement, and a third area in the vicinity of Building 575, where soils are impacted with petroleum hydrocarbons. Figure 4-2 shows the areas of Site 110 (Areas H, J, and K) that require LUCs. Compliance inspections and maintenance of the areas shown on Figure 4-2 have been implemented as part of the LUC Plan (U.S. Navy 2005d) to ensure that these restrictions continue to function as planned.

Remedy Maintenance

Remedy maintenance inspections for Site 110 are described in Section 4.1.1 and Table 4-4.

4.1.5 NEX Gas Station Leak Area

Remedy Selection

The original remedy selected in the OU 1 ROD was described in Section 4.5 of the second 5-year review (U.S. Navy 2011b) and the OU 1 ROD (U.S. Navy, Ecology, and USEPA 2000), which are included in Appendix A. At the time the ROD was signed, it was thought that deeper groundwater had not been impacted. Therefore, the basis for remedial action was protection of the marine environment. However, subsequent investigations (see "Remedy Implementation" below) showed impacts in the deeper groundwater. No HHRA was conducted specifically for the NEX Gas Station Leak Area prior to execution of the OU 1 ROD.

Because the original remedy did not achieve the ROD-specified cleanup objectives, additional investigations and pilot testing were conducted. Based on these investigations, the CSM for the site was revised. Because of the revised understanding of the site CSM, a fundamental change to the primary treatment method was necessary, and cleanup alternatives were developed and evaluated in an FFS. The amended remedy, which utilizes more aggressive treatment technologies with significantly higher cost than the original selected remedy, was selected in the OU 1 ROD Amendment No. 1 for the NEX Gas Station Leak Area (U.S. Navy and USEPA 2013a), which is included in Appendix A. The reasonably anticipated land use, impacted media, COCs, RGs, RAOs, and description of the remedy components for the amended remedy are summarized in Table 4-2. OU 1 ROD Amendment No. 1 revised the benzene RG to 5 μg/L for the NEX Gas Station Leak Area at the conditional point of compliance (the 880 series wells), based on the potential future use of the groundwater aquifer at Site 110 as drinking water. The RGs for the seeps and outfalls at Sites 101, 101-A, and 103 are unchanged by the ROD amendment.

Remedy Implementation

The original remedy for the NEX Gas Station Leak Area was implemented from 2001 to 2003. This included injection of Oxygen Release Compound (ORC) followed by 2 years of quarterly groundwater and seep monitoring. Further information on remedy implementation can be obtained by reviewing Section 4.5 of the second 5-year review (U.S. Navy 2011b) and the OU 1 ROD Amendment No. 1 for the NEX Gas Station Leak Area (U.S. Navy and USEPA 2013a), which are included in Appendix A.

The Navy conducted additional investigation and pilot testing at the NEX Gas Station Leak Area between 2005 and 2010 (Figure 4-3):

- **Soil and Groundwater Investigation, 2005:** The extent of soil and groundwater contamination in the vicinity of the NEX pump island, as well as the lateral extent of contaminated groundwater beneath the site, was assessed during this investigation. During this investigation, the two dual-phase extraction (DPE) wells and one air-sparge well were installed. This investigation generally established the boundaries of the groundwater contamination plume at the site, confirmed that soil beneath the NEX pump island was a residual source of contamination to groundwater, and revealed the presence of free-phase product beneath the source area. Based on the results of the investigation, the CSM was revised and DPE pilot testing was recommended (U.S. Navy 2006a).

- **DPE Pilot Test, 2006:** The results of the DPE pilot test indicated that DPE is not the most feasible means to remove free product from the source area, because extraction and treatment of large volumes of water would be required to sufficiently suppress the groundwater surface and induce migration of free product to the DPE recovery wells. However, the pilot test did demonstrate that sufficient vapor-phase petroleum extraction rates could be achieved in the source area (U.S. Navy 2007a).

- **Non-TCRA, Free-Product Removal, 2009:** A free-product skimming system was installed in three recovery wells for the purpose of removing free product from the source area. Insignificant product removal (approximately 1 gallon) was achieved during the first year of skimming system operation. Skimming results indicate that passive removal of free product, without depressing the groundwater table, is not effective (U.S. Navy 2011d).

- **FFS and Pilot Testing, 2010**: The Navy conducted extensive additional subsurface investigation and pilot testing at the site in 2010 in support of an FFS. The purposes of the FFS were the following: estimate the lateral extent of free product at the site, estimate the vertical extent of dissolved-phase petroleum hydrocarbons in groundwater across the site, document the concentrations of petroleum hydrocarbons discharging to Ostrich Bay, assess the aquifer characteristics in the source area and nearshore area, and assess the effect of the tide on groundwater elevations at the site. The pilot testing assessed four remedial technologies—soil vapor extraction (SVE), bioventing, ORC, and air sparging. The data collected in the FFS was used to develop a revised CSM, conduct an HHRA, and evaluate potential remedial alternatives for the NEX Gas Station Leak Area. The revised CSM showed that dissolved-phase petroleum impacts extend deeper than previously understood, into the aquifer in the Vashon Advance Outwash (Figure 4-4). The HHRA conducted during the FFS identified complete and potentially significant exposure pathways for utility workers, residents, recreational visitors, and seafood harvesters. Based on the revised CSM and HHRA, revised RAOs were identified, and remedial alternatives were developed and evaluated in the FFS (U.S. Navy 2011d).

Based on the results of these investigations, the amended remedy includes electrical resistance heating with DPE in the source area, in situ chemical oxidation in the nearshore area, performance and compliance monitoring, and LUCs as described in Table 4-2. The remedial design for the amended remedy was completed in September 2014, and remedy implementation is scheduled to begin in December 2014.

Although data collected in the FFS were sufficient for evaluation and selection of a remedy, additional data are needed to refine the vertical and lateral dimensions of the treatment zones beneath the source area and the nearshore area. The following data gaps were identified in the FFS report:

- The lateral extent of groundwater impacts to the north, south, and west of the NEX pump island
- Vertical extent of groundwater impacts in the source area and the nearshore area
- Potential vapor intrusion risk in the NEX convenience store, Building 30, and residential homes located upgradient and cross gradient of the source area
- Potential human health risks associated with exposure to impacted sediment, surface water, or seafood near the NEX Gas Station Leak Area seeps and outfalls during recreational activities, seafood harvesting, and seafood ingestion

To close the first three data gaps listed above, a data gaps resolution plan has been developed (U.S. Navy 2014f). A discussion of the planned sampling activities included in the data gaps investigation is described in the monitoring section below. Sediment and marine tissue monitoring will not be conducted as part of the data gaps resolution sampling, because they are not critical to the design of the nearshore remedy. The cleanup levels established for the amended remedy of the NEX Gas Station Leak Area are protective of the marine environment, including human exposures to surface water and sediment, ingestion of aquatic organisms during recreational activities, and tribal/subsistence harvesting. Therefore, the remedy will reduce concentrations to levels protective of the marine environment in groundwater discharging to surface water. Furthermore, the limited exposure area and short life of the COCs in the marine environment support that risks to sediment, surface water, and seafood ingestion exposures during recreational activities or tribal/subsistence harvesting are likely low at this time. Currently, no future sampling is planned of marine surface water, sediment, and tissue.

Operation, Maintenance, and Monitoring

The operation, maintenance, and monitoring program for NEX Gas Station Leak Area specified by the ROD and ROD amendment consists of fulfilling ROD-mandated monitoring requirements and managing the institutional controls program.

Monitoring

The amended remedy includes additional data collection as part of the remedial action and performance and compliance monitoring to document the remedy performance and progress towards achieving the cleanup levels. As discussed above, the additional data collection will be performed to verify the extent of groundwater impacts. The Navy will use the lithological data and lateral and vertical extent of elevated concentrations of COCs in groundwater to update the CSM for the site and refine the target treatment zones for the source and nearshore areas. The soil and groundwater investigation data will also be used to evaluate potential vapor intrusion risks at the NEX convenience store, Building 30, and residential homes located upgradient and cross gradient of the source area. Indoor air, subslab vapor, and crawlspace air samples will also be collected to evaluate vapor intrusion risks. If COC concentrations in indoor air, subslab vapor, and crawlspace air samples exceed the screening levels, additional evaluation will be required to assess whether the remedial design should be modified to mitigate vapor intrusion risks. Results of this data collection will be reported in late 2015 and will be included in the next 5-year review.

Performance monitoring will be performed to verify the effectiveness of the source area and nearshore area treatment systems and optimize these treatment systems, if needed; document changes in COC concentrations throughout the source and nearshore areas; and identify when the criteria for termination of active treatment in the source area have been met and whether the criteria for triggering the contingency remedy in the nearshore area have been met. The performance verification period will extend up to 2 years following construction of the source area and nearshore treatment systems and will include groundwater monitoring, subsurface temperature monitoring, and remedial system operational data monitoring. New performance monitoring wells will be installed in the source and nearshore areas to achieve these goals. Following completion of the performance verification period, performance monitoring will continue in the nearshore area under the long-term operation, maintenance, and monitoring program, which will include groundwater monitoring and remedial system operational data monitoring. Performance monitoring in the nearshore area will continue following the performance verification period as long as the nearshore treatment system continues to be operated, which is expected to be an additional 10 years.

Compliance monitoring will be performed to document progress towards meeting RAOs and attainment of cleanup levels throughout the site, to document when groundwater influent to the nearshore treatment area meets the cleanup levels, and to identify when the criteria for termination of active treatment in the nearshore area have been met. The estimated time to completely flush COC concentrations in groundwater exceeding cleanup levels between the source and nearshore areas is approximately 11 years from the time of completion of the source area amended remedy. Therefore, the compliance monitoring period will extend up to 12 years (1 year of source area treatment followed by 11 years of flushing the downgradient aquifer). Compliance sampling will include groundwater monitoring of wells located throughout the dissolved-phase plume. Results of performance and compliance monitoring will be reported in the next 5-year review.

Institutional Controls

The OU 1 ROD amendment establishes the following RAO for groundwater at the NEX Gas Station Leak Area: reduce petroleum hydrocarbons in groundwater to concentrations less than drinking water standards throughout the aquifer beneath the site. Because of this, the LUCs established in the OU 1 ROD, which prevent use of groundwater beneath the site for drinking water, will continue to be implemented until the combination of active treatment and passive flushing result in meeting the groundwater cleanup levels at the standard point of compliance (throughout the aquifer). Therefore, compliance inspections, which have already been implemented as part of the LUC Plan (U.S. Navy 2005d), will continue to be implemented to ensure that the drinking water restrictions continue to function as planned at the NEX Gas Station Leak Area.

The OU 1 ROD amendment also requires the implementation of LUCs related to potential vapor intrusion risks. More specifically, assessment of vapor intrusion risks for any new building constructed above the groundwater plume is required until the cleanup levels for groundwater are met. This requirement will be incorporated into a revised sitewide LUC Management Plan, currently under development, and compliance inspections will be performed based on the revised plan during the next 5-year review period.

4.2 OPERABLE UNIT 3

Remedy selection, remedy implementation, and operation, maintenance, and monitoring are presented for OU 3T JPHC and OU 3T NHB in the sections below. The O&M costs for OU 3T JPHC are summarized for this 5-year review period in Table 4-1. The OU 3T NHB remedy has not been implemented, because the ROD was executed on September 29, 2014. The O&M costs are more than two times higher than estimated in the ROD. This is primarily the result of higher initial costs associated with the LUC program implementation.

4.2.1 Operable Unit 3T JPHC

Remedy Selection

The reasonably anticipated land use, impacted media, COCs, RAOs, and description of the remedy components are summarized in Table 4-2. Further information on remedy selection can be obtained by reviewing the OU 3T JPHC ROD (U.S. Navy and USEPA 2011), which is included in Appendix A.

Remedy Implementation

Remedy implementation for OU 3T JPHC has been performed separately for the Upland and Intertidal Zones. Areas of concern in the Upland and Intertidal Zones that were targeted for remedial action are shown on Figure 4-5. The remedy for the Upland Zone was implemented from November 2012 through January 2013. All 1,107 anomalies in the three upland grids where DDM-HE was discovered during the RI were reacquired using a real-time kinematic-differential global position system and intrusively investigated. Of the 1,107 anomaly locations, only 38 contained any ordnance-related items, none of which contained known or suspected HE, and all were found within one upland grid (Area of Concern 3). Findings mostly consisted of cultural debris of a domestic and construction material origin. Several findings included permanent structures such as valve boxes or buried utility cables and were not disturbed (U.S. Navy 2013b).

The remedy for the Intertidal Zone was implemented from June 2013 through July 2014. Preliminary results indicate that 19 DMM-HE items were removed from the intertidal area. Although all on-site activities have been completed, the remedy will not be considered complete until the remedial action completion report (RACR) is finalized, which is scheduled to be completed in 2015.

The remedy also included implementation of LUCs at the site. A LUC Management Plan was developed for OU 3T JPHC (U.S. Navy 2013c), which constituted the remedial design for the LUC component of the remedies. As described in the LUC Management Plan, LUCs required by the OU 3T JPHC were implemented at the site through revision of NBK instructions (8020.1B and 11300.3A) and the development of five programs: excavation permitting, education and awareness training for residents, education and awareness training for shellfish harvesters, DMM reporting and response, and LUC monitoring and reporting.

In accordance with the recommendations of the second 5-year review (see Section 5), a combined LUC Management Plan for OU 1 and OU 3T JPHC is currently being developed and is tentatively scheduled to be completed in July 2015. However, the Navy funds activities related to chemical contamination separately from activities related to munitions contamination. As a result, auditing and reporting is performed separately for OU 1 and OU 3T JPHC by different contractors. Therefore, combining the required OU 1 and OU 3T JPHC LUC management activities in one plan complicates the auditing process and it is recommended that the LUC Management Plans for chemical contamination (OU 1) and munitions contamination (OU 3) be kept separate.

Operation, Maintenance, and Monitoring

The LUC Management Plan required annual monitoring and reporting of the LUCs (U.S. Navy 2013c). Since completion of the LUC Management Plan, annual audits of the LUCs have been completed as required (U.S. Navy 2013d and 2015a). However, the 2013 LUC audit report was not submitted to the EPA, as required, because of dispute resolution implementation and because the investigation and removal portion of the OU 3T JPHC remedy for the Intertidal Zone of OU 3T JPHC was not yet complete.

4.2.2 OU 3T NHB

Remedy Selection

The reasonably anticipated land use, impacted media, COCs, RAOs, and description of the remedy components are summarized in Table 4-2. Further information on remedy selection can be obtained by reviewing the OU 3T ROD (U.S. Navy and USEPA 2014a), which is included in Appendix A. Although the ROD for OU 3T NHB was executed on September 29, 2014, after this 5-year review period, the Navy has decided to include a preliminary review of this OU in this 5-year review.

Remedy Implementation

Remedy implementation has not been completed for OU 3T NHB, because the ROD was executed on September 29, 2014 after the 5-year review period. Completion of a LUC Management Plan for NHB will constitute remedy implementation.

Operation, Maintenance, and Monitoring

No operation, maintenance, or monitoring activities have been completed for OU 3T NHB, because the ROD was executed on September 29, 2014 after the 5-year review period. Operation, maintenance, and monitoring activities will include annual LUC audits.

Legend

- Site Boundary Line
- Naval Hospital Property Line
- Public Private Venture Agreement Lease Boundary
- Monitoring Well
- Seep
- Outfall
- Clam Sampling Location
- Crab Sampling Location

* Location No Longer Being Monitored

Notes:

1. Sampling locations based on 2002 survey data from CH2M HILL, when available (U.S. Navy 2002b). Remaining sampling locations based on 1996 RI/FS location data.
2. Sampling location SP704 could not be located and was replaced by SP703.
3. Well MW-11 could not be located in 2002, and is considered lost.
4. Clam and crab background locations not shown.

J:\GIS\Projects\NAVY\jacks_pk\DIQDO 893rd 5-YR Review\FIG 4-1 Long Term Samps.dwg
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U.S. NAVY	JPHC/NHB THIRD FIVE-YEAR REVIEW	0 200 400 SCALE IN FEET	**Figure 4-1** **Long-Term Monitoring Sampling Locations**

Legend

- Site Boundary Line
- Naval Hospital Property Line
- Historical Area of Concern
- Public Private Venture Agreement Lease Boundary
- Former UST
- Existing UST

Designated Area	OU 1 Land Use Restrictions
A,B,C,D,J,K	- Maintain Isolating Barrier Over Soil - Controls on Excavation/Construction
E	- Maintain Non-Residential Land Use
F,G,H	- Controls on Excavation/Construction
I	- Maintain Shoreline Protection
L	- No Excavation/No Construction

U.S. NAVY

JPHC/NHB
THIRD
FIVE-YEAR REVIEW

0 200 400
SCALE IN FEET

Figure 4-2
OU 1 Land Use Restrictions

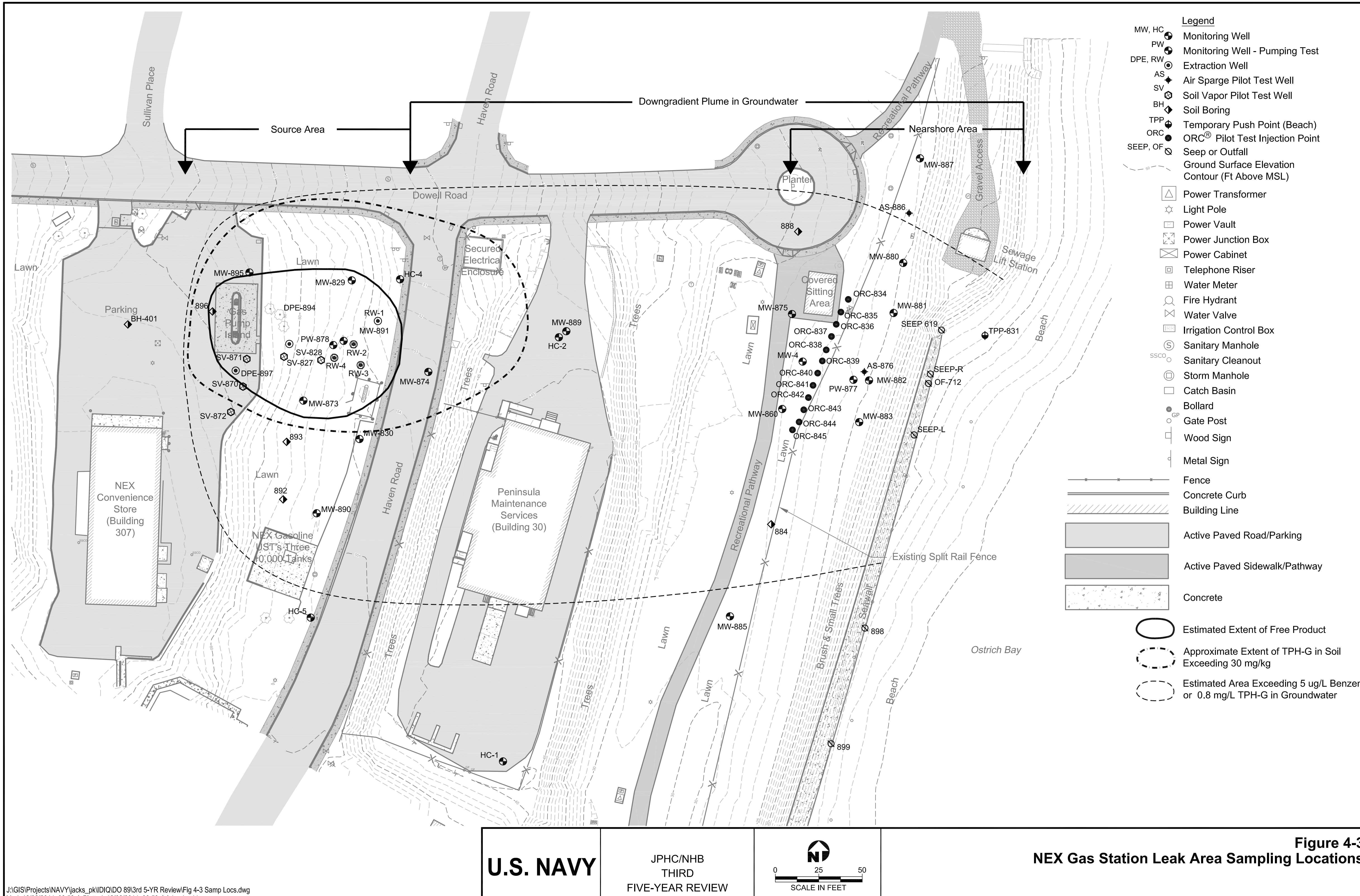

Figure 4-3
NEX Gas Station Leak Area Sampling Locations

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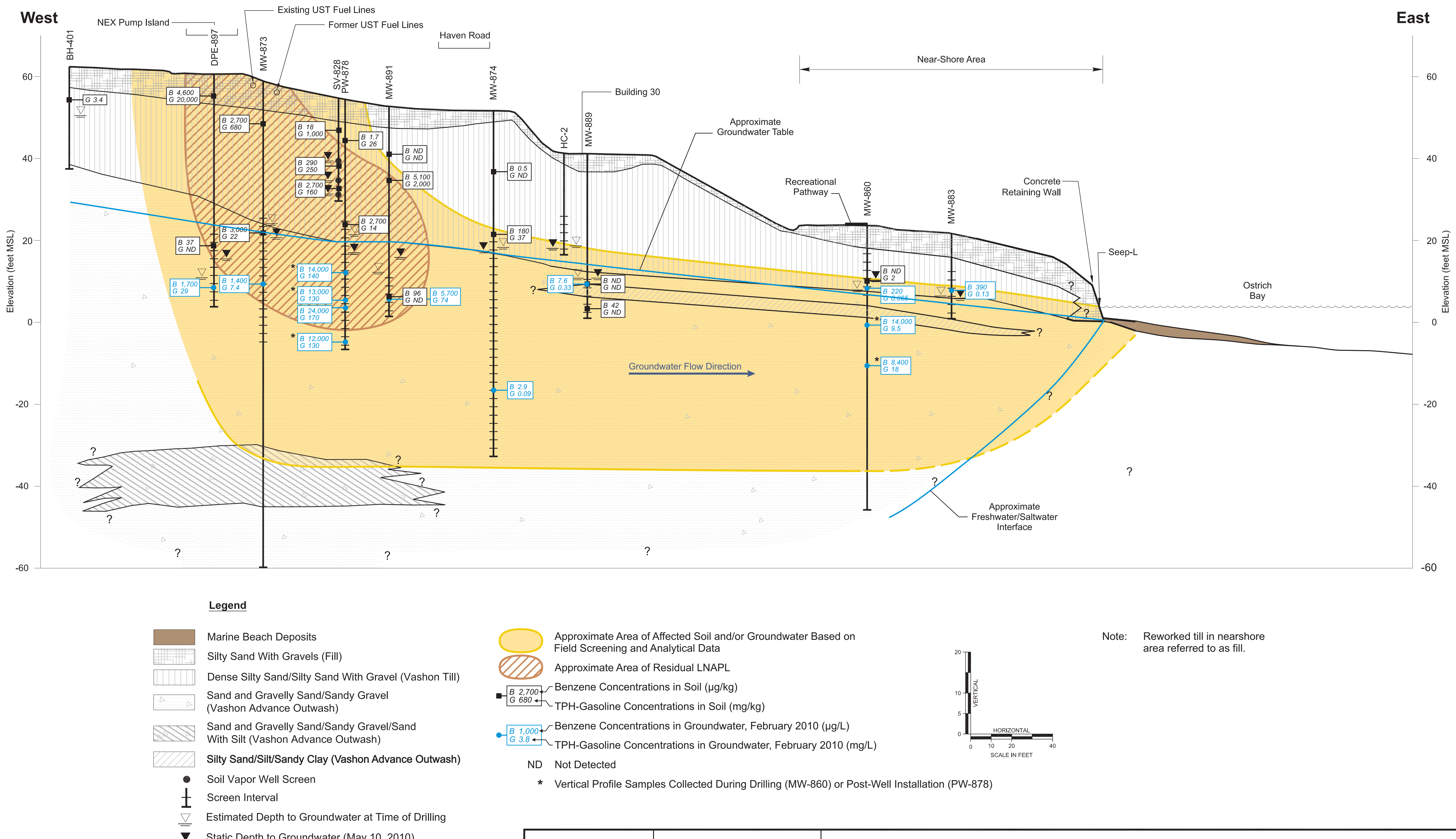
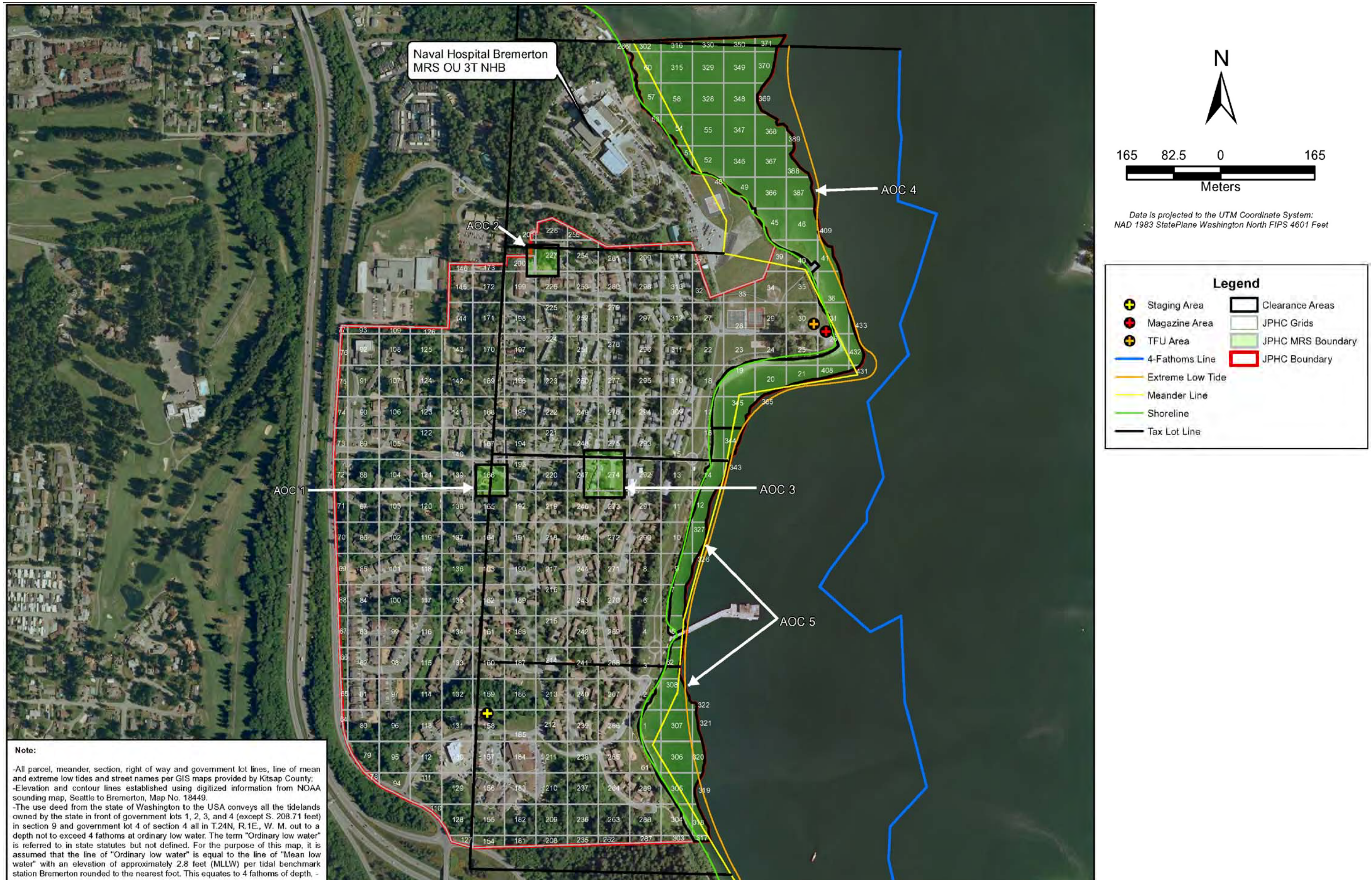


U.S. NAVY

JPHC/NHB
THIRD
FIVE-YEAR REVIEW

Figure 4-4
NEX Gas Station Leak Area
Conceptual Site Model



Source: U.S. Navy 2013b

U.S. NAVY	JPHC/NHB THIRD FIVE-YEAR REVIEW	0 300 600 SCALE IN FEET	**Figure 4-5** **OU 3T JPHC Areas of Concern for Remedial Action**

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Table 4-1
Summary of Annual O&M Costs for OU 1 and OU 3T JPHC

Year	OU 1	OU 3T JPHC
2010	$243,086	NA
2011	$380,408	NA
2012	$532,612	NA
2013	$1,120,945	NA
2014	$4,204,916	$125,881
Average Annual O&M Cost 2010 through 2014	$1,296,593	$125,881
Estimated Annual O&M Cost in ROD	$263,860[a]	$52,706

[a]This does not include the O&M costs estimated in the OU 1 ROD Amendment No. 1. O&M activities at the NEX Gas Station Leak Area will not be implemented until after construction of the remedy.

Notes:
JPHC - Jackson Park Housing Complex
O&M - operation and maintenance
OU - operable unit
ROD - record of decision
T - terrestrial

Table 4-2
Summary of Remedial Actions, JPHC/NHB

OU	Site	Reasonably Anticipated Land Use	Media	COC	Remediation Goals	Remedial Action Objectives	Remedy Components	Remedy Construction/ Implementation Complete?	Ongoing Operation, Maintenance, and Monitoring
1	101	• Recreational • Recreational, subsistence, and commercial shellfish harvesting	Soil	cPAHs Arsenic	0.137 mg/kg 8.6 mg/kg	• Prevent dermal contact with or ingestion of soil containing concentrations of COCs above state cleanup levels. • Reduce the potential for erosional transport of chemicals in soil to the marine environment.	• Install a vegetated cover over the identified areas where COCs in surface soils exceeded the RGs. • Install shoreline stabilization measures to limit erosion of soils that may contain COCs. • Inspect and maintain shoreline stabilization measures and soil covers on a regular basis and after major storm events, and document activities performed. • Implement LUCs to limit or prevent activities that could disturb the vegetated soil cover and the shoreline stabilization measures.	Yes	• Maintain soil cover and shoreline stabilization measures as needed. • Conduct annual LUC monitoring.
			GW	Benzene Arsenic Beryllium[a] Mercury Nickel Thalliun[a]	43 µg/L 3.3 µg/L (total) 0.0793 µg/L (total) 0.025 µg/L (total) 7.9 µg/L (dissolved) 1.56 µg/L (total)	Protect ecological receptors in the marine environment and human health by attaining compliance with water quality standards for marine surface water at the point of GW discharge.	Implement LUCs to prevent construction of drinking water wells in the uppermost water-bearing unit.	Yes	• Perform seep and outfall sampling annually. • Conduct annual LUC monitoring.
			Sediment	Arsenic	None established[b]	None established	NA	NA	NA
			Marine tissue	3,3′-dichlorobenzidine PCP Antimony Arsenic[d] Vanadium Ordnance compounds[d]	None established[c]	For shellfish from Ostrich Bay, reduce risks from subsistence-level ingestion to less than 1 x 10^{-5} excess carcinogenic risk, or less than a noncarcinogenic HI of 1.[d]	• Implement a shellfish sampling program (the Navy, with concurrence from EPA, Ecology, and the WDOH will decide when shellfish on JPHC/NHB beaches can be harvested). • Post signs along the shoreline to notify JPHC residents (and any members of the general public) of any shellfish harvest restrictions.	Yes	• Perform shellfish sampling, once every 5 years. • Conduct annual LUC monitoring.
	101-A	• Recreational • Recreational, subsistence, and commercial shellfish harvesting • Residential	Soil	cPAHs Antimony[e] Arsenic[e] Beryllium	0.137 mg/kg 32 mg/kg 8.6 mg/kg 1.5 mg/kg	• Prevent dermal contact with or ingestion of soil containing concentrations of COCs above state cleanup levels. • Reduce the potential for erosional transport of chemicals in soil to the marine environment.	• Install a vegetated cover over the identified areas where COCs in surface soils exceeded the RGs. • Install shoreline stabilization measures to limit erosion of soils that may contain COCs. • Inspect and maintain shoreline stabilization measures and soil covers on a regular basis and after major storm events, and document activities performed. • Implement LUCs to limit or prevent activities that could disturb the vegetated soil cover, the shoreline stabilization measures, the former construction debris landfill, and the petroleum-impacted soil in the vicinity of the playground.	Yes	• Maintain soil cover and shoreline stabilization measures as needed. • Conduct annual LUC monitoring.

Table 4-2 (Continued)
Summary of Remedial Actions, JPHC/NHB

OU	Site	Reasonably Anticipated Land Use	Media	COC	Remediation Goals	Remedial Action Objectives	Remedy Components	Remedy Construction/ Implementation Complete?	Ongoing Operation, Maintenance, and Monitoring
			GW	TPH[a] Arsenic Beryllium[a] Copper[a] Cyanide[a] Lead[a] Mercury Thallium[a] Zinc[a]	1,000 µg/L 3.3 µg/L (total) 0.0793 µg/L (total) 58 µg/L (dissolved) 1 µg/L 6 µg/L (dissolved) 0.025 µg/L (total) 1.56 µg/L (total) 104 µg/L (dissolved)	Protect ecological receptors in the marine environment and human health by attaining compliance with water quality standards for marine surface water at the point of GW discharge.	Implement LUCs to prevent construction of drinking water wells in the uppermost water-bearing unit.	Yes	• Perform seep and outfall sampling annually. • Conduct annual LUC monitoring.
			Sediment	Arsenic	None established[b]	None established	NA	NA	NA
			Marine tissue	3,3′-dichlorobenzidine PCP Antimony Arsenic[d] Vanadium Ordnance compounds[d]	None established[c]	For shellfish from Ostrich Bay, reduce risks from subsistence-level ingestion to less than 1 x 10^{-5} excess carcinogenic risk, or less than a noncarcinogenic HI of 1[d].	• Implement a shellfish sampling program (the Navy, with concurrence from EPA, Ecology, and the WDOH will decide when shellfish on JPHC/NHB beaches can be harvested). • Post signs along the shoreline to notify JPHC residents (and any members of the general public) of any shellfish harvest restrictions.	Yes	• Perform shellfish sampling, once every 5 years. • Conduct annual LUC monitoring.
	103	• Commercial (helipad, parking) • Recreational • Recreational, subsistence, and commercial shellfish harvesting	Soil	TPH-G[e] cPAHs PCBs Antimony[e] Arsenic Lead[e]	100 mg/kg 5.48 mg/kg 5.19 mg/kg 128 mg/kg 66.7 mg/kg 250 mg/kg	• Prevent dermal contact with or ingestion of soil containing concentrations of COCs above state cleanup levels. • Reduce the potential for erosional transport of chemicals in soil to the marine environment.	• Install a vegetated cover over the identified areas where COCs in surface soils exceeded the RGs. • Install shoreline stabilization measures to limit erosion of soils that may contain COCs. • Inspect and maintain shoreline stabilization measures and soil covers on a regular basis and after major storm events, and document activities performed. • Implement LUCs to limit or prevent activities that could disturb the vegetated soil cover, the shoreline stabilization measures, and the former ordnance burn area. • Implement LUCS to prevent use of Site 103 for residential occupancy in areas where residential soil cleanup levels were exceeded.	Yes	• Maintain soil cover and shoreline stabilization measures as needed. • Conduct annual LUC monitoring.
			GW	1,1-DCE TCE Vinyl chloride Arsenic Beryllium[a] Mercury Silver Thallium[a] Zinc[a] Chlordane[a]	1.93 µg/L 55.6 µg/L 2.92 µg/L 3.3 µg/L (total) 0.0793 µg/L (total) 0.025 µg/L (total) 1.2 µg/L (dissolved) 1.56 µg/L (total) 104 µg/L (dissolved) 0.0022 µg/L	Protect ecological receptors in the marine environment and human health by attaining compliance with water quality standards for marine surface water at the point of GW discharge.	• Implement LUCs to prevent construction of drinking water wells in the uppermost water-bearing unit. • Perform an investigation to attempt to identify the source of three volatile organic chemicals, 1,1-DCE, TCE, and vinyl chloride, that exceeded RGs in seeps and outfalls along the north shoreline of Elwood Point. • Conduct an environmental monitoring program of intertidal seeps and outfalls.	Yes	• Perform seep and outfall sampling annually. • Conduct annual LUC monitoring.

Table 4-2 (Continued)
Summary of Remedial Actions, JPHC/NHB

OU	Site	Reasonably Anticipated Land Use	Media	COC	Remediation Goals	Remedial Action Objectives	Remedy Components	Remedy Construction/ Implementation Complete?	Ongoing Operation, Maintenance, and Monitoring
			Sediment	Arsenic	None established[b]	None established	NA	NA	NA
			Marine tissue	3,3′-dichlorobenzidine PCP Antimony Arsenic[d] Vanadium Ordnance compounds[d]	None established[c]	For shellfish from Ostrich Bay, reduce risks from subsistence-level ingestion to less than 1 x 10^{-5} excess carcinogenic risk, or less than a noncarcinogenic HI of 1[d].	• Implement a shellfish sampling program (the Navy, with concurrence from EPA, Ecology, and WDOH will decide when shellfish on JPHC/NHB beaches can be harvested). • Post signs along the shoreline to notify JPHC residents (and any member of the general public) of any shellfish harvest restrictions. • Remove approximately 450 wooden pilings from abandoned Navy structures, including part of Pier 2 in Site 101, the fishing pier on Elwood Point and its associated wooden pilings, and mooring dolphins offshore of Sites 101 and 103.	Yes	• Perform shellfish sampling, once every 5 years. • Conduct annual LUC monitoring.
	110	• Commercial (Mini Mart, NHB hospital) • Recreational • Residential	Soil	cPAHs Arsenic	0.137 mg/kg 8.6 mg/kg	None established[f]	Although no RAOs were developed for soil at Site 110, the following soil remedies were implemented: • Excavate surface soil containing arsenic and cPAHs above the cleanup levels in residential backyard areas on the east side of Haven Road (note that this cleanup action was evaluated and selected as part of remedial actions to be performed at Site 101 in the feasibility study and ROD). • Inspect and maintain paved areas in front of bunkers 100 and 101 on a regular basis, and document activities performed. • Implement LUCs to limit or prevent activities that could disturb the paved areas in front of bunkers 100 and 101.	Yes	• Maintain paved areas as needed. • Conduct annual LUC monitoring.
			GW	Arsenic Beryllium Manganese Nickel Vanadium	3.3 µg/L 0.0793 µg/L 2,240 µg/L 100 µg/L 112 µg/L	Verify that concentrations of inorganics in Site 110 GW are below background levels or state and federal drinking water applicable or relevant and appropriate requirements.	• Implement LUCs to prevent construction of drinking water wells in the uppermost water-bearing unit. • Conduct an environmental monitoring program of four existing Site 110 monitoring wells located in the western half of the site and screened in GW located beneath the Vashon Till to reassess GW background concentrations (note that LUCs were to be implemented to prevent construction of drinking water wells at Site 110 in GW below the Vashon Till unless the chemical data from the environmental monitoring program demonstrated that inorganics at Site 110 are not present above the cleanup levels).	Yes	Conduct annual LUC monitoring.
	NEX Gas Station Leak Area[g]	Same as 101 and 110	Soil	TPH-G Benzene Ethylbenzene Toluene m,p-Xylene o-Xylene Total xylenes	30 mg/kg[h] 28 µg/kg[h] 6,048 µg/kg[h] 7,271 µg/kg[h] 91,440 µg/kg[h] 91,440 µg/kg[h] 91,440 µg/kg[h]	• Reduce concentrations of petroleum hydrocarbons in soil beneath the site to concentrations protective of GW. • Minimize exposure to free-phase product remaining in the vadose zone beneath the source area.	OU 1 ROD specified the following remedial actions: • Place Oxygen Release Compound® in the subsurface. • Perform limited excavation of petroleum-contaminated soil if significant petroleum contamination were to be found above the seasonal high-water table. • Conduct an environmental monitoring program to verify effectiveness of the remedy.	No	Conduct performance and compliance monitoring once remedy construction is complete.

Table 4-2 (Continued)
Summary of Remedial Actions, JPHC/NHB

OU	Site	Reasonably Anticipated Land Use	Media	COC	Remediation Goals	Remedial Action Objectives	Remedy Components	Remedy Construction/ Implementation Complete?	Ongoing Operation, Maintenance, and Monitoring
			GW	TPH-G Benzene Ethylbenzene Toluene m,p-Xylene o-Xylene Total xylenes	0.8 mg/L 5 µg/L 700 µg/L 640 µg/L 1,600 µg/L 1,600 µg/L 1,600 µg/L	• Reduce petroleum hydrocarbons in GW to levels protective of human health at the point where GW discharges to Ostrich Bay. • Reduce petroleum hydrocarbons in GW to concentrations less than drinking water standards throughout the aquifer beneath the site.	The OU 1 ROD Amendment No. 1 specified the following remedial actions: • Treat subsurface soil and GW in the source area using electrical resistance heating with dual-phase extraction. • Treat GW migrating toward Ostrich Bay in the nearshore area using in situ chemical oxidation with ozone. • Allow flushing of contaminated groundwater between the source area and nearshore area. • Conduct performance monitoring in the source and the nearshore areas. • Conduct compliance monitoring throughout the plume of contaminated GW and the seeps and outfalls on the shore of Ostrich Bay. • If the nearshore treatment system is not as effective as expected after 2 years of active treatment, the contingency remedy, a GW pump and treat system, will be implemented in the nearshore treatment area. • Implement LUCs requiring assessment of vapor intrusion risks for any new building constructed above the GW plume until the cleanup levels for GW are met. • Continue to implement the LUCs established in the OU 1 ROD, which prevent use of groundwater beneath the site for drinking water, until the combination of active treatment and passive flushing result in meeting the groundwater cleanup levels at the standard point of compliance.		
3T JPHC	NA	• Commercial (Mini Mart) • Recreational • Recreational, subsistence, and commercial shellfish harvesting • Residential	Soil (Upland Zone)	DMM-HE	NA	• Allow use of the site for residential housing. • Minimize the explosive hazard from potential encounters with DMM-HE at the site by requiring munitions education and awareness training for all residents, as well as personnel involved in ground-disturbing activities at the site. • Ensure excavation permits for all ground-disturbing activities conducted in the upland areas are obtained prior to initiation of work at the site.	• Investigate and remove 100 percent of the detected subsurface metallic anomalies (approximately 1,100 anomalies) in the three upland grids where DMM-HE was found during the remedial investigation. • If DMM-HE items are found within an upland investigation grid boundary, investigate and remove additional detected metallic anomalies in the immediate vicinity of each grid. • Provide continued reporting and response to a discovery of a potential DMM at JPHC using the 911 system with on-site response by EOD MU 11 Det. Bangor. • Provide continued implementation of the excavation permitting program. • Work with the Suquamish Tribe in anticipation of future shellfish harvesting to develop awareness training that specifically addresses subsistence, commercial, or recreational shellfish harvesting activities and revise the education program with tribal involvement once the harvesting advisories are lifted. • Manage the excavation permitting program to allow auditing and tracking of the permits.	Yes	• Conduct annual LUC monitoring. • Review effectiveness of the enhanced training and excavation permitting program every 5 years.

Table 4-2 (Continued)
Summary of Remedial Actions, JPHC/NHB

OU	Site	Reasonably Anticipated Land Use	Media	COC	Remediation Goals	Remedial Action Objectives	Remedy Components	Remedy Construction/ Implementation Complete?	Ongoing Operation, Maintenance, and Monitoring
							• Provide munitions education and awareness training at two levels: - Basic training for all residents and contractors performing ground-disturbing activities - Enhanced explosive safety management and munitions recognition training for personnel responsible for managing and supporting the excavation permitting process or providing oversight of some aspect of ground-disturbing activities • Provide a complete report concerning the discovery of a DMM-HE item at JPHC to EPA in a timely manner. • Provide maintenance, monitoring, and reporting of LUCs, including annual institutional controls monitoring reports and 5-year review reports, and review the effectiveness of the enhanced training and excavation permit program every 5 years and modify as necessary. • Maintain excavation permits or other records, including signature acknowledgment of notification and understanding regarding munitions hazards, for a minimum of 3 years beyond completion of ground-disturbing site work. • Maintain housing applications, including signature acknowledgment of notification and understanding regarding munitions hazards, for a minimum of 3 years beyond termination of residency.		
			Sediment (Intertidal Zone)	DMM-HE	NA	• Allow use of the intertidal area for recreational, subsistence, and commercial shellfish harvesting. • Minimize the explosive hazard from potential encounters with DMM-HE at the site by requiring munitions education and awareness training for all residents, as well as personnel involved in ground-disturbing activities at the site.	• Investigate and remove 100 percent of the detected subsurface metallic anomalies (approximately 17,300 anomalies) in the Intertidal Zone between mean higher high water and mean lower low water. • Implement LUCs as described above for the OU 3T JPHC Upland Zone, except as follows: After anomaly removal is complete and the health advisory has been lifted, update education and awareness training materials and provide the training materials as an informational advisory to the tribe and Washington State Departments of Fish and Wildlife and Natural Resources.	No	• Conduct annual LUC monitoring. • Review effectiveness of the enhanced training and excavation permitting program every 5 years • Develop awareness training for recreational, subsistence, and commercial shellfish harvesting with tribal involvement.

Table 4-2 (Continued)
Summary of Remedial Actions, JPHC/NHB

OU	Site	Reasonably Anticipated Land Use	Media	COC	Remediation Goals	Remedial Action Objectives	Remedy Components	Remedy Construction/ Implementation Complete?	Ongoing Operation, Maintenance, and Monitoring
3T NHB	NA	• Commercial (NHB) • Recreational • Residential	Soil (Upland Zone)	DMM-HE	NA	Manage the potential risk to human health from contact with an explosively configured DMM-HE item.	Implement LUCs as described above for the OU 3T JPHC Upland Zone, except as follows: Basic munitions education and awareness training for all Bachelor Enlisted Quarters residents, contractors, and nonmedical hospital employees with the potential to perform ground-disturbing activities at the OU 3T NHB.	No	• Conduct annual LUC monitoring • Review effectiveness of the enhanced training and excavation permitting program every 5 years

[a]These chemicals were detected above RGs in upland wells at the time of the ROD and not at the seeps and outfalls.
[b]The human health risk assessment identified arsenic as a COC in sediments, based on a carcinogenic risk of 9.43×10^{-6} for a child. However, this calculated risk represents the total risk, not the incremental based on site-related contamination. Because of this and because the carcinogenic risk falls within the Comprehensive Environmental Response, Compensation, and Liability Act target risk range of 1×10^{-4} to 1×10^{-6}, the ROD for OU 1 concluded that no unacceptable risks are associated with sediments at the site, and no RG or RAO was developed for sediment.
[c]Neither PCP or 3,3′-dichlorobenzidine were detected in terrestrial soil samples, or intertidal sediment samples and there is considerable uncertainty regarding the incremental risk of antimony and vanadium above background levels. Because of this, chemical-specific RGs were not developed in the OU 1 ROD for marine tissue.
[d]Although the ROD did not identify arsenic and ordnance compounds as COCs, it specified that marine tissue would be monitored for these compounds, in addition to 3,3'-dichlorobenzidine, PCP, antimony, and vanadium (see Section 11.3.2 of the ROD). Furthermore, it specified that monitoring would be terminated when human health risks associated with 3,3'-dichlorobenzidine, PCP, antimony, arsenic, vanadium, and ordnance compounds in shellfish reach 1×10^{-5} excess cancer risk and HI of 1, or when risks are reduced to levels consistent with consumption of reference area shellfish.
[e]These chemicals were not identified as COCs based on the results of the risk assessment, but were included as COCs because site concentrations exceeded Model Toxics Control Act cleanup levels or background concentrations for some metals.
[f]No RAOs were developed for Site 110 soils. With few exceptions, the soil removal actions at Site 110 addressed all known or suspected areas of contamination. However, soil containing arsenic and cPAHs above cleanup levels remains beneath paved areas in front of bunkers 100 and 101.
[g]Unless otherwise noted, this row includes information from the OU 1 ROD Amendment No. 1. The OU 1 ROD only identified benzene as the COC for this site. Furthermore, the RAO in the OU 1 ROD was to prevent impacts to ecological receptors in the marine environment and to protect human health by attaining compliance with water quality standards for marine surface water at the point of GW discharge.
[h]These numeric criteria are not established as cleanup levels for soil. Achievement of the RAO for soil (protection of groundwater) will be demonstrated empirically using groundwater samples collected from monitoring wells within the source area.

Notes:
1,1-DCE - 1,1-dichloroethene
COC - chemical of concern
cPAH - carcinogenic polycyclic aromatic hydrocarbon
DMM-HE - discarded military munitions containing high explosives
Ecology - Washington State Department of Ecology
EOD MU 11 Det. Bangor - Explosive Ordnance Disposal Mobile Unit 11, Detachment Bangor
EPA - U.S. Environmental Protection Agency
GW - groundwater
HI - hazard index
JPHC - Jackson Park Housing Complex
LUC - land use control
mg/kg - milligrams per kilogram
µg/kg - microgram per kilogram
mg/L - milligram per liter
µg/L - microgram per liter
NA - not applicable
NHB - naval hospital Bremerton
OU - operable unit
PCB - polychlorinated biphenyl
PCP - pentachlorophenol
RAO - remedial action objective
RG - remediation goal
ROD - record of decision
T - terrestrial
TCE - trichloroethene
TPH - total petroleum hydrocarbon
TPH-G - total petroleum hydrocarbon as gasoline
WDOH - Washington State Department of Health

Table 4-3
Sampling Locations, Frequencies, and Analytical Requirements for Operable Unit 1

Site	Sampling Location	Sampling Frequency		Analyte					
		Annually	Once Every 5 Years	Chlorinated VOCs[a]	Benzene	GRO and DRO	Total and Dissolved Metals[b]	Ordnance Compounds	Cyanide
Seeps and Outfalls									
103	SP-703	X							X
103	OF-705	X		X			X		X
103	SP-707[c]	NS							
101	OF-709	X							X
101	SP-710	X			X	X			X
101	SP-711[c]	NS							
101	OF-712	X			X				X
101	SP-713	X							X
101-A	SP-715	X							X
101-A	OF-716	X							X
Marine Tissue									
Ostrich Bay	16 tissue sampling locations		X				X[d]	X	
Ostrich Bay	Background stations[e]		X				X[d]	X	

[a]1,1-Dichloroethene, trichloroethene, and vinyl chloride
[b]Samples will be tested for total metals (arsenic, beryllium, mercury, and thallium) and dissolved metals (copper, lead, nickel, silver, and zinc).
[c]Seep locations SP-707 and SP-711 were eliminated from the long-term monitoring program in 2012 because they were determined to primarily represent marine water and not groundwater, as demonstrated by high salinity values.
[d]Total arsenic, as well as speciated arsenic
[e]Up to three background stations will be sampled, depending on the species of crab found during the sampling event.

Table 4-3 (Continued)
Sampling Locations, Frequencies, and Analytical Requirements for Operable Unit 1

Notes:
DRO - diesel-range organics
GRO - gasoline-range organics
NS - not sampled
OF - outfall
SP - seep
VOC - volatile organic compound

Table 4-4
Operable Unit 1 Inspection and Maintenance Program Master Schedule

Site 101	Site 101-A	Site 103	Site 110	Remedial Measure	Inspection/Maintenance Activity	Frequency
X	X	X	X	All	Identify and report remedial measures requiring nonroutine maintenance.	As identified
X	X	X	X	All	Inspect structures, facilities, and utilities after severe weather events and initiate repair as needed (storm event inspection).	Within 72 hours of weather event
X	X	X		Trees and shrubs	Inspect trees and shrubs; prune as needed in early spring prior to start of growing season.	Annually
X	X	X	X	Roadways, floors, pads, sidewalks, etc.	Inspect surfaces for new cracks greater than 1/8 inch or changes to existing cracks.	Semiannually
X	X	X		Gravel paths and unpaved trails	Maintain gravel paths and unpaved trails free of vegetation, erosion, washboarding, potholes, etc.	Semiannually
X	X	X		Grassed areas, playground, and ball field	Inspect for settling, erosion, dead grass, holes, or excavation and maintain as appropriate.	Semiannually
X	X	X		Low rock shelf	Inspect low rock shelf for erosion and settling of rock. Inspect rock for spalling and fracturing. Inspect stairways for erosion and settling around, below, or behind stairs and supports.	Semiannually
X	X	X		Shoreline vegetation	Inspect plantings for stressed or dead vegetation and replace as needed.	Semiannually
X	X	X		Mulch beds	Inspect to ensure adequate mulch is in place and augment as needed.	Semiannually
X		X		Armor stone revetment	Inspect around, below, or behind stairways and rock shelf for erosion.	Semiannually
X				Seawall	Inspect seawall for erosion and failure of the concrete.	Semiannually
X				Storm drainage	Monitor for significant erosion or blockage.	Semiannually

Table 4-4 (Continued)
Operable Unit 1 Inspection and Maintenance Program Master Schedule

Site 101	Site 101-A	Site 103	Site 110	Remedial Measure	Inspection/Maintenance Activity	Frequency
X	X	X		Low rock shelf	Inspect low rock shelf for rocks removed and potentially thrown onto beach/intertidal area and replace as needed.	Quarterly
X	X	X		Shellfish harvest restriction signs	Inspect signs and repair or replace as needed.	Quarterly
X	X	X		Shoreline vegetation	Inspect plantings, beds, bulkheads, retaining walls, and riprap areas for weeds and remove.	Quarterly
X	X	X		Shoreline vegetation	Inspect beds and plantings to establish whether watering is needed.	Quarterly
X	X	X		Armor stone revetment	Inspect armor stone revetment for rocks removed and potentially thrown onto beach/intertidal area and replace as needed.	Quarterly
X		X		Pocket beach	Monitor for beach erosion.	Quarterly
X	X	X		Shoreline vegetation	Water newly planted vegetation.	Weekly in summer 2008 and as needed in 2009

5.0 PROGRESS SINCE LAST FIVE-YEAR REVIEW

This section presents the protectiveness statements from the first and second 5-year reviews (Table 5-1) and summarizes the status of recommendations and follow-up actions from the last review, the results of implemented actions, including whether they achieved the intended purpose, and the status of any other prior issues (Table 5-2). The Navy has continued the monitoring actions recommended by the last 5-year review, executed by the Navy February 11, 2011.

Table 5-1
Protectiveness Statements from First and Second 5-Year Reviews

OU	First 5-Year Review	Second 5-Year Review
1	The remedies implemented for OU 1 at JPHC/NHB are protective both in the short and long terms, with the exception of the Benzene Release Area. The remedy in the Benzene Release Area is considered protective in the short term because institutional controls are currently in place, and, therefore, there is no exposure to COCs in groundwater. Follow-up actions are necessary to address long-term protectiveness, because COCs in soil remain a source of contamination to groundwater. Further investigation of groundwater impacts and the extent of residual source material in soil is planned for the summer of 2005. Additional actions will be recommended based on this further investigation. These additional actions will be selected to achieve long-term protectiveness in the Benzene Release Area.	The remedies implemented for OU 1 at JPHC/NHB are protective both in the short and long terms, with the exception of the Benzene Release Area and human consumption of marine tissue. The remedy in the Benzene Release Area is not protective, because benzene concentrations in seep water discharging to Ostrich Bay continue to exceed the RG. Investigation, pilot testing, and removal actions are underway at the Benzene Release Area, with progress toward determining a revised remedy. The revised remedy is expected to be protective once selected and implemented. The protectiveness of the remedy with regard to human consumption of marine tissue cannot be determined at this time, because analysis of marine tissue for ordnance compounds has not yet been performed using the recently developed analytical methodologies. Until such analysis can be completed, human exposure to marine tissue is being prevented through institutional controls that prohibit harvesting of shellfish from Ostrich Bay.
2	The remedy for OU 2 will be selected based on its protectiveness of human health and the environment. The selected remedy is therefore expected to be protective, once selected and implemented.	The remedy for OU 2 will be selected based on its protectiveness of human health and the environment. The selected remedy is therefore expected to be protective, once selected and implemented.
3	The remedy for OU 3 will be selected based on its protectiveness of human health and the environment. The selected remedy is therefore expected to be protective, once selected and implemented.	The remedy for OU 3 will be selected based on its protectiveness of human health and the environment. The selected remedy is therefore expected to be protective, once selected and implemented.

Notes:
COC - chemical of concern
JPHC - Jackson Park Housing Complex
NHB - Naval Hospital Bremerton
OU - operable unit
RG - remediation goal

Table 5-2
Summary of Progress Since Last 5-Year Review

Recommendation/Follow-up Action From Second 5-Year Review (2011)	Completion Date	Notes Regarding Completion	Reference
Update the Land Use Control Plan to include DMM-related land use controls, inspections, and reporting, and complete the land use control base instruction covering JPHC/NHB.	In progress	Land Use Control Management Plan for OU 3T JPHC was completed March 15, 2013. Combined Land Use Control Management Plan for OU 1 and OU 3T JPHC is tentatively scheduled to be completed in July 2015. However, this third 5-year review is recommending that the Land Use Control Management Plans be kept separate (see Section 8). Naval Base Kitsap Instruction 8020.1B was revised in September 2012 and Instruction 11300.3A in April 2014.	U.S. Navy 2013c and 2015b
Review the basis of the RG (i.e., applicable or relevant and appropriate requirements, practical quantitation limits, and risk assessment assumptions) prior to any change in monitoring or institutional controls requirements.	January 18, 2012	The changes that were made to the monitoring program over the last 5 years were based on recommendations in the last 5-year review. The basis for the RGs was reviewed in the second 5-year review prior to recommending the discontinuation of monitoring of seeps and outfalls for specified chemicals at OU 1. Another review of RGs was completed as part of the standard third 5-year review process (see Section 7 under "Continued Validity of ROD Assumptions" for each OU).	U.S. Navy 2012b
Complete additional investigation and pilot testing related to the Benzene Release Area, and optimize the remedy for this area.	October 31, 2011	Focused feasibility study for the Benzene Release Area (NEX Gas Station Leak Area) dated October 31, 2011 reported the results of the additional investigation and pilot testing and evaluated alternatives to optimize the remedy.	U.S. Navy 2011d
Develop a proposal for an interim action to address the discharge of groundwater containing benzene to Ostrich Bay.	September 20, 2013	The proposed plan to address the Benzene Release Area (NEX Gas Station Leak Area) was published in October 2012, and ROD Amendment No. 1 was executed in September 2013. The purpose of the ROD amendment was to amend the selected remedy for contaminated soil and groundwater.	U.S. Navy 2012d and U.S. Navy and USEPA 2013a

Table 5-2 (Continued)
Summary of Progress Since Last 5-Year Review

Recommendation/Follow-up Action From Second 5-Year Review (2011)	Completion Date	Notes Regarding Completion	Reference
Perform an additional marine tissue sampling event utilizing the newly developed methods for ordnance compounds in marine tissue. Use the results of this event to verify the 2009 human health risk conclusions. Develop the sampling and analysis plan and quality assurance project plan for this sampling event in consultation with EPA and the Suquamish Tribe.	In progress	The marine tissue was sampled in August 2014, and the tissue is being analyzed using the newly developed methods for ordnance compounds in marine tissue. The sampling and analysis plan and quality assurance project plan were developed in consultation with EPA and the Suquamish Tribe. The results of this sampling event will be used to verify the 2009 human health risk conclusions. Because the data were collected after the data review period for the third 5-year review, work on the shellfish investigation report and the associated human health risk assessment is currently being performed. These reports are scheduled to be completed in October 2015. An addendum to this 5-year review will be completed following completion of these reports.	U.S. Navy 2014a
Revise the LTM plan to incorporate the specific changes listed in Section 6.4 of this review and the correct RGs for copper and zinc.	January 18, 2012	Monitoring recommendations listed in Section 6.4 of the second 5-year review and RGs for copper and zinc were updated in the LTM Work Plan.	U.S. Navy 2012b

Notes:
Green highlighted text indicates recommended action has been completed.
Yellow highlighted text indicates recommended action is in progress.
DMM - discarded military munitions
EPA - U.S. Environmental Protection Agency
JPHC - Jackson Park Housing Complex
LTM - long-term monitoring
NEX - Naval Exchange
NHB - Naval Hospital Bremerton
OU - operable unit
RG - remediation goal
ROD - Record of Decision
T - terrestrial

6.0 FIVE-YEAR REVIEW PROCESS

This section identifies 5-year review team members, community notification and involvement in the 5-year review process, and documents reviewed. An evaluation is presented of data generated during the past 5 years together with the results of site inspections and site interviews.

6.1 FIVE-YEAR REVIEW TEAM

The Navy is the lead agency for this 5-year review. Personnel from NAVFAC NW, NBK, and NHB represented the Navy in this 5-year review. Project managers and other staff from EPA, Washington State Department of Ecology (Ecology), and other stakeholder groups have also participated in the review process. Both the EPA and Ecology are cosignatories of the ROD for OU 1. Only EPA is a cosignatory of the RODs for OU 3T JPHC and OU 3T NHB and ROD Amendment No. 1 for OU 1. All team members had the opportunity to provide input to this report. Comments received from EPA, the Suquamish Tribe, and Washington State Department of Natural Resources, together with the Navy's responses, are included in Appendix G.

6.2 COMMUNITY NOTIFICATION AND INVOLVEMENT

There are specific requirements pursuant to CERCLA Section 117(a), as amended, that require certain reports to be released to the public and that the public be notified of proposed cleanup plans and remedial actions. Community involvement activities are performed in accordance with the community relations plan for JPHC/NHB (U.S. Navy 2008a). The specific community notification and involvement activities performed over the last 5-year review period are described below.

The Navy placed a notice of intent in the *Kitsap Week* on July 25, 2014 and in the *Kitsap Sun* on July 27, 2014 informing the public that the site is currently undergoing a 5-year review. 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 5-year review, nor were any community members interviewed during this 5-year review (see Section 6.6). Community involvement during this 5-year review period consisted of targeted outreach efforts related to development of RODs and keeping the community informed about remedial action implementation.

The Proposed Plan for OU 3T NHB was issued in September 2013 (U.S. Navy 2013e), and hard copies were provided to the information repository located at the Sylvan Branch of Kitsap Regional Library. A legal advertisement was placed in the *Kitsap Sun* on September 15, 2013 informing the public that the public comment period was open from September 15 to October 15, 2013 and an open house was scheduled for September 24, 2013 at the Hampton Inn and Suites in Bremerton, Washington. The Navy received no comments on the Proposed Plan during the public comment period.

The Proposed Plan for NEX Gas Station Leak Area was issued in October 2012 (U.S. Navy 2012d), and hard copies were provided to the information repository located at the Sylvan Branch of Kitsap Regional Library. An advertisement was placed in the *Kitsap Sun* on October 27, 2012 informing the public that the public comment period was open from October 27 to November 26, 2012. The Navy received no comments from the public on the Proposed Plan during the public comment period.

Also in 2012, the Navy published a public notice in the *Kitsap Sun* on November 10, 2012 informing the public that a removal action at JPHC will be performed in the Upland and Intertidal Zones of OU 3T JPHC. The notice informed the public that the work will be conducted in two phases, from November 15, 2012 through February 28, 2013 and from June 15, 2013 through February 28, 2014. In addition, prior to the start of the work in the Upland Zone, a letter was mailed to all residents of JPHC and a public meeting was held at the Jackson Park Community Center. The letter and public meeting provided additional information on the cleanup activities. A second letter was sent to residents directly impacted by the removal actions, and a daily briefing with impacted residents was performed by the OU 3T JPHC remedial project manager (RPM) during the removal actions.

The Proposed Plan for OU 3T JPHC was issued in November 2010 (U.S. Navy 2010h), and hard copies were provided to the information repository located at the Sylvan Branch of Kitsap Regional Library and the residents of JPHC. An advertisement was placed in the *Kitsap Sun* at the start of the public comment period. This notice informed the public that the public comment period was open from November 1 to December 15, 2010, and a public meeting was scheduled for November 15, 2010 at the Jackson Park Community Center. The Navy received no general public comments on the Proposed Plan during the public comment period. The Suquamish Tribe provided comments, which supported the proposed remedy.

6.3 DOCUMENT REVIEW

Documents reviewed during this 5-year review were those documents describing the monitoring, inspection, and maintenance of the selected remedies. The documents that were reviewed are listed below:

- The first and second 5-year review reports (U.S. Navy 2005c and 2011b)

- The signed RODs (U.S. Navy, Ecology, and USEPA 2000 and U.S. Navy and USEPA 2011 and 2014a)
- ROD Amendment No. 1 for OU 1 NEX Gas Station Leak Area (U.S. Navy and USEPA 2013a)
- The OU 1 LTM Work Plan (U.S. Navy 2012b)
- The OU 1 LTM reports (groundwater, seep, and outfall monitoring) (U.S. Navy 2011f, 2011g, 2013f, 2014b, and 2015c)
- The Inspection and Maintenance Plan (U.S. Navy 2008b)
- LUC Plans (U.S. Navy 2005d, 2013c, and 2015b)
- The OU 1 inspection reports (U.S. Navy 2010i, 2011h, 2012c, 2013g, 2014c, 2014d, and 2014e)
- OU 1 sampling and analysis plan for marine tissue LTM (U.S. Navy 2014a)
- Technical memoranda regarding groundwater sampling at NHB Site 110 (U.S. Navy 2010k and 2010l)
- Phase I environmental site assessment (ESA) report and focused Phase II site investigation (SI) report (Landau 2014 and 2013)

6.4 DATA REVIEW

This section summarizes data collected through the various monitoring programs at JPHC/NHB, with emphasis on data collected since the last 5-year review, which includes the following:

- LTM data at OU 1 including data trends (Section 6.4.1)
- Site 110 groundwater monitoring data in the vicinity of a 2008 tank removal action at NHB (Section 6.4.2)
- A focused Phase II SI and a Phase I ESA of JPHC (Section 6.4.3)
- Annual inspection and maintenance data at OU 1(Section 6.4.4)
- Data associated with LUC management activities at OU 3T JPHC (Section 6.4.5)

Construction of the remedy for the NEX Gas Station Leak Area has not been completed. Therefore, operation, maintenance, and monitoring activities for this area have not been initiated. This data is anticipated to be collected during the next 5-year review period, and will be reported in the next 5-year review.

The required operation, maintenance, and monitoring programs are described in Section 4, and the implications of the data for the functionality and protectiveness of the remedies are discussed in Section 7.

6.4.1 OU 1 Long-Term Monitoring

LTM of seeps, outfalls, and marine tissue is required by the OU 1 ROD and has been occurring since the completion of the remedial actions. The ROD specified that at least 10 seeps and outfalls be sampled as part of LTM for the combined shore areas (Sites 101, 101-A, and 103). The 10 locations were apportioned as follows: 5 seep and outfall locations in Site 101, 2 locations in Site 101-A, and 3 locations in Site 103. Monitoring began in late June 2002 and has continued to the present, but not for all seeps and outfalls as discussed in Section 4.1. The RG for benzene in the seeps and outfalls is 43 µg/L, in accordance with the OU 1 ROD. The change in the benzene RG specified in OU 1 ROD Amendment No. 1 is not applicable to the seeps and outfalls, as discussed in Section 4.1.5. The monitoring results for each of the sites are discussed below.

Because of delays in finalizing the work plan (U.S. Navy 2014a), the marine tissue sampling was not performed until August 2014, after this 5-year review period. Work on the shellfish investigation report and associated HHRA is currently being performed. These reports are scheduled to be completed in October 2015. An addendum to this 5-year review will be completed following completion of these reports. Ongoing work related to development of the sampling and analysis plan for the 2014 marine tissue monitoring is included below.

Site 101

Two seeps (SP-710 and SP-713) and two outfalls (OF-709 and OF-712) located at Site 101 have been sampled since the last 5-year review (Figure 4-1). Historical and recent seep and outfall monitoring data for chlorinated VOCs (1,1-DCE, TCE, and vinyl chloride), benzene, petroleum hydrocarbons (GRO, DRO, and residual-range organics [RRO]), and inorganics (total metals [arsenic, beryllium, mercury, and thallium], dissolved metals [copper, lead, nickel, silver, and zinc] and cyanide) at Site 101 are summarized in Appendix B Tables B-1, B-2, B-3, and B-5, respectively. Since 2012, only benzene, GRO, DRO, RRO, and cyanide are being monitored at Site 101 (see Table 4-3). During this 5-year review period, two chemicals (benzene and cyanide) were detected above their respective RGs. Benzene was detected above its RG in only one outfall (OF-712), and cyanide was detected above its RG seeps SP-710 and SP-713 and outfall OF-712.

Benzene was detected at outfall OF-712 above its RG during 3 of 5 sampling events that have occurred since the last 5-year review and during 12 of the 15 that have occurred since monitoring began (see Appendix B Table B-2). OF-712 is located immediately downgradient from the NEX Gas Station Leak Area. Trends analysis of OF-712 concentrations show a decreasing trend for benzene through 2004 and then stabilizing thereafter, with the exception of a moderate increase between years 2007 and 2010 (see Figure 6-1). However, the last 2 years of sampling show a deceasing trend with results below the RG of 43 µg/L.

Cyanide was detected at seep SP-710 and SP-713 above its RG in 2005 and 2013 at outfall OF-709 in 2005 and 2006 and at outfall OF-712 in 2003, 2005, 2006, 2008, and 2013 (see Appendix B Table B-5). During all other sampling events, cyanide was not detected in any of the seeps and outfalls. However, the detection limit was consistently above the RG of 0.001 mg/L. The OU 1 ROD established the cyanide RG based on the marine water quality criterion, which is below the practical quantitation limit (PQL). The ROD did not establish the cyanide RG as the PQL. Therefore, the absence of cyanide above its RG cannot be verified. Furthermore, because of the inconsistent detections of cyanide, it was not possible to perform a trend analysis. However, the concentrations detected at SP-710 and SP-713 in 2013 were similar to concentrations historically detected at these locations.

Based on these sampling results, it is recommended that monitoring continue for benzene, GRO, DRO, RRO, and cyanide. Monitoring results for cyanide should be compared to the PQL at the time of monitoring, because the ROD established the RG for cyanide below the PQL (note that this is consistent with the procedures of WAC 173-340-720(7)(c) and 40 CFR 300.430(e)(2)(i)(A)(3)). Currently, the lowest PQL achievable by laboratories is 5 µg/L. Although benzene has not been detected at seeps SP-710 and SP-711 and GRO, DRO, and RRO have either been not detected or detected at concentrations less than RGs at these locations, monitoring should continue because of the proximity of the NEX Gas Station Leak Area and the potential for future impacts.

Site 101-A

One seep (SP-715) and one outfall (OF-716) located at Site 101-A have been sampled since the last 5-year review (Figure 4-1). Historical and recent seep and outfall monitoring data for petroleum hydrocarbons (GRO, DRO, and RRO), pesticides (chlordane), and inorganics (total metals [arsenic, beryllium, mercury, and thallium], dissolved metals [copper, lead, nickel, silver, and zinc] and cyanide) at Site 101-A are summarized in Appendix A Tables B-3, B-4, and B-5, respectively. Since 2012, only cyanide is being monitored at Site 101-A (see Table 4-3). During this 5-year review period no chemical was detected above RGs at Site 101-A.

Although cyanide was detected at SP-715 above its RG during the 2005 and 2007 sampling events (see Appendix A Table B-5) and at OF-716 above its RG during the 2005, 2006, 2007, and 2008 sampling events, it has not been detected during this 5-year review period. However, the detection limit was consistently above the RG of 0.001 mg/L (refer to the Site 101 discussion above regarding the cyanide PQL and RG). Therefore, the absence of cyanide above its RG cannot be verified. In addition, although cyanide at SP-715 and OF-716 has not been detected during the last seven (SP-715) and six (OF-716) sampling events, new groundwater monitoring data, presented in Section 6.4.3, suggests cyanide monitoring should continue in seeps at Site 101-A.

Site 103

One seep (SP-703) and one outfall (OF-705) located at Site 103 have been sampled since the last 5-year review (Figure 4-1). Historical and recent seep and outfall monitoring data for chlorinated VOCs (1,1-DCE, TCE, and vinyl chloride), pesticides (chlordane), and inorganics (total metals [arsenic, beryllium, mercury, and thallium], dissolved metals [copper, lead, nickel, silver, and zinc], and cyanide) at Site 103 are summarized in Appendix B Tables B-1, B-4, and B-5, respectively. Since 2012, only chlorinated VOCs, total and dissolved metals, and cyanide are being monitored at Site 103 (see Table 4-3). During this 5-year review period, only cyanide was detected above its RG.

Cyanide was detected at OF-705 and SP-703 above its RG in 2005 and 2013 and also at OF-703 above its RG in 2002 (see Appendix B Table B-5). During all other sampling events, cyanide was not detected. However, the detection limit was consistently above the RG of 0.001 mg/L (refer to the Site 101 discussion above regarding the cyanide PQL and RG). Therefore, the absence of cyanide above its RG cannot be verified. Furthermore, because of the inconsistent detections of cyanide, it was not possible to perform a trend analysis. However, the concentrations detected at SP-703 and OF-704 in 2013 were similar to or less than concentrations historically detected at these locations.

Although TCE has not been detected at OF-705 above RGs, detected concentrations during this 5-year review period have ranged from 22 to 47 µg/L, with a downward trend (Figure 6-2). The ROD RG is based on the Model Toxics Control Act (MTCA) Method B protection of surface water value, which has recently been revised downward from 55.6 to 30 µg/L.

Based on these sampling results, it is recommended that monitoring continue for cyanide and chlorinated VOCs. The following modification to the monitoring program is recommended: Monitoring for total and dissolved metals at OF-705 should be discontinued, because they were either not detected or detected at concentrations much lower than their RGs during the last 5 sampling events.

Marine Tissue

The OU 1 ROD requires periodic sampling of shellfish (clams and crabs) and performance of periodic HHRAs using the sampling data. The results of each risk assessment are used to assess the need for continued LTM of clams and crabs in Ostrich Bay and institutional controls restricting shellfish harvesting of crabs from offshore (subtidal) locations and clams from shoreline (intertidal) locations within OU 1. The ROD specified that shellfish monitoring and restrictions on shellfish harvest in Ostrich Bay were to continue until human health risks declined to a 1 x 10^{-5} excess cancer risk and a hazard index (HI) of 1, or when these risks are reduced to a risk consistent with consumption of reference area shellfish (U.S. Navy, Ecology, and USEPA 2000).

LTM of clam and crab samples from Ostrich Bay and their respective background sites for analyses of ROD-specified COCs was performed in 2002, 2004, and 2009. Risk assessments were performed based on each of these three data sets (U.S. Navy 2003c, 2005e, and 2010j). Future subsistence incremental risks above background exceeded 1 x 10^{-5}, and hazards were at or below 1 in all three risk assessments. Each of the three risk assessments recommended continued monitoring and harvest restrictions, primarily because of uncertainties regarding ordnance compound detections and trends.

Based on the results of the 2010 HHRA, the second 5-year review concluded the ROD requirement to continue monitoring and restrict harvesting until risks are representative of background levels and/or below target health goals had potentially been met, although additional data collection was needed to support that conclusion. Although risks based on the exposure assumptions used in the original RI were acceptable in the 2010 HHRA, risks based on new information regarding Suquamish Tribe-specific fish ingestion rates did not meet target goals if ordnance compounds are actually present. The 2010 HHRA determined that the quality of the 2009 ordnance data was poor. Therefore, at least one more round of monitoring with improved analytical methods was recommended in the second 5-year review. As a result, the 2014 tissue samples were analyzed for speciated arsenic and ordnance compounds, and analysis of ordnance compounds were improved analytical methods in accordance with the EPA-approved sampling and analysis plan (U.S. Navy 2014a). In addition, another HHRA will be completed incorporating the clam and crab tissue results from the 2014 sampling event in accordance with the HHRA work plan, which is included as an appendix to the EPA-approved sampling and analysis plan (U.S. Navy 2014a). As previously discussed, the marine tissue sampling was performed after this 5-year review period. Therefore, work on the shellfish investigation report and associated HHRA is currently being performed. These reports are scheduled to be completed in October 2015. An addendum to this 5-year review will be completed following completion of these reports.

As part of the upcoming HHRA, a data gaps evaluation will be performed. The data gaps evaluation will review available marine tissue data in Ostrich Bay, the completeness of the ROD COC analyte list, the species selected for chemical analysis, and marine tissue sampling locations. Available data under consideration includes the marine tissue data collected in 2009 for the BERA (U.S. Navy 2011c). This evaluation will identify potential data gaps relating to human exposures to seafood (i.e., analyte list, species consumed, and sampling locations) and will be conducted in collaboration with EPA and the Suquamish Tribe. As part of the data gaps evaluation, the Navy performed a preliminary data gaps evaluation on the human health analyte list during this 5-year review period, which is described further below.

Preliminary Data Gaps Evaluation—Human Health Marine Tissue Analyte List Development

Based on a large number of detected chemicals (35) found in the 2009 marine tissue data collected to support the BERA (U.S. Navy 2011c), stakeholders requested that the Navy review the marine tissue analyte list in order to identify any potential data gap that could impact human health exposures. The marine tissue analyte list in the ROD was based on the COCs identified in the baseline risk assessment: antimony, vanadium, 3,3′-dichlorobenzidine, and PCP. Although not specifically identified as COCs, the ROD also specified that arsenic and ordnance compounds be included on the analyte list. PCP, antimony, vanadium, and 3,3′-dichlorobenzidine were dropped from the analyte list during the last 5-year review because they were never detected in three rounds of post-ROD monitoring, or were detected below concentrations found in the reference areas.

The preliminary review of the human health marine tissue analyte list was conducted in 2012 for metals, carcinogenic polycyclic aromatic hydrocarbons (cPAHs), pesticides, polychlorinated biphenyls (PCBs), and semivolatile organic compounds (SVOCs). At that time, it was agreed among all stakeholders that ordnance compounds would be included on the analyte list and, therefore, were not included in the preliminary data gaps evaluation. The Navy reviewed existing data, including pre- and post-ROD marine tissue sampling data, to determine if additional chemicals should be added to the current marine tissue analyte list. This preliminary review was documented in the Stakeholder Meeting #1 handout e-mailed to the stakeholders on June 18, 2012 (U.S. Navy 2012e). The handout is included in Appendix C and summarized in Table 6-1. Figure 1 in Appendix C provides the weight-of-evidence steps used to include or exclude additional chemicals in future LTM events. The following summarizes each weight-of-evidence step performed during this preliminary data gaps analysis. These steps include:

- Step 1: Comparison of marine tissue concentrations to subsistence risk-based screening levels (RBSLs)
- Step 2: Assessment of whether the chemical is site related based on comparison to 2009 BERA sediment background
- Step 3: Assessment of whether the chemical is site related based on RI/ROD findings
- Step 4: Assessment of whether the chemical is an ongoing site source based on post-ROD LTM monitoring and the 2009 BERA sampling

Step 1: Step 1 assessed if the detected chemical in tissue exceeded RBSLs. The RBSLs were developed for shellfish tissue based on the Suquamish-specific exposure factors, including an adult ingestion rate of 498.4 grams/day, child ingestion rate of 57.5 grams/day, adult body weight of 79 kg, and child body weight of 16.8 kg. Several marine species were evaluated, including bent-nose clam, crab, sea cucumber, and starry flounder. The bent-nose clam and crab results were combined and screened against the calculated shellfish tissue RBSL. An RBSL was also developed for sea cucumber and starry flounder using Suquamish-specific exposure factors. Thirteen chemicals out of the 35, not including ordnance compounds, did not have a maximum concentration exceeding an RBSL. Therefore, no further analysis of these chemicals was performed, and they were excluded from the human health marine tissue analyte list (see Table 6-1).

Step 2: This step summarizes the 2009 BERA conclusions on whether a chemical exceeding a marine tissue screening level was site related. The BERA compared the current concentration of the chemical in Ostrich Bay sediment to the 2009 BERA sediment background level. Of the 10 metals that exceed RBSLs (including lead, which has no screening level), 2, chromium and arsenic, were found to be below BERA sediment background levels (U.S. Navy 2011c). Five metals were found to be above background in sediment: cadmium, copper, mercury, selenium, and zinc. The remaining three metals, lead, nickel, and silver, were not evaluated for sediment background in the BERA.

Step 3: This step assessed if the chemical was site-related, based on being historically selected as a COPC in the RI and whether it was selected as a COC in the ROD. Summary tables including sampling dates and analyte lists for the extensive sampling events for outfalls, seeps, and sediments (directly relevant to the marine environment) were included in the Stakeholder Meeting #1 handout as Attachment C (U.S. Navy 2012e), which is included in Appendix C.

As shown on Table 6-1, of the 22 chemicals that exceeded the RBSLs, the 1996 HHRA identified only two chemicals as COCs in marine tissue (arsenic and PCP). All 22 chemicals, except pesticides and PCBs (whose detection limits were greater than the RBSLs), were detected in marine tissue samples used in the 1996 HHRA and were carried through the risk assessment. Arsenic and PCP were identified as COCs based on exceedances of target health goals. The remaining chemicals were below target health goals and/or found to be at background in marine tissue. The concentrations in marine tissue for the following seven chemicals were found to be at background at the time of the RI, based on the 1996 HHRA:

- Arsenic
- Cadmium
- Chromium
- Copper
- Lead

- Mercury
- Zinc

For the remaining three metals, nickel, selenium, and silver, no tissue background evaluation was conducted during the 1996 HHRA. Note that the 1996 HHRA followed current EPA guidelines (USEPA 2002) regarding evaluating chemicals for background after they have been carried through the baseline risk assessment.

Although selenium was identified as a COPC in the RI for marine tissue, it was not retained as a COC in the ROD for any medium. Furthermore, no upland source of selenium has been identified. Nickel and silver were not retained as COCs in marine tissue because target health goals were not exceeded. However, they were identified as COCs in seeps/outfalls and groundwater and are included in the LTM program. Their site-related relevance is further addressed in Step 4.

Pesticides were not identified as a COPCs or COCs in any medium. Although the detection limits for marine tissue sampling performed during the RIs were above RBSLs, no upland source of pesticides was identified. Therefore, pesticides detected in marine tissue in the 2009 BERA samples are not considered to be site related.

Although cPAHs and PCBs were identified as COCs in soil in the ROD, they were not identified as COCs in groundwater (seeps/outfalls) because of the following:

- cPAHs were not detected in seep/outfall samples collected during the RI (1991, 1992, 1996, and 1998), indicating no significant historical source to the marine environment. There was only 1 detection of TPH-D (possible source of cPAHs) in pre-ROD seep/outfall data. However, there were data quality issues with that sample.

- PCBs were not detected in seep/outfall samples collected in 1991, 1992, 1996, and 1998.

Therefore, concentrations of these chemicals in marine tissue in the 2009 BERA samples are not considered to be site related.

Step 4: This step assessed if there is an ongoing source of the chemicals, detected above RBSLs in the 2009 BERA samples, to the marine environment based on post-ROD LTM and the 2009 BERA sampling. Of the chemicals detected above the RBSLs in marine tissue in 2009, only arsenic, copper, lead, mercury, nickel, silver, and zinc are monitored in seeps and outfalls. The following summarizes the results of the annual post-ROD LTM monitoring for metals in seeps and outfalls (see Appendix B Table B-5):

- Arsenic: Detected once at seep SP-707 in 2003 at a concentration of 4.05 µg/L, slightly above the RG of 3.7 µg/L

- Copper: Not detected at any seep/outfall location at a concentration above the RG of 4.8 µg/L

- Lead: Not detected at any seep/outfall location at a concentration above the RG of 5.8 µg/L

- Mercury: Mercury was detected once at seep SP-707 in 2002 at a concentration of 0.2 µg/L, slightly above the RG of 0.1 µg/L. However, detection limits during the past 5 years have been consistently above the RG.

- Nickel: Detected once at outfall OF-705 in 2008 at a concentration of 10.5 µg/L, slightly above the RG of 7.9 µg/L

- Silver: Not detected at any seep/outfall location at a concentration above the RG of 81 µg/L

- Zinc: Not detected at any seep/outfall location at a concentration above the RG of 1.2 µg/L

LTM of marine tissue for PCP has occurred three times since the execution of the ROD. PCP has not been detected in any of the clam (littleneck) or crab tissue samples collected during the three sampling events. Furthermore, the creosote-treated pilings/piers were removed in 2001 that were the possible source of PCP. (Note that the there was no known upland source of PCP, because it was not detected in seep/outfall samples collected in 1991, 1992, 1996, and 1998.) Furthermore, during the 2009 BERA sampling event, PCP was detected in 4 of 6 bent-nose clam samples, but not in sea cucumber, crabs, or starry flounder tissue samples (6 samples each species), and it was not detected in any of the 43 sediment samples collected.

The 2009 BERA sediment sampling results were compared to SQS to determine whether concentrations are above regulatory levels. The following are the conclusions from this comparison:

- Copper was detected below the SQS during the 2009 BERA, indicating low levels of contamination. In addition, copper has a low toxicity in humans compared to marine organisms and, thus, is not a human health concern.

- Lead was detected below the SQS during the 2009 BERA, indicating low levels of contamination.

- Zinc was detected below the SQS during the 2009 BERA, indicating low levels of contamination. In addition, zinc has low toxicity in humans compared to marine organisms and, thus, is not a human health concern.

- cPAHs were detected in all sediment samples during the 2009 BERA, but most detections were below the lowest SQS, indicating low levels of contamination.

- None of the detected concentrations of pesticides or PCBs in sediment samples collected during the 2009 BERA exceeded ecological screening criteria, indicating low levels of contamination.

Based on these sampling results, the site is not an ongoing source to the marine environment of arsenic, copper, lead, mercury, nickel, silver, zinc, cPAHs, pesticides, PCBs, or PCP.

Conclusion: The Navy recommended that none of the chemicals detected in the 2009 BERA marine tissue above RBSLs, other than ordnance compounds, be included in the next round of marine tissue monitoring. However, EPA and the Suquamish Tribe did not agree with the Navy's conclusions presented in these meeting materials, and, therefore, the project team did not reach a consensus on the chemicals to be added to the analyte list. Although consensus was not achieved, the project team did agree to proceed with marine tissue sampling and analysis of marine tissue for speciated arsenic and ordnance compounds. Finally, ordnance compounds would be analyzed using the improved analytical methods.

6.4.2 Groundwater Sampling at Site 110

During the last 5-year review period, two 35,000-gallon underground storage tanks (USTs) located within Site 110 were removed as part of the heating oil fuel tank replacement project for NHB (U.S. Navy 2008c). The two tanks were removed on March 3 and 5, 2008. After the tanks were removed, approximately 2,600 tons of impacted soil were removed and disposed of, and approximately 201,050 gallons of petroleum-impacted water were transported off site for treatment and disposal. Further information on the tank removal and soil sampling conducted at the site can be obtained by reviewing Section 6.4.5 of the second 5-year review (U.S. Navy 2011b), which is included in Appendix A.

Because of the presence of petroleum-impacted groundwater in the tank excavation, groundwater sampling was performed in three existing monitoring wells located in the vicinity of the former USTs on June 17, 2008. Groundwater samples were analyzed for DRO, which was not detected above the method reporting limit of 200 μg/L (U.S. Navy 2008). To obtain closure at this site, the Navy conducted an additional round of groundwater sampling at the same locations on October 16, 2009 to confirm attainment of cleanup levels. DRO was not detected in any of the samples above the reporting limit of 110 μg/L, except for at one location (SB-7) with an estimated concentration of 740 μg/L. However, the DRO detection did not appear to be diesel, but rather an overlap into the diesel range because of the presence of a heavy oil substance. Well SB-7 dried out during purging, possibly the result of silt accumulating within the well that clogged the well-screen slots (U.S. Navy 2010k).

In an effort to obtain a more representative groundwater sample from well SB-7 and further investigate and quantify the concentrations, if any, of diesel (DRO) and heavy oil (RRO), it was recommended that well SB-7 be redeveloped to remove silt and increase well production. After well redevelopment, follow-up groundwater sampling of SB-7 revealed that DRO and RRO were both undetected at reporting limits of 110 µg/L. A summary of the three rounds of groundwater sampling following tank removal is presented in Appendix B Tables B-6 and B-7. Based on the results of this sampling, no further action was warranted (U.S. Navy 2010l).

6.4.3 Additional Site Investigations at OU 1 – Phase I ESA Report and Focused Phase II SI Report

In 2013, at the request of Forest City, Landau Associates conducted a Phase I ESA and a focused Phase II SI for approximately 200 acres of property at JPHC in advance of the public-private venture agreement between Forest City and the Navy (see Section 3). These documents are included as attachments in Appendix A for easy reference. Forest City intends to construct new buildings and maintain and/or renovate existing buildings and related community facilities. The purpose of these investigations was to identify known and potential areas of contamination that may pose a potential liability to a potential leasee or purchaser. The Phase I ESA identified the known and potential areas of contamination that would require further investigation at the site (Landau 2014). The focused Phase II SI further evaluated the potential areas of contamination and documented environmental conditions at the site (Landau 2013).

The areas investigated by Landau are generally coincident with areas investigated and assessed through the RI/FS process. However, the Landau investigation included additional media (e.g., freshwater in a stream), different reporting limits, or data from slightly different locations that can be used to assess the protectiveness of the remedy. The six general areas identified in the Phase I ESA for further evaluation in the focused Phase II SI included:

- The Root Court area, which includes former USTs, Buildings 575 and 100, and a demolition debris landfill (construction debris fill area)
- The street waste disposal area adjacent to the southern end of Wencker Circle
- The area to the northeast of Rankin Road where cPAH contamination in soil has been identified (polycyclic aromatic hydrocarbon soil excavation area)
- The NEX Gas Station Leak Area

- The areas surrounding the former munitions storage bunkers
- The drum disposal area located near the intersection of Elwood Point Road and Olding Road

The scope of work consisted of drilling soil borings to collect soil, groundwater, and soil vapor samples to assess surface and subsurface conditions at the site. Additional investigation activities included sampling existing groundwater monitoring wells, collection of surface water samples from groundwater seeps and an adjacent stream, radon sampling inside representative housing units, and interior wipe sampling in existing bunkers formerly used for munitions storage. Based on preliminary soil and soil gas sampling results, indoor air samples were also collected from vacant residential housing units in three of the six areas identified above to evaluate potential vapor intrusion issues. Figures 2A and 2B in Appendix D show the entire site area and identify soil, water, soil vapor, indoor air and radon sampling locations. Figures 3 through 13 of Appendix D present the individual study areas within the study site.

In the focused Phase II SI report, analytical results from the above sampling were compared to screening levels based on applicable Ecology regulations and other applicable, relevant, and appropriate requirements (ARARs). The screening levels used in the focused Phase II SI report were generally more conservative than the RGs in the ROD, except that screening levels for cyanide in groundwater, nickel in surface water, and arsenic in soil were higher than the RGs. Appendix B Table B-8 presents results only for those chemicals that exceeded the screening criteria used in the focused Phase II SI report. This table also includes RGs from the OU 1 ROD, if an RG was established, for comparison purposes. Figure 14 of Appendix D identifies the approximate areas of the site where contamination was found at concentrations exceeding the focused Phase II SI screening criteria within 15 feet of ground surface. The results of the investigation and the impacts of the focused Phase II SI results on the protectiveness of the OU 1 remedy are discussed below.

Root Court Area

Landau investigated three areas which, in their assessment, had potential contamination within the Root Court area: the six former USTs, the construction debris landfill, and the existing petroleum contamination located underneath Buildings 575 and 100. Landau performed soil, groundwater, soil gas, and/or indoor air sampling in these areas as well as sampling of two seeps discharging along the shoreline adjacent to Root Court and an adjacent stream (originating from within the vicinity of the construction debris landfill). Areas and media exceeding the focused Phase II SI screening criteria are depicted on Figures 3, 4, and 14 in Appendix D. The Landau data provided the following new information:

- TPH as creosote was detected in soil at a concentration greater than the focused Phase II SI screening criteria in the vicinity of former UST-2 and UST-2A (near the north end of Root Court) at depths between 7.5 and 9 feet below ground surface (bgs). No RG was established in the OU 1 ROD for TPH as creosote. Impacts on remedy protectiveness are discussed below.

- TPH as creosote, TPH as diesel, TPH as heavy oil, and cPAHs were detected in soil at concentrations greater than the focused Phase II SI screening criteria in the south end of Root Court at depths greater than 10 feet bgs. No RGs were established for these TPH compounds in the OU 1 ROD. However, the cPAH concentration exceeded the ROD RG. Impacts on remedy protectiveness are discussed below.

- Cyanide was detected in groundwater at Site 101-A in the vicinity of Building 100 at concentrations greater than both the focused Phase II SI screening criteria and the OU 1 ROD RG. The Navy currently samples two seeps/outfalls at Site 101-A for cyanide: OF-716 and SP-715. Cyanide has not been detected at these two locations during this 5-year review period, but the reporting limits have consistently been greater than the ROD RG. Although direct contact with groundwater is not anticipated because of its depth below the ground surface (approximately 24 feet bgs within the Root Court area) and use of groundwater as a drinking water source is not anticipated at JPHC, cyanide could be migrating to surface water at concentrations above the ROD RG. Samples collected from the seeps/outfalls along the shoreline of Site 101-A during the focused Phase II SI were not analyzed for cyanide. Therefore, the presence of cyanide above the ROD RG in the seeps/outfalls was not confirmed during the focused Phase II SI. Monitoring should continue for cyanide at Site 101-A using the best analytical method capable of achieving the PQL. Currently, the lowest PQL achievable by laboratories is 5 μg/L. Therefore, monitoring data should be compared to the current PQL of 5 μg/L. In the future, if a lower PQL is achievable, then the analytical methods should be adjusted accordingly and monitoring data should be compared to the lower PQL.

- Royal demolition explosive (RDX) was detected in groundwater at the south end of Root Court at a concentration greater than the focused Phase II SI screening criteria. However, an RG was not established in the ROD for RDX, because it was not identified as a COC for the site. The groundwater concentration for RDX of 1.2 μg/L was only slightly above the focused Phase II SI screening criteria of 0.8 μg/L, which is based on a drinking water standard. As discussed above, groundwater at JPHC is not anticipated to be a drinking water source, and the screening level used in the focused Phase II SI is overly conservative. Table 3-7 of the BERA report (U.S. Navy 2011c) presented freshwater and marine surface water criteria for munitions compounds. The lowest, and therefore most conservative criterion, presented for RDX was 186 µg/L, which was based on the freshwater chronic value (Talmage et al. 1999). The RDX concentration of 1.2 µg/L is significantly lower than the freshwater chronic value of 186 µg/L. Therefore, although the focused Phase II SI reported RDX concentrations exceeding the focused Phase II SI screening criterion in groundwater, RDX is not present in groundwater exceeding the criterion protective of surface water. Thus, the remedy is still protective.

- Mercury was detected in seep water to the west of Root Court along the shoreline at concentrations greater than both the focused Phase II SI screening criteria and the OU 1 ROD RG. The Navy does not currently sample seeps/outfalls OF-716 and SP-715 for metals, including mercury. The Navy discontinued monitoring in 2012 per the recommendation of the second 5-year review. The reporting limits for mercury have frequently been greater than the current ROD RG (0.1 µg/L) and fairly consistently above the original ROD RG (0.025 µg/L). (Note that mercury's RG was adjusted from the ROD level of 0.025 to 0.1 µg/L based on the PQL [U.S. Navy 2001]. In the last 5-year review, it was recommended that the RG for mercury, which was based on the PQL of 0.1 µg/L, be lowered to the original ROD RG level of 0.025 µg/L, because lower mercury PQLs could be achieved by laboratories and mercury concentrations were likely below the original ROD RG level of 0.025 µg/L.) However, these focused Phase II SI data indicate that mercury in these two outfalls may be above the ROD RG. Monitoring for mercury should be restarted at the two seeps/outfalls of Site 101-A, and an analytical method capable of achieving the ROD RG should be used.

- Total copper and nickel were detected in stream water to the east of Root Court at concentrations exceeding the focused Phase II SI screening criteria. The total concentrations also exceeded the OU 1 ROD RG. However, the OU 1 ROD RGs are based on dissolved concentrations. See further discussion below.

- 1,3-butadiene and benzene were detected in soil gas throughout the Root Court area and chloroform was detected at one location in the vicinity of Building 575 at concentrations exceeding the focused Phase II SI screening criteria. No RGs were established for soil gas in the OU 1 ROD. Although soil gas was detected at concentrations exceeding the focused Phase II SI screening criteria indicating a potential risk to residents via the vapor intrusion pathway, Landau concluded that indoor air is not a significant concern at the site based on a comparison of the indoor air sampling results in the Root Court area to ambient air and typical background concentrations (see Table 13 in Appendix D).

Currently, LUCs in place at JPHC require digging permits be obtained for all excavation activities. However, the areas of soil exceedances identified during the focused Phase II SI (listed in the first two bullets above) are not specifically identified as areas where LUCs are applicable in the LUC Management Plan (U.S. Navy 2015b). Because of this, excavation could occur in these areas without the proper controls, and the remedy may not be protective of human health and the environment in the future. Therefore, the LUC Management Plan should be revised to include these areas of exceedances identified in the focused Phase II SI report.

The source of the copper screening criteria (0.0024 mg/L) used in the focused Phase II SI is the National Toxics Rule. As noted in this rule, the bioavailability and toxicity of metals depend strongly on the exact physical and chemical form of the metal (USEPA 1992). Generally, dissolved metal has greater toxicity than particulate metal, and for some metals, such as copper, certain dissolved forms have greater toxicity than other dissolved forms. This 1992 National Toxics Rule value was withdrawn and replaced with a value of 0.0031 mg/L for dissolved-phase copper in 2007 (USEPA 2007b), except in Washington State where the Puget Sound chronic criterion of 0.0028 mg/L is applicable (i.e., only to waters east of a line from Point Roberts to Lawrence Point to Green Point to Deception Pass and south from Deception Pass and of a line from Partridge Point to Point Wilson) (USEPA 2007b). Copper was not detected in the dissolved phase (less than 0.002 mg/L) in the focused Phase II SI data. Therefore, the concentration of copper does not exceed the Puget Sound chronic criterion and is unlikely to pose a hazard to aquatic life in the stream. Finally, the dissolved copper reporting limit was less than the OU 1 ROD RG.

The source of the focused Phase II screening criteria for nickel (0.0082 mg/L) is the EPA national ambient water quality criteria (AWQC) for saltwater. The EPA clearly indicates that the AWQC for nickel are expressed in terms of dissolved, not total, metal concentrations in the water column (USEPA 2014b). The dissolved-phase nickel concentration was not detected in the same sample (less than 0.01 mg/L). Although the detection limit is slightly greater than the nickel criterion, dissolved-phase nickel was also not detected in Root Court groundwater (Landau 2013), nor has it been detected in seep and outfall samples at Site 101-A at a concentration greater than the AWQC or the ROD RG (note that monitoring was terminated in 2011 based on a recommendation in the second 5-year review; see Appendix B Table B-5). For these reasons, there is a low likelihood that nickel is present in the stream in dissolved-phase concentrations that could pose a hazard.

Finally, the levels of copper and nickel (and other metals detected) were found to be below drinking water standards. Therefore, water in the stream does not appear to be a risk for human direct contact or ingestion.

Street Waste Disposal Area

Landau advanced six soil borings in the street waste disposal area to a depth of 10 feet bgs. The concentration of total petroleum hydrocarbons as gasoline (TPH-G) in a sample collected from one boring (ST-5) at a depth between 3 and 4 feet bgs exceeded the focused Phase II screening criteria (see Figures 5 and 14 in Appendix D), but was below the ROD RG. This sample was collected from below the 3-foot soil cap that was placed in the area during a prior removal action. This cap is anticipated to restrict direct exposure to soil. Because concentrations are below the ROD RG, the Site 110 remedy remains protective of human health and the environment. However, the soil cap area is not specifically identified as an area where LUCs are applicable in the LUC Management Plan (U.S. Navy 2015b). Therefore, the LUC Management Plan should be revised to include this soil cap area.

Northeast of Rankin Road

Landau advanced thirteen soil borings in the area northeast of Rankin Road to depths of between 4.5 and 10 feet bgs. Shallow soil samples (less than 3 feet bgs) from three borings (RR-1, RR-4, and RR-8) exceeded the focused Phase II screening criteria for cPAH and lead (see Figure 6 and 14 in Appendix D). The cPAH concentration exceeded the ROD RG, but the lead concentration did not exceed the ROD RG. Because concentrations of lead are below the ROD RG, the Site 110 remedy remains protective of human health and the environment for this contaminant. cPAH exceeded the criteria at the very southern end of the sampling area. Landau concluded that cPAH contamination extends farther to the south than what had been previously documented, and that the contamination was not fully delineated during their investigation. Therefore, further investigation of this area should be performed to determine the potential extent of cPAH contamination. Because the cPAH contamination was identified in shallow soil, there is a potential direct exposure pathway to human or ecological receptors, although it should be noted that digging is currently not allowed at JPHC. Following further investigation, an analysis of potential human health and ecological risks should be performed if detected concentrations indicate potential risks.

Currently, LUCs in place at JPHC require digging permits be obtained for all excavation activities. However, the area where cPAH exceeds the ROD RG is not specifically identified as an area where LUCs are applicable in the LUC Management Plan (U.S. Navy 2015b). Because of this, excavation could occur in this area without the proper controls, and the remedy may not be protective of human health and the environment in the future. Therefore, the LUC Management Plan should be revised to include this area.

NEX Gas Station Leak Area

Landau advanced four soil borings to the north and south of the NEX Gas Station Leak Area to depths between 26 and 30 feet bgs (Figures 7 and 14 in Appendix D). Landau collected one soil sample from each boring, and a groundwater sample from one boring where groundwater was observed. Landau also collected groundwater samples from two existing groundwater monitoring wells. Finally, Landau collected soil gas samples from six boring locations from the residential areas on the north, west, and south sides of the NEX Gas Station Leak Area at depths of approximately 5 to 7 feet bgs.

Concentrations of chemicals in groundwater and soil samples were less than the focused Phase II SI screening criteria. Concentrations of 1,3-butadiene and benzene in soil gas to the north, south, and west exceeded the focused Phase II screening criteria. No RGs were established for soil gas in the OU 1 ROD. Although soil gas was detected at concentrations exceeding the focused Phase II SI screening criteria indicating a potential risk to residents via the vapor intrusion pathway, Landau concluded that indoor air is not a significant concern at the site based on a comparison of the indoor air sampling results in the NEX Gas Station Leak Area to ambient air and typical background concentrations (see Table 13 in Appendix D).

Bunkers

Six bunkers formerly used for munitions storage were historically located at Site 110 (designated bunkers 98, 99, 100, 101, 103, and 104). Landau advanced thirty-three soil borings adjacent to the bunkers to depths between 1.4 and 5 feet bgs (Figures 8 through 12 and 14 in Appendix D), and collected one soil sample from each boring. In addition, Landau collected three wipe samples each of the interior concrete surfaces of Bunkers 98 and 99. Wipe test results do not indicate the presence of residual explosive compounds within the interiors of Bunkers 98 and 99.

Concentrations of cPAH, 4-nitrotoluene, arsenic, and/or lead in shallow soil samples (less than 3 feet bgs) from 10 borings (B98-1, B99-3, B100-5, B101-5, B101-6, B103-2, B103-3, B103-7, B104-2, and B104-5) adjacent to Bunkers 98, 99, 100, and 101 and the former locations of Bunkers 103 and 104 exceeded the focused Phase II SI screening criteria. Concentrations of cPAH and arsenic also exceeded the ROD RGs, but the lead concentrations were less than the ROD RG. No RG was established for 4-nitrotoluene in the OU 1 ROD. However, the detected concentrations of 4-nitrotoluene are orders of magnitude lower than the MTCA Method B cleanup level of 62.5 mg/kg. Therefore, concentrations of this chemical in soil are unlikely to result in unacceptable risks to human health or the environment. Based on the locations of the soil RG exceedances, the extent of contamination was not fully delineated during the Landau investigation. Because cPAH and arsenic contamination was identified in shallow soil, there is a potential direct exposure pathway to human or ecological receptors, although it should be noted that digging is currently not allowed at JPHC. Therefore, further investigation and analysis should be conducted to determine the extent of exceedances and whether the exceedances could represent a potential human health or ecological risk.

Currently, LUCs in place at JPHC require digging permits be obtained for all excavation activities. However, the areas where cPAH and arsenic exceed the ROD RG are either not specifically identified as areas where LUCs are applicable or outside of the LUC restriction areas adjacent to Bunkers 100 and 101 identified in the LUC Management Plan (U.S. Navy 2015b). Because of this, excavation could occur in these areas without the proper controls, and the remedy may not be protective of human health and the environment. Therefore, the LUC Management Plan should be revised to include these areas of exceedances.

Drum Disposal Area

Landau advanced five soil borings to the groundwater table or a maximum of 41.5 feet bgs (Figures 13 and 14 in Appendix D). Landau collected two soil samples from each boring, and a groundwater sample from one boring where groundwater was observed. Finally, Landau collected soil gas samples from two of the boring locations at a depth of 7 feet bgs.

Concentrations of chemicals in groundwater and soil samples were less than the focused Phase II SI screening criteria. Concentrations of 1,3-butadiene and benzene in soil gas in the vicinity of the former drum disposal area exceeded the focused Phase II screening criteria. No RGs were established for soil gas in the OU 1 ROD. Although soil gas was detected at concentrations exceeding the focused Phase II SI screening criteria indicating a potential risk to residents via the vapor intrusion pathway, Landau concluded that indoor air is not a significant concern at the site based on a comparison of the indoor air sampling results in the former drum disposal area to ambient air and typical background concentrations (see Table 13 in Appendix D).

Radon

Radon results from the five representative homes sampled indicate that radon concentrations were below the screening level 4 pCi/L, with concentrations between 0 and 2.3 pCi/L. The EPA identifies Kitsap County as a low risk area for radon intrusion into homes. The EPA recommends conducting mitigation actions at homes with radon levels at or above 4 pCi/L (EPA action level). However, the EPA also recommends that people consider mitigation in their homes for radon levels between 2 and 4 pCi/L.

6.4.4 OU 1 Inspection and Maintenance Activities

All OU 1 inspection activities since the last 5-year review were performed in accordance with the Inspection and Maintenance Plan (U.S. Navy 2003e) and the revised Inspection and Maintenance Plan (U.S. Navy 2008a), as summarized in Tables 4-4 and 6-2. In addition to the routine quarterly inspections, a site inspection is required within 72 hours of a significant storm event, which is defined as a 2-year storm for Bremerton, Washington. The National Oceanic and Atmospheric Administration determined the 2-year storm for Bremerton to be 1.37 inches of rain in a 6-hour period or 2.92 inches of rain in a 24-hour period. Storm events meeting these criteria occurred on December 12, 2010, November 22 and 23, 2011, November 19, 2012, November 30, 2012, September 24, 2013, and February 16, 2014. Inspections were performed within 72 hours of these rainfall events (see Table 6-2).

The maintenance activities were also performed in accordance with the Inspection and Maintenance Plan. The maintenance activities that were performed during this 5-year review period are presented in Tables 4-4 and 6-2 (U.S. Navy 2010i, 2011h, 2012c, 2013g, 2014a, 2014c, and 2014e). In general the routine maintenance activities included the following:

- Replacing rocks removed from the low rock shelf and the armor stone revetment
- Removing dead vegetation from the shoreline area
- Trimming vegetation that was encroaching on walkways and stairs
- Watering newly planted vegetation on an as-needed basis
- Replacing broken and missing shellfish warning signs
- Replacing rock on the seep/outfall rock splash pad areas in the vicinity of the seawall
- Weeding shoreline vegetation areas and gravel pathways
- Placing mulch on shoreline vegetation areas

The nonroutine maintenance activities that were performed during this 5-year review period are described in Table 6-2 (U.S. Navy 2010i, 2011h, 2012c, 2013g, 2014a, 2014c, and 2014e). Additional maintenance activities that may be required in the future are the following:

- Deterioration of the seawall surface in areas that had been previously patched has been observed over this 5-year review period. Although this deterioration does not appear to impact the structural integrity of the seawall, the seawall should continue to be monitored. If monitoring indicates an impact to the structural integrity, then repairs should be implemented.
- Continue to monitor the shoreline vegetation affected by the ordnance investigation, and replant and augment mulch as needed.

6.4.5 OU 3T JPHC LUC Management Activities

URS Corporation (URS) conducted audits of the LUCs required by the OU 3T JPHC ROD on behalf of the Navy between April 18 and 26, 2013 and between July 11 and 25, 2014 (U.S. Navy 2013d and 2015a). The auditors followed the procedures described in the LUC Management Plan (U.S. Navy 2013c) and completed the audit checklist for each LUC program: excavation permitting, education and awareness training for residents, education and awareness training for shellfish harvesters, DMM reporting and response, and LUC monitoring and reporting. Each audit includes three types of checks: (1) document reviews, (2) interviews with Navy personnel and contractors responsible for implementation of the LUCs, and (3) observations. Because JPHC is now operated by a public-private venture agreement between the Navy and Forest City, some modifications were made to the audit procedures in 2014, which will be reflected in a revised LUC Management Plan, scheduled to be completed in 2015. A compliance evaluation of the LUCs required by the OU 3T JPHC ROD based on the audit findings was performed during each audit, and the results of this compliance evaluation are summarized in Table 6-3.

The OU 3T JPHC ROD requires that the enhanced training and excavation permitting program be reviewed for effectiveness every 5 years and modified as necessary to remain protective. The enhanced training and the excavation permitting programs were reviewed by the NAVFAC NW Munitions Response Program Manager. The enhanced training materials were found to be up to date and excavation permitting program to be consistent with requirements in NBK Instruction 11300.3A, the OU 3T JPHC and OU 3T NHB RODs, as well as the LUC Management Plan for OU 3T JPHC (U.S. Navy 2013c).

6.5 RESULTS OF SITE INSPECTION

The site inspection checklist is included as Appendix E. This section contains a summary of the site inspection findings. The site visit occurred on July 22, 2014 and was conducted by the following personnel:

- Ray Kobeski, NAVFAC NW
- Demetrio Cabanillas, URS
- Debbie Rodenhizer, URS

The site visit consisted of inspecting all portions of the site covered by institutional controls or requiring ongoing remedy maintenance. The site walk verified that the remedial action components are being regularly maintained, including the soil covers and shoreline protection features, and the institutional controls requirements for Sites 101, 101-A, 103, and 110 are being met. The more durable shellfish harvesting restriction signs that were installed during the last 5-year review period are in good shape. However, the new asphalt that was placed at Buildings 100 and 101 is showing some cracking and settling (depressions were evident), and additional maintenance of these asphalt covers is needed. At Site 101, cracks were observed in the concrete seawall, and maintenance is required to maintain the integrity of the seawall. The presence of minor amounts of invasive plant species was also observed during the site inspection. These observations demonstrate the need for ongoing maintenance activities.

During the site inspection, the OU 1 RPM is interviewed to determine whether any excavation activities have occurred in areas that have land use restrictions, and, if so, whether proper excavation controls have been implemented and the site has been restored to pre-excavation conditions. In reviewing permit applications, it can be difficult to determine whether planned excavation activities are located in land use restriction areas. Therefore, it is recommended that the excavation permitting program be revised to include a mapping application to be used to quickly and easily identify whether the planned excavation activities are within a land use restriction area.

6.6 RESULTS OF INTERVIEWS

Interview candidates consisted of persons familiar with the CERCLA actions at JPHC/NHB. Interviewees were selected from the Navy (including NAVFAC NW and NHB), EPA, Ecology, Washington State Department of Natural Resources, and the Suquamish Tribe. Because of a lack of community interest, no community members were interviewed. Interview instructions and questions were sent to potential interviewees via email, and responses to questions were returned by email. Not all those invited to comment chose to do so. Interview responses are documented in Appendix F. Highlights of the interview responses are summarized in the following sections.

6.6.1 Navy Personnel

Of the five Navy personnel who were sent questionnaires, only three had responses to the questions. Two of the respondents felt that they had not been involved in the JPHC/NHB site in a very long time, had no new knowledge of the remedial activities, and, therefore, had no opinions. The Navy respondents were confident that components of the OU 1 remedy continue to be effective and reported no institutional controls violations. One respondent felt that with the exception of the marine tissue monitoring at OU 1, the ongoing environmental monitoring performed at OU 1 was sufficiently thorough. The Navy did not complete the 2011 marine sampling round because of a lack of consensus on the analyte list with the stakeholders. However, the Navy is working with stakeholders to reach consensus. The respondents also had positive remarks on the progress toward implementing the revised remedy for the OU 1 NEX Gas Station Leak Area and the progress on implementing the remedy for OU 3T JPHC. Although no community concern was reported, it was noted that a concerned citizen contacted the Navy for a copy of a report documenting a property investigation with no significant findings. A respondent also noted that JPHC is now part of a “public-private venture” with Forest City, and, therefore, the Navy needs to ensure that they are coordinating with Forest City, especially at times when information is released to the public.

6.6.2 Agency Personnel

The three agencies that responded to questionnaires were Ecology, EPA, and Washington State Department of Natural Resources. Ecology responded to the interview request, but had no comments.

The EPA respondent generally felt that most of the remedy components for OU 1 and OU 3T JPHC were effective. The respondent did not feel the LTM for shellfish was consistent with the sampling requirements of the OU 1 ROD, which required sampling every 2 years (tissue sampling has not occurred since 2009).[1] In addition to frequency requirements of the OU 1 ROD, the EPA respondent commented that tissue sampling has not met laboratory data quality objective requirements. The respondent also noted that seep monitoring results were not representative of groundwater in the NEX Gas Station Leak Area. Therefore, groundwater monitoring will be used instead of seep monitoring in the future in accordance with the OU 1 ROD Amendment No. 1. The EPA respondent remarked that the components of the revised remedy for the OU 1 NEX Gas Station Leak Area have not yet been implemented because of remaining data gaps in the site characterization, which are being addressed in the data gaps investigation report. The EPA respondent felt that all the remedy components of OU 3T JPHC have been implemented. However, the RACR has not been completed. Although the EPA felt the institutional controls components for OU 1 and OU 3T JPHC appear to be effective, the 5-year review will need to evaluate the reasonably anticipated future land use, given the substantial planned demolition and construction of housing under the public-private venture agreement.[2]

The EPA respondent also expressed two concerns regarding the JPHC/NHB site. The first concern was in regards to the significant redevelopment of JPHC, which could present future challenges to the unexploded ordnance construction support LUC component[3] of the OU 3T JPHC remedy. The second concern was the need for evaluation of the effectiveness of the OU 1 ROD Amendment No. 1 after 2 years of operation. Specifically, if the remedy does not meet the Safe Drinking Water Act maximum contaminant level criterion for benzene in 2 years, then a contingency remedy will be triggered under the OU 1 ROD Amendment No. 1.

The Washington State Department of Natural Resources respondent generally felt that the remedy components for OU 1 and OU 3T JPHC were effective. Although institutional controls are in

[1] Based on a recommendation in the first 5-year review (U.S. Navy 2005c), the marine tissue sampling frequency was decreased from every other year to once every 5 years. Because of delays in finalizing the work plan (U.S. Navy 2014a), the marine tissue sampling was not performed until August 2014, after this 5-year review period. Work on the shellfish investigation report and the associated HHRA is currently being performed. These reports are scheduled to be completed in October 2015. An addendum to this 5-year review will be completed following completion of these reports.
[2] No change to land use at JPHC is planned. The current and anticipated future land use is residential.
[3] The OU 3T JPHC ROD does not include unexploded ordnance construction support as part of the required LUCs (see Sections 11.2 and 11.4 of the OU 3T JPHC ROD included in Appendix A).

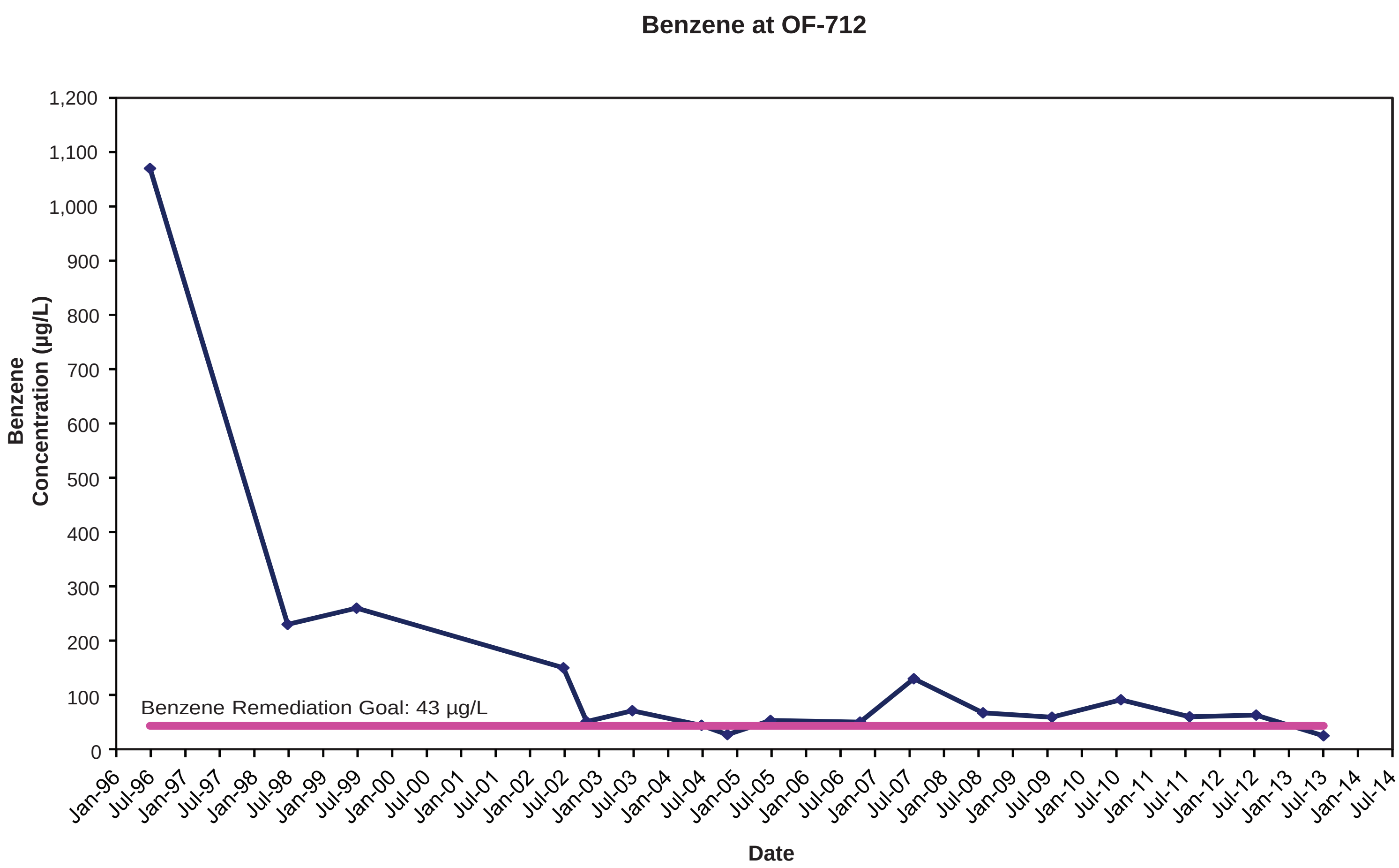
place to protect human health, they stated that they support remedy decisions that will allow unrestricted use of aquatic lands in the future. They also believed that OU 1 environmental monitoring has been sufficiently thorough, with the exception of the delayed marine tissue monitoring.

6.6.3 Tribal Representative

The Suquamish Tribe respondent believed that the covering and excavation of contaminated soils, shoreline stabilization measures, and removal of pilings components of the OU 1 remedy were effective components of the remedy. However, the tribe respondent did not feel the other remedy components, including excavation of petroleum-impacted soils in the NEX Gas Station Leak Area, LTM, and LUCs, have been effective in addressing contamination or in achieving the tribe's long-term goal of unrestricted use, including shellfish harvesting. The respondent stated that the OU 1 remedial action objective of reducing risks of subsistence-level ingestion to less than 1×10^{-5} excess cancer risk, or less than the noncancer HI of 1 has not yet been achieved.

Although, the tribe respondent agreed with the revised remedial actions taken at the OU 1 NEX Gas Station Leak Area, she felt the actions were long overdue. The respondent also had issues with the OU 3T JPHC remedy implementation. The tribe believes that if technical questions regarding the no find rate in the northern intertidal grids had been addressed in a timely manner, the process would have been more efficient and would have resulted in less overall disturbance of intertidal habitats.[4]

[4] The Navy agrees with the Suquamish Tribe. The Navy could not achieve concurrence with EPA Region 10 to resurvey the intertidal area to reduce the number of anomalies requiring excavation, which would have resulted in less disturbance of the intertidal area. The EPA position resulted in additional excavation and disturbance to the intertidal habitat.



U.S. NAVY	**Figure 6-1** **Benzene Trend at OF-712 during OU 1 Long-Term Monitoring**	JPHC/NHB THIRD FIVE-YEAR REVIEW

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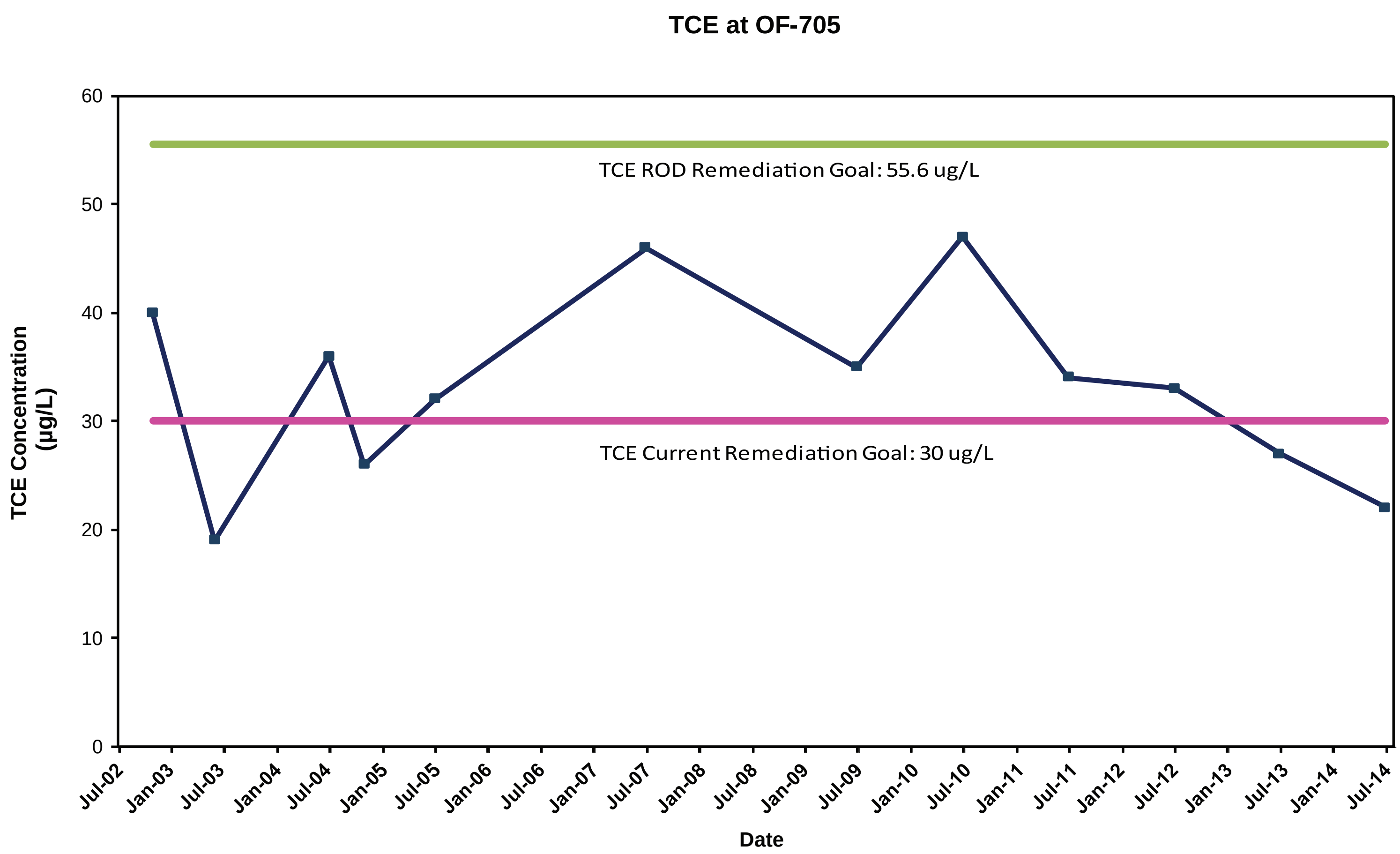

U.S. NAVY

Figure 6-2
TCE Trend at OF-705 during OU 1 Long-Term Monitoring

JPHC/NHB
THIRD
FIVE-YEAR REVIEW

Table 6-1
Four-Step Weight-of-Evidence Summary for HHRA Marine Tissue Analyte List Based on Meeting Handout Submitted to Stakeholders on June 18, 2012

Detected Marine Tissue Chemicals (BERA 2009)	Step 1: Do Concentrations Exceed Marine Tissue RBSL?	Step 2: Do Concentrations Exceed 2009 BERA Sediment Background[a]?	Step 3: Was the Chemical Selected as a COC for Marine Tissue Based on the RI/ROD Findings?	Step 4: Is the Chemical an Ongoing Source to the Marine Environment Based on LTM and 2009 BERA Sampling (Post-ROD Findings)?	Analyte Included?	Weight of Evidence Conclusions
Metals						
Arsenic	Yes	No	Yes	No	No	The chemical is at background in tissue, sediment, and seeps/outfalls.
Cadmium	Yes	Yes	No	NE	No	Not a site-related chemical. Not found to be above tissue background during 1996 HHRA.
Chromium	Yes	No	No	NE	No	Not a site-related chemical. Not found to be above tissue background in the 1996 HHRA. Chemical at background in 2009 BERA sediment data results.
Copper	Yes	Yes	No	No	No	Not a site-related chemical. Not found to be above tissue background in the 1996 HHRA. Low toxicity to humans compared to marine organisms, and SQS are not exceeded.
Lead	Yes	NE	No	No	No	No significant historical source based on limited soil contamination and low concentrations in seeps/outfalls. Not found to be above tissue background in the 1996 HHRA.
Mercury	Yes	Yes	No	No	No	Weight of evidence indicates the chemical is unlikely to be site-related based on the very limited detections in seep/outfall (only detected once above the RG), no defined source at JPHC, and the HHRA/RI findings of background levels in tissue, soil, and sediment.
Nickel	Yes	NE	No	No	No	The chemical is unlikely to be site-related based on only one exceedance found above the WQS of 8.2 µg/L in seep/outfall data and no known source at JPHC.
Selenium	Yes	Yes	No	NE	No	No site-related source.
Silver	Yes	NE	No	No	No	The chemical is unlikely to be site-related based on only one exceedance found above the WQS of 81 µg/L in seep/outfall data.
Zinc	Yes	Yes	No	NE	No	No site-related source. Not found to be above tissue background in the 1996 HHRA. Low toxicity to humans compared to marine organisms, and SQS are not exceeded.
Polycyclic Aromatic Hydrocarbons (PAHs)						
Acenaphthene	No	NE	NE	NE	No	Significant sources to the marine environment unlikely. No detections in seep/outfall data for cPAHs and infrequent low detections of total petroleum hydrocarbon as diesel. cPAHs detected in 2009 BERA sediment data, but mostly below SQS, indicating relatively low levels of contamination. Sediment concentrations likely reflective of regional sources because of the ubiquitous use of petroleum compounds.
Acenaphthylene	No	NE	NE	NE	No	
Anthracene	No	NE	NE	NE	No	
Benz(a)anthracene	Yes	NE	No	No	No	
Benzo(a)pyrene	Yes	NE	No	No	No	
Benzo(b)fluoranthene	Yes	NE	No	No	No	
Benzo(g,h,i,)perylene	No	NE	NE	NE	No	
Benzo(k)fluoranthene	Yes	NE	No	No	No	
Chrysene	No	NE	NE	NE	No	
Dibenzo(a,h)anthracene	Yes	NE	No	No	No	
Fluoranthene	No	NE	NE	NE	No	
Fluorene	No	NE	NE	NE	No	
Indeno(1,2,3-cd)pyrene	Yes	NE	No	No	No	
Phenanthrene	No	NE	NE	NE	No	
Pyrene	No	NE	NE	NE	No	
Semivolatile Organic Compounds (SVOCs)						
Benzoic acid	No	NE	NE	NE	No	Concentration does not exceed the marine tissue RBSL.
Diethyl phthalate	No	NE	NE	NE	No	

Table 6-1 (Continued)
Four-Step Weight-of-Evidence Summary for HHRA Marine Tissue Analyte List

Detected Marine Tissue Chemicals (BERA 2009)	Step 1: Do Concentrations Exceed Marine Tissue RBSL?	Step 2: Do Concentrations Exceed 2009 BERA Sediment Background[a]?	Step 3: Was the Chemical Selected as a COC Based RI/ROD Findings?	Step 4: Is the Chemical an Ongoing Source to the Marine Environment Based on LTM and 2009 BERA Sampling (Post-ROD Findings)?	Analyte Included?	Weight of Evidence Conclusions
Di-n-butyl phthalate	No	NE	NE	NE	No	
N-nitrosodiphenylamine	No	NE	NE	NE	No	
Pentachlorophenol	Yes	NE	Yes	No	No	No significant historical source. Only one detection in crab pre-ROD and no detection in other media. Pentachlorophenol has not been detected in shellfish tissue samples in post-ROD monitoring. 2009 BERA data results did not detect pentachlorophenol in sediment, and bent nose clams only species with tissue concentrations above a screening level.
PCBs						
Aroclor 1254	Yes	NE	No	No	No	Significant sources to the marine environment from JPHC were unlikely, based on very limited soil contamination and no detection in seep/outfall data during the RI.
Aroclor 1260	Yes	NE	No	No	No	
Pesticides						
4,4'-DDE	Yes	NE	No	NE	No	No site-related source. Never detected in seeps/outfalls during the RI. Sediment concentrations likely reflective of regional sources because of the ubiquitous historical use of dichlorodiphenyltrichloroethane (DDT) and its persistence in the environment.
4,4'-DDT	Yes	NE	No	NE	No	
Aldrin	Yes	NE	No	NE	No	No site-related source. Never detected in seeps/outfalls during the RI.
Ordnance Compounds[b]	NE	NE	NE	NE	NE	NE

[a]Lead, nickel, silver, and chemicals other than metals were not included in the BERA background evaluation.
[b]Stakeholders have agreed that ordnance compounds will be included in the marine tissue monitoring sampling program.

Notes:
BERA - Baseline Ecological Risk Assessment; data collected in 2009 and report finalized in 2011
COC - chemical of concern
cPAHs - carcinogenic aromatic hydrocarbons
HHRA - human health risk assessment
JPHC - Jackson Park Housing Complex
LTM - long-term monitoring
µg/L - microgram per liter
NE - not evaluated
RBSL - risk-based screening level
RI - remedial investigation
ROD - Record of Decision
SQS - Sediment Quality Standards
WQS - Water Quality Standards

Table 6-2
OU 1 Inspection and Maintenance Summary

Site	Field Inspection Site	Field Inspection Area	2009–2010	2010–2011	2011–2012	2012–2013	2013–2014
Site 101	Upland area	Southern shoreline cover area (Area A)	This inspection was performed as part of the playground area inspection (see Site 103, playground and soil cover areas below).	This inspection performed as part of the playground area inspection (see Site 103, playground area and soil cover area below)	A crack in the asphalt was observed traversing the walking trail south of Dowell Road cul-de-sac. Concrete patches in the asphalt pathway near Dowell Road show signs of minor cracking along the edges where the concrete is in contact with the asphalt. No repair was necessary; however, the patches will be monitored for changes in condition during future inspection events. The concrete split-rail fence is damaged. Several horizontal concrete rails with rebar reinforcement were broken in half. **Removal of unwanted and invasive vegetation was conducted during the spring and fall 2011.**	During the fall inspection event, an area of cracking of at least ⅛ inch in width caused by tree roots was observed along the asphalt pathway west of the pocket beach. Another area with two cracks was located south of the Dowell Road cul-de-sac. Additional cracking of the asphalt was observed northwest of the pocket beach. A crack in the asphalt with a failed tack seal and grass growth was observed traversing the walking trail approximately 200 feet south of the Dowell Road cul-de-sac toward the southern end of the cover area. Concrete patches in the asphalt pathway near Dowell Road had failed tack seals and cracking (at least ⅛ inch in width) along the edges where the concrete is in contact with the asphalt. **Removal of unwanted and invasive vegetation was conducted during the spring and fall 2012 maintenance events on the bank just north of the long pier (Pier 2).**	**All cracks identified in the previous 2012–2013 annual inspection report were repaired and require no further action.**
	Shoreline area	Seawall	Patch repairs along seawall were slowly failing; several patches fallen off. However, the structural integrity of seawall is not affected. Rock splash pads were mostly intact. **Minor rock movement was completed during the fall inspection to bolster some of the splash pads (part of routine maintenance).**	Same as previous year.	Patch repairs along seawall were failing; several patches had fallen off. Larger cracks above patches are continuing to form. The seawall appeared structurally sound; however, future repairs are necessary.	Same as previous year.	Same as previous year. Cracks are from ground level to the top of the seawall.
	Shoreline area	Central low rock shelf	The concrete split-rail fence has been damaged. Several horizontal concrete rails with rebar reinforcement have been broken in half. This fence separates the walking trail and planted area between the Dowell Road cul-de-sac and pier abutment. A previously	Same as previous year. Additional cracks were observed, including some found in spaces between the abandoned well and monument and the surrounding asphalt, within the NEX Gas Station (just south of the Dowell Road cul-de-sac).	No settling or erosion around stairs. However, several rocks were missing from area beneath the top rock steps of the stairway at the time of the fall inspection. **Damage was from human activity and was repaired during the winter inspection event.**	Found in good condition. **Displaced rocks on beach were returned to low rock shelf area.**	Found in satisfactory condition. **Displaced rocks on beach were returned to low rock shelf area.**

Table 6-2 (Continued)
OU 1 Inspection and Maintenance Summary

Site	Field Inspection Site	Field Inspection Area	2009–2010	2010–2011	2011–2012	2012–2013	2013–2014
			sealed crack in the asphalt was observed traversing the paved walking trail south of the Dowell Road cul-de-sac (the crack exceeded 1/8 inch in width). **Displaced rocks on beach were returned to low rock shelf area.**				
Site 101-A	Upland area	Root Court cul-de-sac (Area D)	Found to be in good condition.	Same as previous year.	Found in good condition.	Found in good condition.	Found in satisfactory condition.
	Upland area	Root Court and South Shore Road areas (Areas G and H)	No significant area of erosion or soil exposure.	Same as previous year.	Some distressed grass, a 2-cubic-foot hole was observed in the front of Housing Unit 91B. However, grass is growing in hole so no repair necessary.	Same as previous year.	Grass has filled hole so no repair necessary.
	Upland area	Construction debris landfill (Area F)	Exhibited ruts typical for the late fall and winter seasons. Overall, landfill was in good condition.	Same as previous year. **During fall 2010 inspections, straw remaining from erosion control during a project at the Benzene Release Area was spread in the muddy area near the landfill dumpster.**	Found in good condition.	Found in good condition.	Found in satisfactory condition.
	Shoreline area	Southern low rock shelf	The trees growing along the bluff of the southern beach assist in the stabilization of the slope above the beach and reduce stormwater runoff. Several of the trees have extensive ivy growth around their trunks, which may be detrimental to the health and growth of the trees. **Displaced rocks on beach were returned to low rock shelf area.**	One tree inaccessible to maintenance crew remains with ivy growth. **Displaced rocks on beach were returned to low rock shelf area. Ivy vines were severed during spring 2010 maintenance and were removed during fall 2010 maintenance.**	Found to be in good condition. **Displaced rocks on beach were returned to low rock shelf area.**	Same as previous year.	Same as previous year.
Site 103	Upland area at Elwood Point	Playground and soil cover areas (Area B)	Found to be in good condition. **The wood chips displaced under swings were raked back into place during the spring and fall maintenance events.**	Same as previous year.	During the fall 2011 inspection event, some minor cracking was observed in the asphalt pathway just southwest of the playground. **The wood chips displaced under swings were raked back into place during the spring and fall maintenance events**.	During the fall 2012 inspection event, some minor cracking was observed in the asphalt pathway just southwest of the playground, and a failed tack seal and minor cracking was observed in the asphalt pathway above the soil cover southwest of the playground. **The wood chips displaced under swings were raked back into place during the spring and fall maintenance events.**	**The failed tack seal and minor cracking were caulked.**

Table 6-2 (Continued)
OU 1 Inspection and Maintenance Summary

Site	Field Inspection Site	Field Inspection Area	2009–2010	2010–2011	2011–2012	2012–2013	2013–2014
	Upland area at Elwood Point	Northern shoreline cover area (Area C)	A few more recently exposed small areas of minor erosion due to the December 2007 storm even were observed near the helicopter pad. **Additional gravel was added during the fall 2009 maintenance event to prevent further erosion.**	Ruts up to 6 inches were observed deep in the grass.	Removal of unwanted and invasive vegetation was conducted during spring and fall maintenance events.	Same as previous year.	Visual evidence of minor surface disturbance and ruts observed above northern low rock shelf. Area was approved for vehicle movement and staging and will be restored upon completion of the OU 3T work. Ruts also observed at ball field (also to be restored during completion of OU 3T work).
	Shoreline area	Northern low rock shelf	The trees growing along the shoreline near the fishing pier assist in the stabilization of the soil and serve to reduce erosion from stormwater runoff and tidal action. One of the trees in this area has significant ivy growth on its trunk and branches, which has adversely affected its health. **Weed and blackberry removal was performed during summer and fall 2009 inspections. Displaced rocks on beach were returned to low rock shelf area.**	**Displaced rocks on beach were returned to low rock shelf area. Ivy vines were severed near base of tree in spring 2010 and then dead material was removed in fall 2010.**	**Displaced rocks on beach were returned to low rock shelf area.**	During winter inspection report a UXO investigation created a disturbance in the area. A follow-up inspection is required after completion of the investigation. **Displaced rocks on beach were returned to low rock shelf area.**	Surface disturbance was observed in area east of stairs. Rocks from the toe of the slope were removed and placed on top of armor. Although several rocks were disturbed, the remedy was not adversely affected. Vehicle movement from UXO investigation created shallow ruts and minor surface erosion. However, the minor disturbance does not affect the remedy. **Displaced rocks on beach were returned to low rock shelf area.**
	Shoreline area	Armor stone revetment	Minor soil erosion that occurred along the top of the revetment in the helicopter pad area was stemmed by the addition of gravel and mulch during previous maintenance events. **Additional gravel was placed near the helipad for minor erosion control during fall 2009.**	Vegetation is growing back, increasing soil stability. Several wooden railing slats on the wooden beach access stairway were no longer in place at the time of the inspections. **New mulch was placed during spring 2010 maintenance event in landscaped areas where mulch was thin.**	Found in good condition. **Displaced rocks were replaced on the revetment.**	Same as previous year. Visual evidence of ground disturbance from digging and removal of debris was observed in the intertidal area along the northern armor stone revetment due to UXO investigations.	Soil stability is increasing because of well established vegetation on slopes. **Displaced rocks were replaced and metal debris removed (during winter 2014 inspection event).**
	Shoreline area	Pocket beach	Use of undesignated pathways from bike path to pocket beach has lessened after placement of additional plants in fall 2009. No area of significant washout or deposition of fish mix was noted. **During fall 2009, pathways were weeded and crushed gravel added to encourage use. Rocks were removed from the pocket beach and placed back on low shelf.**	Use of undesignated pathways from bike path to pocket beach has lessened after placement of additional plants in fall 2010. No area of significant washout or deposition of fish mix was noted. **Additional mulch was applied to landscaped areas during spring 2010 maintenance event.**	During the fall and winter inspection events, numerous small, shallow holes and low sand mounds were observed. These holes were filling and the mounds leveled as a result of tidal/wave action and did not require repair. No area of washout or deposition of fish mix was noted. Numerous small, shallow holes and low sand mounds were observed in the fish mix area. These holes were filling and the	An area of cracking of at least 1/8 inch width was caused by tree roots observed along the asphalt pathway west of the pocket beach. No areas of washout or deposition of fish mix were noted. Numerous small, shallow holes and low sand mounds were observed in the fish mix area. These holes were filling and the mounds leveling as a result of tidal/wave action and did not require repair.	One path contains the OU 3T perimeter fence and will be addressed upon removal. Non-designated pathways have been created causing stress to nearby vegetation. No areas of washout or deposition of fish mix were noted. Numerous small, shallow holes and low sand mounds were observed in the fish mix area. These holes were filling and the mounds leveling as a result of tidal/wave action and did not require repair. **The pathways were better established during the fall 2013 maintenance event to**

Table 6-2 (Continued)
OU 1 Inspection and Maintenance Summary

Site	Field Inspection Site	Field Inspection Area	2009–2010	2010–2011	2011–2012	2012–2013	2013–2014
					mounds leveling as a result of tidal/wave action and did not require repair. **The pathways were weeded and the gravel raked during the spring and fall 2011 maintenance event to encourage use. One trail to the pocket beach was enhanced with wood chips/mulch during the spring maintenance event.**	**The pathways were weeded and the gravel raked during the spring and fall 2012 maintenance event to encourage use. One trail to the pocket beach was enhanced with wood chips/mulch during the spring maintenance event.**	**encourage use. Several failed seals and cracks were repaired and require no further action. The 1/8-inch-wide crack created by tree roots observed along the asphalt pathway west of the pocket beach was caulked and roots were cut back.**
Site 110	Upland area	Building 100 asphalt cover area (Area K)	Found to be in excellent condition. A small crack, approximately 0.25 inch wide by a foot long, was present in the sidewalk in front of Building 484 during the fall 2009 inspection.	Same as previous year.	Two small cracks approximately 0.25 inch wide by 6 to 8 inches long, were observed in the sidewalk in front of Building 484. These cracks do not appear to represent a threat to the integrity of the cover area. Some minor cracking was observed in the asphalt parking area. Some crack repair has been completed in the past, but minor cracking of the asphalt appears to continue.	Same as previous year.	Found to be in satisfactory condition. Crack in sidewalk remains, however, has not increased in size. **Previous cracks and failed seals were repaired.**
	Upland area	Building 101 asphalt cover area (Area J)	Found to be in excellent condition.	Found to be in excellent condition, except for minor ruts and minor erosion observed in the sloped lawn area during fall 2010 inspection. Do not affect the remedy.	Found to be in excellent condition.	Found to be in excellent condition.	Found to be in excellent condition.
All	Upland area	Storm event inspection	No storms occurred.	Storm occurred on Sunday, December 12, 2010 (4 inches of rain in a 24-hour period) causing storm runoff. However, no major erosion occurred, and, therefore, no repair or action was required.	Storm occurred between November 22 and 23, 2011 (3.4 inches of rain in a 24-hour period). However, no major erosion occurred, therefore, no repairs or actions were required.	Storm occurred on November 19, 2012 (1.86 inches in a 6-hour period) and November 30, 2012 (3.04 inches of rain in a 24-hour period). However, no major erosion occurred, and, therefore, no repair or action was required.	Storm occurred on September 24, 2013 (3.04 inches in a 24-hour period) and February 16, 2014 (1.6 inches of rain in a 6-hour period). However, major erosion occurred, and, therefore, no repair or action was required.
All	Upland area	Signage	All 16 replacement posts were intact and legible, as well as old shellfish harvest warning signs.	Same as previous year.	Same as previous year.	The sign and its post at the southern lower rock shelf were washed out due to tidal action. All other signs were intact and legible. **A new legible sign was placed on the nearby wooden post.**	All 16 replacement posts were intact and legible, as well as old shellfish harvest warning signs.

Table 6-2 (Continued)
OU 1 Inspection and Maintenance Summary

Site	Field Inspection Site	Field Inspection Area	2009–2010	2010–2011	2011–2012	2012–2013	2013–2014
All	Upland area	Shoreline vegetation[a]	Entire shoreline requires weeding.	**Minor trimming occurred, mulch was placed over bare and thinning landscaped areas, and extensive weeding occurred.**	Same as previous year.	Same as previous year.	Same as previous year.
All	Additional maintenance requests	Not applicable[b]	None.	None.	None.	None.	None.

[a]Maintenance includes trimming, removing unwanted vegetation from lawn areas, replacement planting, mulching, weed control, and watering.
[b]These areas were not inspected during the designated time frame.

Notes:
Bolded text indicates maintenance activities that occurred during inspections.
UXO - unexploded ordnance

Table 6-3
OU 3T JPHC Land Use Control Compliance Evaluation Summary

LUC Program	Year	Compliance Evaluation Finding	Recommended Action	Responsible Party	Time Frame
Excavation permitting	2013	NBK Instruction 11300.3 has been updated with the current procedures, but has not been finalized or signed.	Finalize and sign the updated NBK Instruction 11300.3.	NAVFAC NW Munitions Response Program Manager	3 months
		Compliance with the ROD requirement for enhanced explosive safety management and munitions recognition training is in progress, but not complete.	Finalize the list of people required to attend the enhanced training and conduct the first training class in June 2013 as planned. Maintain up-to-date tracking lists of people responsible for the excavation permitting program and people who have taken the enhanced training for comparison in future audits.		June 2013
		The most recent 5-year review report did not specifically describe monitoring of the LUCs required by the OU 3T JPHC ROD, because the report predated the ROD.	Include review of the LUCs required by the OU 3T JPHC ROD in the next 5-year review report, tentatively scheduled for 2015.		2015 5-year review
	2014	Two permits (20%) from FY 2014, two (7%) from FY 2013, and four (40%) from FY 2012 did not include signed affidavits confirming that contractors viewed the *Jackson Park Munitions Precautions Briefing* DVD. Two permits from FY 2013 (7%) and three from FY 2012 (30%) were not retained for 3 years confirming proper approvals and utility locations.	Ensure all contractors watch and sign the affidavit to confirm viewing the *Jackson Park Munitions Precautions Briefing* DVD. Maintain signed excavation permits and signed affidavits for 3 years following completion of ground-disturbing activities as part of the LUC audit reports.	Public Works Department and NAVFAC NW Munitions Response Program Manager	3 months

Table 6-3 (Continued)
OU 3T JPHC Land Use Control Compliance Evaluation Summary

LUC Program	Year	Compliance Evaluation Finding	Recommended Action	Responsible Party	Time Frame
		Compliance with the ROD requirement for enhanced explosive safety management and munitions recognition training is partially complete, but a list of people required to take the training has not been finalized.	Develop the list of Navy positions required to attend the enhanced training and include in the audit checklist. Maintain up-to-date tracking lists of people responsible for the excavation permitting program and continue to maintain up-to-date tracking lists of people who have taken the enhanced training for comparison in future audits.	NAVFAC NW Munitions Response Program Manager	3 months
Resident education and awareness training	2013	Approximately 87% of current housing application packages on file at the Forest City office contain the signed affidavit verifying viewing of the *Jackson Park Munitions Precautions Briefing* DVD.	Require all prospective residents to watch the *Jackson Park Munitions Precautions Briefing* DVD and sign the affidavit. Do not process the housing applications without the signed affidavit.	NBK Bangor Housing Service Center	6 months
		None of the housing application packages on file at the Forest City office contains more than one signed affidavit, suggesting that only one adult in each household has watched the *Jackson Park Munitions Precautions Briefing* DVD.	Develop a procedure to ensure that all adults in each household watch the Jackson *Park Munitions Precautions Briefing* DVD and sign the affidavit. Continue providing other forms of munitions education and awareness training, such as pamphlets and posters.		6 months
	2014	Only five of the housing application packages on file at the Forest City office contains more than one signed affidavit, suggesting that only one adult in the majority of households had watched the *Jackson Park Munitions Precautions Briefing* DVD, even though the rent roll showed that the majority of the residents were married.	Change resident affidavit to state "I have seen or read this brief and watched this brief with my family on the internet at http://www.youtube.com/watch?v=1hmr6dPMwyo. My family and I understand our responsibilities in regards to the educational and awareness program information on the munitions or explosives of concern education and awareness program. I fully understand my responsibilities should I or any of my dependents or guests encounter any possible explosively	NAVFAC NW Munitions Response Program Manager	6 months

Table 6-3 (Continued)
OU 3T JPHC Land Use Control Compliance Evaluation Summary

LUC Program	Year	Compliance Evaluation Finding	Recommended Action	Responsible Party	Time Frame
			hazardous discarded military munitions. I will report any munitions or explosives of concern to emergency response '911' telephone notification system immediately upon discovery." Add a section to the resident affidavit listing all household members and person signing names. Provide a copy of the revised affidavit to Forest City and post on the website with the Jackson Park Munitions Public Service Announcement (which is identical to the *Jackson Park Munitions Precautions Briefing* DVD available for viewing at Forest City's leasing office).		
		Approximately 87% of former resident housing application packages were kept on file at the housing service centers for 3 years following termination of residency.	Store housing files electronically, organized by move-out date, and do not delete files for 3 years following the end of a fiscal year. In addition to current resident affidavits, include in each annual audit report all of the affidavits for those who have moved out over the previous year to ensure that this information is maintained as a part of the site file.	NBK Bangor Housing Service Center, Forest City, and NAVFAC NW Munitions Response Program Manager	6 months
		Following completion of the audit, the auditors noticed that the occupancy reports provided by the NBK Housing Service Center did not include all of the residents that had moved out over the last 3 years and were therefore not complete.	When performing the audit of the residents that have moved out over the last 3 years, ensure that the resident move-out list is complete (request the monthly vacate list from NBK Housing Service Center for the period of interest and not the occupancy reports, which are not complete).	NAVFAC NW Munitions Response Program Manager	1 year

Table 6-3 (Continued)
OU 3T JPHC Land Use Control Compliance Evaluation Summary

LUC Program	Year	Compliance Evaluation Finding	Recommended Action	Responsible Party	Time Frame
Shellfish harvesting education and awareness training	2013	Compliance with this ROD requirement is in progress, but not complete. The Navy has not coordinated with the Suquamish Tribe to develop shellfish harvester training since submittal of the LUC Management Plan, which initiated the process for working with the tribe to develop awareness training.	Follow up with the tribe to develop shellfish harvester training, using the *Jackson Park Munitions Precautions Briefing* DVD for reference.	NAVFAC NW Munitions Response Program Manager	Prior to lifting of Health District advisories
	2014	Compliance with this ROD requirement is in progress, but not complete. The Navy has not coordinated with the Suquamish Tribe to develop shellfish harvester training since submittal of the LUC Management Plan, which initiated the process for working with the tribe to develop awareness training.	Add the following audit question to the audit checklist for shellfish harvesting education and awareness training program: "Has the Navy sent a letter to the Tribe, WDFW, and WDNR asking whether the informational advisory should be updated or discontinued?" This audit question should be added to the checklist under "Audit Questions Applicable After Health District Shellfish Harvesting Advisories Are Lifted and Anomaly Removal Is Complete." Follow up with the tribe to develop shellfish harvester training, using the *Jackson Park Munitions Precautions Briefing* DVD for reference.		The first recommended action will be implemented with next update of the LUC Management Plan and the second will be implemented prior to lifting of Health District advisories.

Table 6-3 (Continued)
OU 3T JPHC Land Use Control Compliance Evaluation Summary

LUC Program	Year	Compliance Evaluation Finding	Recommended Action	Responsible Party	Time Frame
LUC monitoring and reporting procedures	2013	No institutional controls monitoring report for the OU 3T JPHC ROD requirements was completed in 2012 because of disputes raised by the U.S. Environmental Protection Agency during development of the LUC Management Plan.	Prepare an institutional controls monitoring report in 2013 to monitor and report implementation of the ROD-required LUCs.	NAVFAC NW Munitions Response Program Manager or a designated individual	2013 annual report
		The most recent 5-year review report did not specifically describe monitoring of the LUCs required by the OU 3T ROD, because the report predated the ROD.	Include review of the LUCs required by the OU 3T JPHC ROD in the next 5-year review report, tentatively scheduled for 2015.	NAVFAC NW Munitions Response Program Manager	2015 5-year review
	2014	None			

Notes:
Forest City - Forest City Residential Management
FY - fiscal year
JPHC - Jackson Park Housing Complex
LUC - Land Use Control
NAVFAC NW - Naval Facilities Engineering Command Northwest
NBK - Naval Base Kitsap
OU - operable unit
ROD - Record of Decision
T - Terrestrial
WDFW - Washington Department of Fish and Wildlife
WDNR - Washington Department of Natural Resources

7.0 TECHNICAL ASSESSMENT AND IDENTIFICATION OF ISSUES

This section presents the details of the functionality of the remedies, the continued validity of ROD assumptions, any new information that has arisen that could affect the protectiveness of the remedy, and a technical assessment summary for the OU 1 shoreline (Sites 101, 101-A, and 103), OU 1 upland soil areas (Sites 101, 101-A, 103, and 110), OU 1 groundwater remedy (Site 110), OU 1 NEX Gas Station Leak Area, OU 3T JPHC, and OU 3T NHB. This section also summarizes the issues identified during this 5-year review process.

This section answers three questions:

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

Based on the answers to the questions discussed in this section, a technical assessment of the remedies is summarized in Table 7-1. This table provides a quick reference to question A, B, and C answers by OU and site, or combination of sites where grouped for easier analysis. A discussion of the answers to the three questions (A, B, and C) and the technical assessment summary are presented in order under each OU and site (or combination of sites) in the sections below. Note that in the sections below, the questions and the answers to these questions are highlighted in green if the remedy is functioning as intended, the cleanup levels or RAOs are still valid, or there is no new information that could call into question the protectiveness of the remedy. Yellow highlighting is used if the information reviewed calls into question the protectiveness of the remedy.

In answering Question B, any change to ARARs used to establish RGs in the ROD and any change to risk assessment assumptions (exposure and toxicity) are reviewed to evaluate the protectiveness of the remedy. In the preamble to the NCP, EPA stated 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 (USEPA 2001) indicates that the question of interest in developing the 5-year review is not whether a standard identified as an ARAR in the ROD has changed in the intervening period, but whether this 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 standard and the new standard 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}. If the old standard is not considered protective, a new cleanup standard may need to be adopted after the 5-year review through CERCLA's processes for modifying a remedy.

RGs were established for soil, groundwater, and surface water. During the first and second 5-year reviews for JPHC/NHB, ARARs were reviewed to assess whether any substantive changes were made to ARARs that would call into question the protectiveness of the remedy and the RGs established in the ROD. For this 5-year review, all the ARARs identified in the ROD were again reviewed for changes that could affect the assessment of whether the remedy is protective. Based on this review, it was concluded that three of the regulations listed as ARARs have changed, as follows:

- Washington State MTCA regulations
- Federal marine AWQC
- Washington State marine AWQC

In addition to establishing risk-based cleanup levels, MTCA also allows for use of background or the laboratory PQL as a cleanup level when the MTCA cleanup level is lower than these values. Based on new analytical techniques, laboratories now are able to readily achieve lower PQLs for some COCs. When cleanup levels are established as PQLs and the PQLs decrease with improved technology, the 5-year-review process does not typically recommend revising the cleanup levels during every 5-year review. Instead, the 5-year review includes an assessment of whether the latest PQLs are being used for monitoring and decision making.

7.1 OU 1 SHORELINE (SITES 101, 101-A, AND 103)

7.1.1 Functionality of Remedy for the Shoreline (Sites 101, 101-A, and 103)

Is the remedy functioning as intended by the decision document? Yes, the remedy for the shoreline is functioning as designed and progress is being made towards meeting the RAOs.

Three of the RAOs for these sites were related to protection of the marine environment:

- Reduce the potential for erosion and transport of chemicals in soil to the marine environment.

- Protect ecological receptors in the marine environment and human health by attaining compliance with water quality standards for marine surface water at the point of groundwater discharge.

- For shellfish from Ostrich Bay, reduce risks from subsistence-level ingestion to less than 1 x 10^{-5} excess carcinogenic risk and less than a noncarcinogenic HI of 1.

Shoreline remedial actions included shoreline stabilization, monitoring of seeps and outfalls, and monitoring of shellfish tissue in Ostrich Bay.

Shoreline Stabilization

The shoreline stabilization along Ostrich Bay from Sites 101-A to 103 was constructed to prevent the erosion of impacted soil in order that soil contaminants would not enter the marine environment. In addition, impacted soil remaining in the shoreline areas of Sites 101 and 103 was covered and vegetated to further prevent the movement of contaminants into the bay.

The shoreline stabilization efforts appear to be working effectively to prevent erosion and transport of soil to the marine environment, based on observations made during the 5-year review site inspection, the reports of interviewees, and the results of the annual inspection reports. However, during the 5-year review site inspection and the annual inspection and maintenance activities, seawall patch repairs were observed to be failing, although it was noted that the seawall is structurally sound and the remedy is still protective of human health and the environment. Therefore, continued effectiveness requires ongoing inspection and maintenance.

The appropriate programs and activities are in place and are fulfilling inspection and maintenance requirements. The required LUCs are formalized in a LUC Plan (U.S. Navy 2005d), which is currently being revised (U.S. Navy 2015b). Institutional controls inspections are being performed and documented yearly, and documentation is available. The site inspections for this 5-year review indicate that the required LUCs have been maintained since signing the ROD and that the institutional controls component of the remedy is functional.

Seep and Outfall Monitoring

To assess whether the remedy is protecting ecological receptors in the marine environment and human health by attaining compliance with water quality standards for marine surface water at the point of groundwater discharge, ongoing monitoring of the seeps and outfalls along the shoreline has been performed as specified in the ROD. There have been few exceedances of the water quality RGs specified in the ROD, with the exception of benzene related to the NEX Gas Station Leak Area. Benzene exceeded its RG at outfall OF-712 in 2010, 2011, and 2012, and was below the RG in 2013 and 2014. The RG for benzene in the seeps and outfalls is 43 µg/L, in accordance with the OU 1 ROD. The change in the benzene RG, specified in OU 1 ROD Amendment No. 1, is not applicable to the seeps and outfalls, as discussed in Section 4.1.5. There have also been sporadic exceedances of the cyanide RG at various seeps and outfalls at Sites 101 and 103. However, the detection limits for cyanide were consistently an order of magnitude higher than the

RG. These results suggest that the soil removal and covering efforts that have occurred at the site over the last several years are effective in minimizing chemical concentrations entering the marine environment from groundwater.

Shellfish Monitoring

To assess whether the remedy is reducing risks from subsistence-level ingestion of shellfish from Ostrich Bay to less than 1 x 10^{-5} excess carcinogenic risk and less than a noncarcinogenic HI of 1, shellfish monitoring is conducted once every 5 years. Shellfish monitoring was last conducted in May 2009. As discussed in Sections 4.1.1 and 6.4.1, the marine tissue sampling was not performed until August 2014, after this 5-year review period, because of delays in finalizing the work plan. Despite this delay, progress is being made to assess the risks from subsistence-level ingestion of shellfish. Work on the shellfish investigation report and associated HHRA is currently being performed. These reports are scheduled to be completed in October 2015. An addendum to this 5-year review will be completed following completion of these reports and the additional actions described in Section 9.1.

The pilings offshore of Sites 101 and 103 were thought to be a potential source of 3,3'-dichlorobenzidine and PCP, and these COCs were a potential concern in shellfish. The pilings have been removed, and 3,3'-dichlorobenzidine and PCP have not been detected in shellfish (see Table 6-7 in the second 5-year review included in Appendix A). While the source of those two SVOCs is not definitively known, the remedy of pilings removal may have functioned as intended and removed the source for those two compounds. Therefore, 3,3'-dichlorobenzidine and PCP, as well as antimony and vanadium, were dropped from the analyte list during this review period as recommended in the second 5-year review.

Signs have been posted at regular intervals along Ostrich Bay to warn that shellfish harvesting is not allowed in the area. As observed during 5-year review site inspection and the annual inspection and maintenance activities, signs are in good condition and legible.

7.1.2 Continued Validity of ROD Assumptions

Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection still valid? Yes, the ARARs, exposure assumptions, toxicity data, and RAOs for the OU 1 shoreline are still valid and protective of human health and the environment. Changes to the ARARs used to establish RGs in the ROD and the risk assessment assumptions (exposure and toxicity) are evaluated below.

Review of ARARs

The point of compliance for groundwater at these sites was established to be the point where groundwater enters the marine environment. As such, the RGs are based on AWQC protective of human and ecological receptors in the marine environment. Therefore, COCs for groundwater at Sites 101, 101-A, and 103 were identified based on exceedances of AWQC at the point of compliance (seeps and outfalls) at the time of the ROD. These COCs include arsenic, mercury, nickel, silver, benzene, 1,1-DCE, TCE, and vinyl chloride (see Table 4-2). Although not detected at the seeps and outfalls at the time of the ROD, additional chemicals were detected in upland wells at Sites 101, 101-A, and 103 at concentrations exceeding AWQC and are included as COCs for these sites. These COCs include beryllium, copper, cyanide, lead, thallium, zinc, chlordane, and TPH (see Table 4-2). Monitoring of seeps and outfalls included these additional chemicals to ensure that they are not migrating to the marine environment at concentrations greater than AWQC. The ARAR changes for COCs detected in seeps and outfalls are shown on Table 7-2, while the ARAR changes for COCs detected in the upland wells are shown on Table 7-3.

The ARARs for the protection of surface water have changed for many of the COCs in groundwater as shown on Tables 7-2 and 7-3. However, most of the changes resulted in higher values (i.e., the ROD values are more protective, based on the current ARAR). For those chemicals with lower ARARs, none of the changes affects the protectiveness of the remedy. For the COCs detected in seeps and outfalls at the time of the ROD, benzene and TCE would have lower RGs today because of changes in toxicity. These changes and the impacts on protectiveness are discussed further below in the review of risk assessment assumptions.

Copper and zinc RGs were set at background levels in the OU 1 ROD (58 µg/L and 104 µg/L, respectively). However, the ROD required that the background levels used in the ROD be confirmed by performing a background study (U.S. Navy 2001). The background study determined that the background concentrations of these two chemicals were significantly lower than the background concentrations in the OU 1 ROD, and less than the Washington State marine AWQS values applicable at the time of the background study. Therefore, the RGs defaulted to the AWQS values following completion of the background study (2.5 µg/L and 76.6 µg/L, respectively). The last 5-year review recommended that the RGs for copper and zinc be revised to the current Washington State AWQS (4.8 µg/L and 81 µg/L, respectively). There have been no changes to these AWQS values during this 5-year review period. Copper and zinc have not been detected at concentrations above any of these RGs. Currently, total and dissolved metals are only being monitored at location OF-705.

The second 5-year review found that a lower ARAR had been promulgated for chlordane, which would result in lower RGs. Because chlordane has never been detected in the seeps and outfalls, the RG for chlordane was not revised. Currently, chlordane is no longer being monitored.

During this 5-year review period, the MTCA Method B value for thallium was lowered from 1.56 to 0.216 µg /L. However, thallium concentrations have never been detected above the existing RG, and with the exception of one concentration, all thallium concentrations were also below the current MTCA value.

Prior to the last 5-year review, the RG for mercury was adjusted from the ROD level of 0.025 to 0.1 µg/L based on the PQL (U.S. Navy 2001). In the last 5-year review, it was recommended that the RG for mercury, which was based on the PQL of 0.1 µg /L, be lowered to the original ROD RG of 0.025 µg/L. This recommendation was made because lower mercury PQLs could be achieved by laboratories, and mercury concentrations were likely below the original ROD RG of 0.025 µg/L, based on the monitoring results. However, because of low detections and no detections above the RG, mercury was eliminated from monitoring, except at location OF-705, and the RG was not adjusted to the original ROD RG of 0.025 µg/L during the last 5-year review period. Since mercury was detected at the seeps at Site 101-A at concentrations above the original ROD RG during the focused Phase II SI, it is again recommended that the RG for mercury be lowered to the original ROD RG.

Review of Risk Assessment Assumptions—Toxicity

As part of the RG selection process in the ROD, a MTCA Method B value protective of surface water exposures was selected as the RG for groundwater if there was no background value and if the Method B value was the most stringent ARAR (see Tables 7-2 and 7-3). If Method B values were to be calculated now, revisions to the toxicity criteria for five chemicals would result in different MTCA Method B values than those presented in the ROD. Three of the COCs would have higher cleanup levels if established today (beryllium, 1,1-DCE, and vinyl chloride) and two (benzene and TCE) would have lower cleanup levels. Therefore, MTCA Method B values were recalculated using current toxicity values and compared to the ROD RGs. The results of the recalculation and the specific toxicity changes are presented in Table 7-4 and are discussed below.

Beryllium: EPA's Integrated Risk Information System (IRIS) does not currently report an oral carcinogenic toxicity value (slope factor) for beryllium and considers the data inadequate to evaluate carcinogenicity by ingestion (USEPA 2009). The previous study that the EPA used to estimate the oral slope factor used to calculate the MTCA Method B value in the ROD (4.3 mg/kg-d^{-1}) is now considered by EPA to be inadequate for the assessment of carcinogenicity (USEPA 2009). EPA concluded that beryllium cannot be evaluated as a carcinogen by the oral route (ingestion) and, therefore, should be evaluated as a noncarcinogen for the purposes of the MTCA Method B calculation. Because MTCA Method B surface water values are protective of an ingestion pathway (eating fish), the oral pathway is the pathway of concern. If the current oral reference dose (0.002 [mg/kg-d]$^{-1}$) is used to calculate the MTCA Method B value, the new value would be 273 µg/L (based on surface water protection). This change does not affect the protectiveness of the remedy, because the RG is considerably lower than the new MTCA Method B value. In addition, because beryllium has been detected infrequently and for the most part below the RG, monitoring has been discontinued at all locations except OF-705. In recent samples collected from outfall location OF-705, beryllium has not been detected at or below the RG (Appendix B Table B-5).

Benzene: At the time of the ROD, the oral slope factor for benzene was not available on IRIS. Therefore, the inhalation slope factor (0.029 [mg/kg-d]$^{-1}$) was used to calculate a MTCA Method B value. Currently, IRIS reports an oral slope factor of 0.055 (mg/kg-d)$^{-1}$. Because MTCA Method B surface water values are protective of an ingestion pathway (eating fish impacted by the chemical), the oral slope factor should be used for the MTCA Method B surface water calculations. Ecology is now using the oral slope factor in the benzene surface water calculation (<http://www.ecy.wa.gov/programs/tcp/tools/CLARC_v_3.1>). Using the current oral slope factor to calculate the MTCA Method B value results in an ARAR change from 43 to 22.7 μg/L. Using the new slope factor, the cancer risk of the RG of 43 μg/L is 2 x 10^{-6}, below the ROD cancer risk goal of 1 x 10^{-5}. Because the ROD cancer goal is still being met, the remedy designed to achieve the RG is protective, and no RG change is recommended. The most recent benzene concentration of 21 μg/L (sampled in July 2014) is below the current MTCA Method B value of 22.7 μg/L (Table B-2), however benzene should be monitored until concentrations are consistently below the current MTCA Method B value.

1,1-DCE: Today's RG would be higher than the ROD value because EPA has withdrawn the cancer slope factor for this chemical and no longer considers it a potential carcinogen. If a MTCA Method B surface water value were calculated now, it would be based on noncancer toxicity and would be higher than the RG selected in the ROD. The former MTCA Method B calculated value was 1.93 μg/L, and the current value is 23,100 μg/L. The new ARAR value for the surface water pathway is therefore less stringent, and there is no impact on the protectiveness of the remedy. Because this chemical has not been detected in the last 10 years (Appendix B Table B-1), monitoring for 1,1-DCE should be discontinued.

TCE: The ROD cleanup value for the surface water pathway is based on the MTCA Method B value available at the time the ROD was prepared. The former MTCA Method B calculated value was 56 μg/L, and the current value listed in Ecology's CLARC database is 12.8 μg/L. However, MTCA requires cleanup levels to comply with ARARs, which for TCE are the federal and state water quality criteria. The federal and state water quality criteria factor in the survivability of organisms, the risk to humans from fish/shellfish consumption, and the use of the surface body as a beneficial drinking water source. The surface water at JPHC/NHB is not used as drinking water. Therefore, the more appropriate criteria for TCE is 30 μg/L (WDOE 2012). The new ARAR value of 30 μg/L for the surface water pathway is lower than the ROD RG and therefore more stringent. The current MTCA B surface water cleanup level of 12.8 μg/L for TCE is calculated with the cancer slope factor of 4.64 x 10^{-2}, which is a sum of three slope factors (with no early life exposure adjustment). Using this oral slope factor of 4.64 x 10^{-2} to recalculate the health risk of exposure to TCE via the surface water pathway at the seeps and outfalls, the current ARAR (56 μg/L) represents a health risk of 4.3 x 10^{-6}, which is below the ROD goal of 1 x 10^{-5}. Risks calculated using the higher ARAR value of 30 μg/L would be lower. Therefore, the protectiveness of the remedy is not currently affected. Concentrations of TCE in surface water at the seeps and outfalls do not exceed the latest MTCA Method B value of 30 μg/L (see

Appendix B Table B-1), except at location OF-705. (Note that current concentrations of TCE sampled in 2013 and 2014 are lower than 30 µg/L.) Prior to discontinuation of monitoring, the RG should be reviewed to assess protectiveness.

Vinyl Chloride: The oral slope factor for vinyl chloride, as reported in IRIS (USEPA 2009), has changed from 1.9 to 1.5 $(mg/kg\text{-}d)^{-1}$. If the current oral slope factor is used to calculate the MTCA Method B value, a slightly higher cleanup level would be calculated, changing it from 2.92 to 3.69 µg/L. This change would not impact the protectiveness of the remedy. Vinyl chloride has not been detected in the last 5 years (Appendix B Table B-1), and monitoring for this chemical should be discontinued.

Review of Risk Assessment Assumptions—Exposure Assumptions

The exposure parameters used in the original baseline HHRA for subsistence and recreational harvesters of shellfish were a combination of EPA default parameters and parameters obtained from peer-reviewed literature. With regard to subsistence exposures, subsequent to the original risk assessment, the Suquamish Tribe conducted a study on tribal-specific fish ingestion rates (Suquamish Tribe 2000), and the regional EPA office published new guidance on fish ingestion risk assessments for EPA Region 10 (USEPA 2007). The Suquamish Tribe has “usual and accustomed” fishing rights in Ostrich Bay, and, therefore, Suquamish information is most applicable to subsistence harvesters in this area. The 2010 HHRA incorporated the 2009 tissue data, Suquamish ingestion rates, the latest EPA guidance available at the time, and evaluated risks using the same exposure parameters as were used in the original baseline HHRA (Suquamish subsistence and “RI” subsistence populations). An HHRA will be completed in 2015, incorporating the 2014 marine tissue data results. The HHRA will be prepared in accordance with current EPA guidelines for HHRAs (USEPA 1989, 1991, 1997, 1998, and 2000). Ingestion rates and exposure factor defaults from EPA’s framework document (USEPA 2007) and other EPA sources (USEPA 1989 and 1991) are proposed in the current work plan, which will be finalized in consultation with the Suquamish Tribe and EPA.

7.1.3 New Information

Has any other information come to light that could call into question the protectiveness of the remedy? Yes, new information reviewed during this 5-year review does call into question the protectiveness of the remedy.

As described in section 6.4.3, a Phase I ESA and focused Phase II SI were performed within the OU 1 JPHC/NHB site. Issues related to the protectiveness of the shoreline remedy identified during the review of this data include:

- Cyanide was detected in groundwater at Site 101-A in the vicinity of Building 100 at concentrations greater than the OU 1 ROD RG.

- Reporting limits for cyanide in seep and outfall samples collected from all sampling locations during LTM have consistently been greater than the ROD RG, and greater than the current PQL for cyanide.

- Mercury was detected in seep water to the west of Root Court along the shoreline at concentrations greater than the OU 1 ROD RG.

- The reporting limits for mercury in seep and outfall samples during LTM have frequently been greater than the current ROD RG (0.1 µg/L) and fairly consistently above the original ROD RG (0.025 µg/L), which is the current PQL.

- The current ROD RG for mercury is above the current PQL.

7.1.4 Technical Assessment Summary

The remedy for the shoreline areas is functioning as designed. The ARARs, exposure assumptions, toxicity data, and RAOs are still valid and protective of human health and the environment. However, new data reviewed during this 5-year review period does call into question the protectiveness of the remedy. In particular, new groundwater and seep data at Site 101-A indicate that concentrations of contaminants in these media are above ROD RGs. To address these issues, cyanide monitoring should be continued at Site 101-A using the best analytical method for achieving the current PQL, and mercury monitoring should be restarted at Site 101-A using the best analytical method for achieving the original ROD RG.

7.2 OU 1 UPLAND SOIL AREAS (SITES 101, 101-A, 103, AND 110)

7.2.1 Functionality of Remedy for Upland Soil Areas (Sites 101, 101-A, 103, and 110)

Is the remedy functioning as intended by the decision document? Yes, the remedy for the upland soil areas is functioning as designed.

The RAO for the upland soil areas of OU 1 is the following: Prevent dermal contact with or ingestion of soil containing concentrations of COCs above state cleanup levels.

The soil RAO for OU 1 has been achieved by removing surface soil containing COCs above cleanup levels and covering the subsurface soil containing COCs above cleanup levels. A restriction was placed on land use at Site 103 to prevent residential development, and for the areas of JPHC/NHB where subsurface COCs remain above cleanup levels, institutional controls are in place that would prevent uncontrolled digging or disturbance of those areas. During the 5-year review site inspection and the annual inspection and maintenance activities, minor cracking has been observed in asphalt paving in front of Bunkers 100 and 101, as well as in the walking paths along the shoreline. Furthermore, regular weeding, placement of gravel on gravel paths and along the armor stone revetment, replacement of wood chips and mulch in planted areas along the shoreline and beneath the play structure have been required. Therefore, continued effectiveness requires ongoing inspection and maintenance.

The appropriate programs and activities are in place and fulfilling inspection and maintenance requirements. The required LUCs are formalized in a LUC Plan (U.S. Navy 2005d), which is currently being revised (U.S. Navy 2015b). Institutional controls inspections are being performed and documented yearly, and documentation is available. The site inspections for this 5 year review indicate that the required LUCs have been maintained since signing the ROD and that the institutional controls component of the remedy is functional.

7.2.2 Continued Validity of ROD Assumptions

Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection still valid? Yes, the ARARs, exposure assumptions, toxicity data, and RAOs are still valid and protective of human health and the environment. Changes to the ARARs used to establish RGs in the ROD are discussed below. There were no changes to the risk assessment assumptions (exposure and toxicity).

The RGs established for soil are shown on Table 7-5. RGs were based on MTCA Method B or background for residential soils at Sites 101, 101-A, and 110 and on MTCA Method C for industrial soils at Site 103. As shown on Table 7-5, if RGs were established today, they would be the same or higher than those established at the time of the ROD.

Under the November 2007 revision of MTCA (Washington Administrative Code 173-340-708[8][e]), determining compliance with cleanup levels for mixtures of cPAH compounds is now done by calculating a benzo(a)pyrene “equivalent” value for each sample. This toxic equivalent concentration is derived by adjusting the concentrations of the seven cPAHs based on their toxicity compared to benzo(a)pyrene. The sum of the adjusted concentrations is then calculated and compared to the RG. The new compound-specific cleanup levels would be the same (Sites 101, 101-A, 103, and 110) or higher (Site 103) than the RGs established in the ROD, and the new method of evaluating cPAHs does not call into question the protectiveness of the remedy.

7.2.3 New Information

Has any other information come to light that could call into question the protectiveness of the remedy?” Yes, new information reviewed during this 5-year review does call into question the protectiveness of the remedy.

As described in Section 6.4.3, a Phase I ESA and focused Phase II SI were performed within the OU 1 JPHC/NHB site. Issues related to the protectiveness of the shoreline remedy identified during the review of these data include the following:

- One area where concentrations of TPH as creosote in deep soil (greater than 3 feet bgs) exceed the focused Phase II SI screening criteria (no OU 1 ROD RGs are established for the detected chemicals), and this area is not identified in the LUC Management Plan (U.S. Navy 2015b). This area is located in the vicinity of former UST-2 and UST-2A near the north end of Root Court.

- One area where concentrations of TPH as creosote, diesel, and oil and cPAH in deep soil (greater than 3 feet bgs) exceed the focused Phase II SI screening criteria at the south end of Root Court, and this area is not identified in the LUC Management Plan (U.S. Navy 2015b). No RGs were established for these TPH compounds in the OU 1 ROD. However, the cPAH concentration exceeds the ROD RG.

- One soil cover area (street waste disposal area) where concentrations of TPH-G in deep soil (greater than 3 feet bgs) exceed the focused Phase II SI screening criteria, but not the ROD RG, and this soil cover area is not identified in the LUC Management Plan (U.S. Navy 2015b).

- One area in the vicinity of NE Rankin Road where the concentration of cPAH in shallow soil (less than 3 feet bgs) exceeds the ROD RG, and the extent of the soil exceeding the ROD RG is not known. This area is not identified in the LUC Management Plan (U.S. Navy 2015b). This area of shallow soil contamination may represent a risk to human health and the environment.

- Multiple areas in the vicinity of the bunkers where concentrations of cPAH and arsenic in shallow soil samples (less than 3 feet bgs) exceed the ROD RGs, and the extent of soil exceeding ROD RGs is not known. These areas are not identified in the LUC Management Plan (U.S. Navy 2015b). Furthermore, these areas of shallow soil contamination may represent a risk to human health and the environment.

7.2.4 Technical Assessment Summary

The remedy for the upland soil areas is functioning as designed. The ARARs, exposure assumptions, toxicity data, and RAOs are still valid and protective of human health and the environment. However, new data reviewed during this 5-year-review period does call into question the protectiveness of the remedy. In particular, new soil data indicates areas of OU 1 with concentrations of contaminants in both shallow and deep soil above ROD RGs and/or focused Phase II SI screening criteria (where no OU ROD RG was established) that are not currently included in the LUC Management Plan. The extent of contamination exceeding ROD RGs in the vicinity of NE Rankin Road and the bunkers is not known. Furthermore, areas with shallow soil contamination may represent a risk to human health and the environment. To address these issues, the LUC Management Plan should be revised, the extent of ROD RG exceedances in the vicinity of NE Rankin Road and the bunkers delineated, and further analysis of risks associated with shallow surface soil contamination performed.

7.3 OU 1 GROUNDWATER REMEDY (SITE 110)

7.3.1 Functionality of Groundwater Remedy for Site 110

Is the remedy functioning as intended by the decision document? Yes, the remedy for the groundwater at Site 110 is functioning as designed.

The RAO for the groundwater at Site 110 is the following: Verify that concentrations of inorganics in Site 110 groundwater are below background levels or state and federal drinking water ARARs.

The remedy only included groundwater monitoring of selected metals. Groundwater in upland wells at Site 110 was sampled post-ROD and results reevaluated against new (post-ROD) background data The metals concentrations were found to be below background levels and/or RGs, and monitoring was discontinued. In addition, the first 5-year review concluded that groundwater use restrictions were not necessary for upland groundwater beneath Site 110 outside of the NEX Gas Station Leak Area, and the restrictions were removed with the concurrence of EPA and Ecology.

7.3.2 Continued Validity of ROD Assumptions

Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection still valid? Yes, the ARARs, exposure assumptions, toxicity data, and RAOs are still valid and protective of human health and the environment. Changes to the ARARs used to establish RGs in the ROD are discussed below. There was no change to the risk assessment assumptions (exposure and toxicity).

ROD RGs for groundwater at this site (five metals—arsenic, beryllium, manganese, nickel, and vanadium) were based on drinking water standards (except for arsenic, which was based on background) because it would be possible to drink the water, although groundwater is not being used. Of the five COCs, only vanadium would have a more stringent (i.e., lower) RG if cleanup levels were established today (see Table 7-6). Because two rounds of post-ROD monitoring did not find concentrations in excess of RGs, monitoring was discontinued in 2004. However, the most recent concentrations of vanadium available for Site 110 (sampled in 2002 and 2004) were below the current MTCA B groundwater cleanup level of 80 µg/L. Therefore, the remedy remains protective of human health.

7.3.3 New Information

Has any other information come to light that could call into question the protectiveness of the remedy? No, there is no new information regarding the groundwater remedy at Site 110.

7.3.4 Technical Assessment Summary

The remedy for the groundwater at Site 110 is functioning as designed. The ARARs, exposure assumptions, toxicity data, and RAOs are still valid and protective of human health and the environment, and there is no new information regarding the groundwater remedy at Site 110. Therefore, the remedy continues to be protective of human health and the environment.

7.4 OU 1 NEX GAS STATION LEAK AREA (BENZENE RELEASE AREA)

7.4.1 Functionality of Remedy for NEX Gas Station Leak Area

Is the remedy functioning as intended by the decision document? Yes, the revised remedy for the NEX Gas Station Leak Area selected in the OU 1 ROD Amendment No. 1 is expected to function as designed once it is implemented.

The RAOs for the NEX Gas Station Leak Area established in the OU 1 ROD Amendment No. 1 are the following:

- Reduce concentrations of petroleum hydrocarbons in soil beneath the site to concentrations protective of groundwater.
- Minimize exposure to free-phase product remaining in the vadose zone beneath the source area.
- Reduce petroleum hydrocarbons in groundwater to levels protective of human health at the point where groundwater discharges to Ostrich Bay.
- Reduce petroleum hydrocarbons in groundwater to concentrations less than drinking water standards throughout the aquifer beneath the site.

7.4.2 Continued Validity of ROD Assumptions

Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection still valid? Yes, the ARARs, exposure assumptions, toxicity data, and RAOs are still valid and protective of human health and the environment.

There has been no ARAR change that would result in a change to RGs or risk-based screening concentrations (RBCs) established in the OU 1 ROD Amendment No. 1. However, ARARs used to establish RGs in the ROD are discussed below. There were no changes to the risk assessment assumptions (exposure and toxicity) since the OU 1 ROD Amendment No. 1 was executed.

The ROD Amendment No. 1 established revised cleanup levels for COCs in soil and groundwater based on the new RAOs. The chemical-specific ARARS potentially applicable to soil and groundwater cleanup standards for the COCs and the RGs established at the site are listed in Tables 7-7 and 7-8. The OU 1 ROD Amendment No. 1 also established RBCs protective of recreational exposures to outdoor air resulting from discharges during ozone sparging. Table 7-9 presents the equations used to calculate the RBCs and the resulting RBCs. Since the signing of the ROD amendment, there have been no ARAR changes that would result in a change to RGs or RBCs.

The ROD amendment numeric criteria for soil listed in the first column of Table 7-7 are based on the protection of the groundwater pathway (leaching of contaminants from to soil to groundwater). Although these criteria are provided, they are only presented for comparison and are not established as cleanup levels for soil. Achievement of the RAO for soil (protection of groundwater) will be demonstrated empirically using groundwater samples from monitoring wells located within the source area. The RG established in the OU 1 ROD for TPH-G at Site 110 is provided in the table for comparison, although the OU 1 ROD did not specify that this RG applied to the NEX Gas Station Leak Area.

Table 7-8 presents the ARARs for COCs in groundwater at the NEX Gas Station Leak Area, which are protective of drinking water. Although no ecological risk resulting from exposure to petroleum hydrocarbons was identified in the 2011 BERA (U.S. Navy 2011c), chemical-specific ARARs for groundwater protective of marine surface water were also presented in the OU 1 ROD amendment. However, groundwater cleanup levels (protective of potable groundwater) are lower and therefore more protective than the potential groundwater ARARs protective of marine surface water. Therefore, the groundwater cleanup levels presented in Table 7-8 are selected to be protective of all pathways, including ecological receptors.

7.4.3 New Information

Has any other information come to light that could call into question the protectiveness of the remedy? No, there is no new information regarding the revised remedy at the NEX Gas Station Leak Area since the OU 1 ROD Amendment No. 1 was executed.

There are possible vapor intrusion risks from groundwater near the NEX convenience store and residential housing units immediately north and south of the source area, although the likelihood of unacceptable risks is low. However, potential vapor intrusion health risks above risk target goals for both the NEX convenience store and residential homes cannot be entirely ruled out without additional data collection and evaluation efforts. To close these data gap, additional sampling of indoor air, subslab vapor, and crawlspace air will be performed in 2015.

7.4.4 Technical Assessment Summary

The revised remedy for the NEX Gas Station Leak Area, selected in the OU 1 ROD Amendment No. 1, is expected to function as designed once it is implemented. The ARARs, exposure assumptions, toxicity data, and RAOs are still valid and protective of human health and the environment. Currently, there is no new information regarding the revised remedy at the NEX Gas Station Leak Area since the OU 1 ROD Amendment No. 1 was executed. However, data will be collected to assess the vapor intrusion pathway. If COC concentrations in indoor air, subslab vapor, and crawlspace air samples exceed the screening levels, additional evaluation will be required to assess whether the remedial design should be modified to mitigate vapor intrusion risks. These data may call into question the protectiveness of the remedy.

7.5 OU 3T JPHC

7.5.1 Functionality of Remedy for OU 3T JPHC

Is the remedy functioning as intended by the decision document? Yes, the remedy for OU 3T JPHC is expected to function as designed once it is fully completed.

The RAOs established in the OU 3T JPHC ROD are the following:

- Allow use of the site for residential housing.
- Minimize the explosive hazard from potential encounters with DMM-HE at the site by requiring munitions education and awareness training for all residents as well as personnel involved in ground-disturbing activities at the site.

- Ensure that excavation permits for all ground-disturbing activities conducted in the upland areas are obtained prior to initiation of work at the site.

Remedy implementation for OU 3T JPHC has been performed separately for the Upland Zone and Intertidal Zone. The remedial action for the Upland Zone was implemented from November 2012 through January 2013 and is considered complete. All 1,107 anomalies in the three upland grids where DDM-HE was discovered during the RI were reacquired and intrusively investigated. No known or suspected HE was found (U.S. Navy 2013b). The remedy for the Intertidal Zone was implemented from June 2013 through July 2014. Preliminary results indicate that 19 DMM-HE items were removed from the intertidal area. Although all on-site activities have been completed, the intertidal remedy will not be considered complete until the RACR is finalized, which is scheduled to be in 2015.

Implementation of the anomaly investigation and removal portion of the OU 3T JPHC remedy provides enough reduction in potential explosive hazards posed by the site and a heightened degree of certainty regarding the residual hazard posed by potential encounters with DMM at the site to allow removal of the requirement to obtain an excavation permit within the intertidal area of OU 3T JPHC, in accordance with Sections 3.2 and 6 of the LUC Management Plan (U.S. Navy 2013c). This also allows the transition of the education and awareness training program to a voluntary program. Therefore, it is recommended that once the Washington State Department of Health lifts the shellfish harvesting advisories, the Navy update education and awareness training materials with the Suquamish Tribe and provide the training materials as an informational advisory to the tribe, Washington State Department of Fish and Wildlife, and Washington State Department of Natural Resources.

The remedy also included implementation of LUCs at the site. A LUC Management Plan was developed for OU 3T JPHC (U.S. Navy 2013c), which constituted the remedial design for the LUC component of the remedies. Because JPHC is now operated by a public-private venture agreement between the Navy and Forest City, some modifications were made to the audit procedures in 2014, which will be reflected in a revised LUC Management Plan scheduled to be completed in 2015. LUCs required by the OU 3T JPHC ROD were audited in 2013 and 2014. A compliance evaluation of the LUCs required by the OU 3T JPHC ROD based on the audit findings was performed during each audit, and the results of this compliance evaluation are summarized in Table 6-3. Continued effectiveness of the LUC program requires implementation of the recommendations listed in Table 6-3.

The appropriate programs and activities are in place and are fulfilling inspection and maintenance requirements. The required LUCs are formalized in a LUC Plan (U.S. Navy 2005d). Institutional controls inspections are being performed and documented yearly, and documentation is available. The site inspections for this 5-year review indicate that the required LUCs have been maintained since signing the ROD and the institutional controls component of the remedy is functional.

In accordance with the recommendations of the second 5-year review, a combined LUC Management Plan for OU 1 and OU 3T JPHC is currently being developed and is tentatively scheduled to be completed in July 2015 (U.S. Navy 2015b). However, the Navy funds activities related to chemical contamination separately from activities related to munitions contamination. As a result, auditing and reporting is performed separately for OU 1 and OU 3T JPHC by different contractors. Therefore, combining the required OU 1 and OU 3T JPHC LUC management activities in one plan complicates the auditing process and it is recommended that the LUC Management Plans for chemical contamination (OU 1) and munitions contamination (OU 3) be kept separate. This issue does not impact remedy protectiveness.

7.5.2 Continued Validity of ROD Assumptions

Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection still valid? Yes, the ARARs, exposure assumptions, and RAOs are still valid and protective of human health and the environment.

No ARAR is applicable to the OU 3T JPHC remedy, and there is no change to the exposure assumptions used in the explosive hazard assessment.

7.5.3 New Information

Has any other information come to light that could call into question the protectiveness of the remedy? No, there is no new information regarding the OU 3T JPHC remedy.

7.5.4 Technical Assessment Summary

The remedy for OU 3T JPHC is expected to function as designed once it is fully completed. The exposure assumptions and RAOs are still valid and protective of human health and the environment, and there is no new information regarding the OU 3T JPHC remedy. Therefore, the remedy is protective of human health and the environment.

7.6 OU 3T NHB

7.6.1 Functionality of Remedy for OU 3T NHB

Is the remedy functioning as intended by the decision document? Yes, the remedy for OU 3T NHB is expected to function as designed once it is implemented.

The RAO established in the OU 3T NHB ROD is as follows: Manage the potential risk to human health from contact with an explosively configured DMM-HE item.

7.6.2 Continued Validity of ROD Assumptions

Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection still valid? Yes, the exposure assumptions and RAOs are still valid and protective of human health and the environment.

No ARAR is applicable to the OU 3T NHB remedy, and there is no change to the exposure assumptions used in the explosive hazard assessment.

7.6.3 New Information

Has any other information come to light that could call into question the protectiveness of the remedy? No, there is no new information regarding the OU 3T NHB remedy.

7.6.4 Technical Assessment Summary

The remedy for OU 3T NHB is expected to function as designed once it is implemented. The exposure assumptions and RAOs are still valid and protective of human health and the environment, and there is no new information regarding the OU 3T NHB remedy. Therefore, the remedy is expected to be protective of human health and the environment once it is implemented.

7.7 ISSUES

Table 7-10 lists the issues identified as a result of this 5-year review. Issues that do not affect protectiveness, but have been identified during this 5-year review process are included in a footnote to the table.

Table 7-1
Technical Assessment Summary

OU/Area	Sites	Question A: Is the remedy functioning as intended by the decision documents?	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	Question C: Has any other information come to light that could call into question the protectiveness of the remedy?
OU 1 shoreline	101, 101-A, and 103	Yes	Yes	Yes
OU 1 upland soils	101, 101-A, 103, and 110	Yes	Yes	Yes
OU 1 groundwater	110	Yes	Yes	No
OU 1 NEX Gas Station Leak Area	NEX Gas Station Leak Area	Yes, by ROD amendment	Yes	No
OU 3T JPHC	NA	Yes	Yes	No
OU 3T NHB	NA	Yes	Yes	No

Notes:
JPHC - Jackson Park Housing Complex
NEX - Navy Exchange
NHB - Naval Hospital Bremerton
OU - operable unit
RAO - remedial action objective
ROD - Record of Decision

Table 7-2
ARARs for COCs Detected in Seeps and Outfalls at OU 1 Groundwater Sites 101, 101-A, and 103

Chemical	ROD Selected Cleanup Level (µg/L)	Basis of Cleanup Level	Revised Cleanup Level Based on Background Study (µg/L)	Current Chemical-Specific ARAR for Marine Surface Water Protection (µg/L)					Change in Cleanup Level if Established Today?
				MTCA Method B	State AWQC	National AWQC	Federal NTR (HH)	Clean Water Act (HH) Criterion[a]	
Volatile Organic Compounds									
Benzene	43	MTCA B	NA	22.7	None	None	71	51	Yes, lower
1,1-Dichloroethene	1.93	MTCA B	NA	23,100	None	None	3.2	7,100	Yes, higher
Trichloroethene	56	MTCA B	NA	30	None	None	81	30	Yes, lower
Vinyl chloride	2.92	MTCA B	NA	3.7	None	None	525	2.4	Yes, higher
Metals									
Arsenic - total	3.3	Background	3.7[b]	0.0982	36[d]	36[d]	0.14	0.14	No
Beryllium - total	0.0793	MTCA B	NA	273	None	None	None	None	Yes, higher
Mercury - total	0.025	Marine chronic AWQC	0.1[c]	None	0.025	0.94	0.15	0.3	No (either a new PQL or the ROD RG)[b]
Nickel - dissolved	7.9	Marine chronic AWQC	NA	1100	8.2	8.2	4,600	4,600	Yes, higher
Silver - dissolved	1.2	Marine acute AWQC	NA	25,900	1.9	1.9	None	None	Yes, higher

[a]Values are based on current Clean Water Act (304) protective of human health organism only. These criteria are currently under review by the U.S. Environmental Protection Agency.
[b]Basis of cleanup level was revised from original ROD to background level after completion of metals background study (U.S. Navy 2001), because background levels were higher than the most stringent ARAR.
[c]Basis of cleanup level was revised from original ROD to the practical quantitation limit (PQL). PQLs at the remediation goal (RG) level of 0.025 µg/L can now be achieved. Therefore, the ROD RG of 0.025 µg/L would apply to mercury at the site.
[d]Value is based on marine chronic AWQC.

Table 7-2 (Continued)
ARARs for COCs Detected in Seeps and Outfalls at OU 1 Groundwater Sites 101, 101-A, and 103

Notes:
Green highlighting indicates that the cleanup level would be higher if established today.
Yellow highlighting indicates that the cleanup level would be lower if established today.
ARAR - applicable or relevant and appropriate requirement
AWQC - ambient water quality criteria
COCs - chemicals of concern
HH - the AWQC based on human ingestion of fish in the water body
µg/L - microgram per liter
MTCA - Model Toxics Control Act
NA - not applicable
NTR - National Toxics Rule
ROD - Record of Decision

Table 7-3
ARARs for COCs Detected in Upland Wells at OU 1 Groundwater Sites 101, 101-A, and 103

Chemical	ROD Selected Cleanup Level (µg/L)	Basis of Cleanup Level	Revised Cleanup Level Based on Background Study (µg/L)	Current Chemical-Specific ARAR for Surface Water Protection (µg/L)					Change in Cleanup Level if Established Today?
				MTCA Method B	State AWQC	National AWQC	Federal NTR (HH)	Clean Water Act (HH) Criterion[c]	
Copper - dissolved	58[a]	Marine acute AWQC[a]	4.8[b] (2.5)[a]	2,880	4.8	4.8	None	None	Yes, lower
Cyanide	1	Marine acute AWQC	N/A	1,555	1	1	220,000	16,000	No
Lead - dissolved	6[a]	Marine chronic AWQC[a]	5.8[a]	None	8.1	8.1	None	None	Yes, higher
Thallium - total	1.56	MTCA B	NA	0.216	None	None	6.3	0.47	Yes, lower
Zinc - dissolved	104 [a]	Marine chronic AWQC [a]	81[b] (76.6)[a]	16,500	81	81	None	26,000	Yes, lower
Chlordane	0.0022	Federal NTR (HH)	NA	0.0013	0.004[d]	0.004[d]	0.00059	0.00081	Yes, lower
Total petroleum hydrocarbon	1,000	MTCA A	NA	1,000[e]	None	None	None	None	No

[a]Basis of cleanup level was revised from original ROD value to Washington State AWQC after completion of metals background study (U.S. Navy 2001).
[b]Basis of cleanup level was revised to the current Washington State AWQC during the second 5-year review. Dissolved copper is based on acute exposure.
[c]Values are based current Clean Water Act (304) protective of human health organism only. These criteria are currently under review by the U.S. Environmental Protection Agency.
[d]Cleanup level is based on marine chronic AWQC.
[e]Value based on gasoline-range organics; no detectable benzene present.

Notes:
Green highlighting indicates that the cleanup level would be higher if established today.
Yellow highlighting indicates that the cleanup level would be lower if established today.
ARAR - applicable or relevant and appropriate requirement

Table 7-3 (Continued)
ARARs for COCs Detected in Upland Wells at OU 1 Groundwater Sites 101, 101-A, and 103

AWQC - ambient water quality criteria
COCs - chemicals of concern
HH - the AWQC based on human ingestion of fish in the water body
µg/L - microgram per liter
MTCA - Model Toxics Control Act
NA - not applicable
NTR - National Toxics Rule
ROD - Record of Decision

Table 7-4
Changes in Toxicity Values

Chemical	MTCA Method B Value in ROD Selected as RG (µg/L)	MTCA Method B Value for Surface Water Based on New Toxicity (µg/L)	Reason for Revision
Beryllium	0.0793	273	See text for further discussion.
Benzene	43	22.7	An inhalation slope factor of 0.029 $(mg/kg\text{-}d)^{-1}$ was used previously. An oral slope factor of 0.055 $(mg/kg\text{-}d)^{-1}$ is currently available.
1,1-Dichloroethene (DCE)	1.93	23,100	DCE is no longer considered a potential carcinogen. New value is for noncancer.
Trichloroethene (TCE)	56	30	MTCA calculations now incorporate a slope factor for TCE of 0.046 $(mg/kg\text{-}d)^{-1}$, resulting in a MTCA B value of 13 µg/L. However, MTCA requires cleanup levels to comply with applicable or relevant and appropriate requirements, which in this case are the federal and state water quality criteria. Therefore, the Federal AWQC of 30 µg/L is used based on consumption of organisms only (marine surface water is not used as drinking water).
Vinyl chloride	2.92	3.69	Oral slope factor changed from 1.9 to 1.5 $(mg/kg\text{-}d)^{-1}$.

Notes:
Green highlighting indicates that the cleanup level would be higher if established today.
Yellow highlighting indicates that the cleanup level would be lower if established today.
AWQC - ambient water quality criteria
µg/L - microgram per liter
mg/kg-d - milligram per kilogram per day
MTCA - Model Toxics Control Act
RG - remediation goal
ROD - Record of Decision

Table 7-5
ARARs for COCs in Soil at Sites 101, 101-A, 103, and 110

	Sites 101, 101-A, and 110				Site 103			
Chemical	**ROD RG (mg/kg)**	**Basis**	**Today's Value (mg/kg)**	**Change?**	**ROD RG (mg/kg)**	**Basis**	**Today's Value (mg/kg)**	**Change?**
Antimony	32	MTCA B	32	No	128	MTCA C	1,400	Yes, higher
Arsenic	8.6	Background	0.67 (MTCA B)	No	66.7	MTCA C	88	Yes, higher
Beryllium	1.5	Background	160	Yes, higher (MTCA B)	9.3	MTCA C	7,000	Yes, higher
Lead	250	MTCA A (unrestricted)	250	No	250	MTCA A (industrial)	1,000	Yes, higher
cPAHs	0.137[a]	MTCA B	0.137[a]	No[b]	5.48	MTCA C	18[a]	Yes, higher
PCBs	0.130	MTCA B	0.5	Yes, higher	5.19	MTCA C	66	Yes, higher
TPH-G[c]	100	MTCA A (unrestricted)	100	No	100	MTCA A (industrial)	100	No

[a]The MTCA B and C values are based on benzo(a)pyrene.
[b]The over-all approach for evaluating cPAHs has changed under the November 2007 revision of MTCA (Washington Administrative Code 173-340-708[8][e]). Determining compliance with cleanup levels for mixtures of cPAH compounds is now done by calculating a benzo(a)pyrene "equivalent" value for each sample. This toxic equivalent concentration is derived by adjusting the concentrations of the seven cPAHs based on their toxicity compared to benzo(a)pyrene. The sum of the adjusted concentrations is then calculated and compared to the RG.
[c]Value is based on no detectable benzene present.

Notes:
Green highlighting indicates that the cleanup level would be higher if established today.
ARARs - applicable or relevant and appropriate requirements
COCs - chemicals of concern
cPAHs - carcinogenic polycyclic aromatic hydrocarbon
MTCA - Model Toxics Control Act
PCBs - polychlorinated biphenyls
RG - remediation goal
ROD - Record of Decision
TPH-G - total petroleum hydrocarbon as gasoline

Table 7-6
ARARs for COCs in Groundwater at Site 110

Chemical	ROD Selected Cleanup Level (µg/L)	Basis of Cleanup Level	Revised Cleanup Level Based on Background Study (µg/L)	Current ARAR Based on Drinking Water		Change in Cleanup Level if Established Today?
				MTCA Method B (µg/L)	Federal MCL (µg/L)	
Arsenic	3.3	Background	3.7	0.058	10	No
Beryllium	0.0793	MTCA B	N/A	32	4	Yes, higher
Manganese	2,240	MTCA B	NA	2,240	None	No
Nickel	100	MCL	NA	320	100[a]	No
Vanadium	112	MTCA B	NA	80	None	Yes, lower

[a]State MCL; federal value remanded

Notes:
Green highlighting indicates that the cleanup level would be higher if established today.
Yellow highlighting indicates that the cleanup level would be lower if established today.
ARARs - applicable or relevant and appropriate requirements
COCs - chemicals of concern
MCL - maximum contaminant level
µg/L - microgram per liter
MTCA - Model Toxics Control Act
ROD - Record of Decision

Table 7-7
ARARs for COCs in Soil at NEX Gas Station Leak Area

Chemical	ROD Amendment Numeric Criterion[a]	Basis of Cleanup Level	Typical PQL	Current ARARS: Direct Contact MTCA Method B[b]: Carcinogenic	Current ARARS: Direct Contact MTCA Method B[b]: Noncarcinogenic	Current ARARS: Protection of Groundwater: MTCA Method A (Unrestricted Land Use)[c]	Current ARARS: Protection of Groundwater: MTCA Method B[d]	OU 1 ROD Remediation Goal[e]	Change in Cleanup Level if Established Today?
Total Petroleum Hydrocarbons (mg/kg)									
Gasoline-range hydrocarbons (benzene not present)	NA	NA	10	NE	NE	100	NE	NE	No
Gasoline-range hydrocarbons (benzene present)	30	MTCA Method A (Unrestricted Land use)	10	NE	NE	30	NE	100	No
Volatile Organic Compounds (µg/kg)									
Benzene	28	MTCA Method B[d]	5	18,200	320,000	30	28	NE	No
Toluene	7,271		5	NE	6,400,000	7,000	7,271	NE	No
Ethylbenzene	6,048		5	NE	8,000,000	6,000	6,048	NE	No
m,p-Xylene	91,440		5	NE	16,000,000	NE	91,440	NE	No
o-Xylene	91,440		5	NE	16,000,000	NE	91,440	NE	No
Total xylenes	91,440		5	NE	16,000,000	9,000	91,440	NE	No

[a]These numeric criteria are not established as cleanup levels for soil. Achievement of the remedial action objective for soil (protection of groundwater) will be demonstrated empirically using groundwater samples collected from monitoring wells within the source area.
[b]Chapter 173-340 WAC: MTCA Method B values are from Ecology website CLARC tables downloaded July 2014 (https://fortress.wa.gov/ecy/clarc/CLARCDataTables.aspx).
[c]MTCA Method A Soil Cleanup Levels for Unrestricted Land Use, WAC 173-340-900, Table 740-1
[d]Values calculated using the Safe Drinking Water Act maximum contaminant levels and the three-phase partitioning model under WAC 173-340-747.

Notes:
ARARs - applicable or relevant and appropriate requirements
COCs - chemicals of concern
µg/kg - microgram per kilogram

Table 7-7 (Continued)
ARARs for COCs in Soil at NEX Gas Station Leak Area

mg/kg - milligram per kilogram
MTCA - Model Toxics Control Act
NA - not applicable
NE - not established
PQL - practical quantitation limit
ROD - Record of Decision
WAC - Washington Administrative Code

Table 7-8
ARARs for COCs in Groundwater at NEX Gas Station Leak Area

Chemical	ROD Amendment Cleanup Level	Basis of Cleanup Level	Typical PQL	Current ARARS							OU 1 ROD Remediation Goal[f]	Change in Cleanup Level if Established Today?
				MTCA[a]			Safe Drinking Water Act[c]		Washington State Department of Health[d]			
				Method A Groundwater	Method B Groundwater (Carcinogen)	Method B Groundwater (Noncarcinogen)	MCL	MCLG	MCL	MCLG		
Total Petroleum Hydrocarbons (mg/L)												
Gasoline-range hydrocarbons (benzene not present)	NA	NA	0.25	1	NE	NE	NE	NE	NE	NE	NE	No
Gasoline-range hydrocarbons (benzene present)	0.8	MTCA Method A	0.25	0.8	NE	NE	NE	NE	NE	NE	NE	No
Volatile Organic Compounds (µg/L)												
Benzene	5	Safe Drinking Water MCL	0.5	5	0.795	32	5	0	5	0	43[f]	No
Toluene	640[b]	MTCA Method B	0.5	1,000	NE	640	1,000	1,000	1,000	1,000	NE	No
Ethylbenzene	700		0.5	700	NE	800	700	700	700	700	NE	No
m,p-xylene	1,600[b,e]		0.5	NE	NE	1,600	10,000[e]	10,000[e]	10,000[e]	10,000[e]	NE	No
o-xylene	1,600[b,e]		0.5	NE	NE	1,600	10,000[e]	10,000[e]	10,000[e]	10,000[e]	NE	No
Total xylenes	1,600[b]		0.5	1,000	NE	1,600	10,000	10,000	10,000	10,000	NE	No

[a]Chapter 173-340 WAC: MTCA Method B values are from Ecology website CLARC tables downloaded July 2014 (https://fortress.wa.gov/ecy/clarc/CLARCDataTables.aspx).
[b]MCLs for toluene and xylenes revised downward to the MTCA Method B cleanup levels to meet human health goals under MTCA, per WAC 173-340-720(7)(b). MCLs for benzene and ethylbenzene were found to meet MTCA human health goals and no revision downward was necessary. See Section 4.1.4 of ROD amendment (U.S. Navy and USEPA 2013a).
[c]Safe Drinking Water Act, 40 CFR 141.50 and 141.61
[d]Washington State Department of Health (WAC 246-290-310(7) has adopted by reference the concentrations for volatile organic compounds under the Safe Drinking Water Act, 40 CFR 141.61(a).
[e]MCL and MCLG for total xylenes
[f]The remediation goal (RG) for benzene in the OU 1 ROD was based on protection of surface water. The OU 1 ROD did not establish any RGs protective of drinking water.

Notes:
ARARs - applicable or relevant and appropriate requirements
CFR - Code of Federal Regulations

Table 7-8 (Continued)
ARARs for COCs in Groundwater at NEX Gas Station Leak Area

COCs - chemicals of concern
MCL - maximum contaminant level
MCLG - maximum contaminant level goal
µg/L - microgram per liter
mg/L - milligram per liter
MTCA - Model Toxics Control Act
NA - not applicable
NE - not established
PQL - practical quantitation limit
ROD - Record of Decision
WAC - Washington Administrative Code

Table 7-9
ARARs for COCs in Outdoor Air at NEX Gas Station Leak Area

Exposure medium: outdoor air
Receptor population: recreational visitors
Receptor age: child and adult
Exposure point: outdoor air

MTCA equation 750-1: RBCair nc = (THQ x RfDi x BW x ATnc)/BR x EF x ED x ABS)
MTCA equation 750-2: RBCair ca = (TCR x BW x ATca)/(SFi x BR x EF x ED x ABS)

Parameter	Unit	Recreational		Reference
		Noncancer	Cancer	
Risk-based screening concentration for outdoor air (RBCair)	mg/m^3	Chemical-specific	Chemical-specific	Calculated value using MTCA equations 750-1 and 750-2
Target cancer risk (TCR)	unitless	--	1.00E-06	MTCA default (WAC 173-340-750)
Target hazard quotient (THQ)	unitless	1.0E+00	--	MTCA default (WAC 173-340-750)
Inhalation reference dose (RfDi)	mg/kg-day	Chemical-specific	Chemical-specific	MTCA CLARC[a]
Inhalation slope factor (SFi)	$(mg/kg\text{-}day)^{-1}$	Chemical-specific	Chemical-specific	MTCA CLARC[a]
Exposure frequency (EF)	unitless	0.023	0.023	Professional judgment: assumes 2 hours twice per week, 50 weeks per year (EF = 2h/24h x 2d/7d x 50w/52w = 0.023)
Exposure duration (ED)	year	6	30	MTCA default (WAC 173-340-750)
Breathing rate (BR)	m^3/day	10	20	MTCA default (WAC 173-340-750)
Body weight (BW)	kg	16	70	MTCA default (WAC 173-340-750)
Averaging time (AT)	year	6	75	MTCA default (WAC 173-340-750)
Inhalation absorption fraction (ABS)	unitless	1	1	MTCA default (WAC 173-340-750)

Table 7-9 (Continued)
ARARs for COCs in Outdoor Air at NEX Gas Station Leak Area

Chemical	RfDi (mg/kg-day)	SFi $(mg/kg\text{-}day)^{-1}$	RBCair nc[b] (mg/m^3)	RBCair ca[b] (mg/m^3)	Change in RBCair values if Established Today?
Benzene	8.6E-03	2.7E-02	0.60	0.014	No
Toluene	1.4E+00	--	97	--	No
Ethylbenzene	2.9E-01	--	20	--	No
Xylenes	2.9E-02	--	2	--	No
TPH-G[c]	1.7	--	118	--	No

[a]MTCA CLARC database accessed on July 2014 (https://fortress.wa.gov/ecy/clarc/CLARCDataTables.aspx)
[b]nc - noncancer; ca - cancer
[c]The RfDi for TPH-G is based on the aliphatic portion of the gasoline range (EC5 to EC8) from Washington State Department of Ecology (Ecology) "Fact Sheet: Reference Doses for Petroleum Compounds" located at: https://fortress.wa.gov/ecy/clarc/FocusSheets/petroToxParameters.pdf. Ecology recommends evaluating the aromatic portion of the gasoline range using the toxicity criteria for the individual aromatic constituents benzene, toluene, ethybenzene, and xylenes.

Notes:
m^3 - cubic meter
mg/kg - milligram per kilogram
mg/m^3 - milligram per cubic meter
MTCA - Model Toxics Control Act
TPH-G - total petroleum hydrocarbons as gasoline
WAC - Washington Administrative Code

Table 7-10
Issues

No.	Issue	Affects Protectiveness?[a]	
		Current	Future
OU 1			
1	During the focused Phase II SI performed by Forest City as part of their due diligence inquiries, cyanide was detected at concentrations exceeding the ROD RG in groundwater in the vicinity of Building 100 at Site 101-A and could be migrating to surface water at concentrations above the ROD RG. The OU 1 ROD established the cyanide RG based on the marine water quality criterion, which is below the PQL. Therefore, the absence of cyanide above its RG cannot be verified in the seeps and outfalls at Site 101-A (OF-716 and SP-715).	Yes	Yes
2	During the focused Phase II SI performed by Forest City as part of their due diligence inquiries, mercury was detected in seep/outfall samples collected from OF-716 and SP-715 at Site 101-A above the original ROD RG, and monitoring for metals in seeps and outfalls at the site has been discontinued.	Yes	Yes
3	The mercury RG that was established post-ROD, based on the PQL at the time of the change, is above the current PQL.	Yes	Yes
4	During the focused Phase II SI performed by Forest City as part of their due diligence inquiries, petroleum hydrocarbons were detected at concentrations greater than the focused Phase II SI screening criteria (RGs have not been established in the OU 1 ROD for the detected chemicals) and cPAHs were detected at concentrations greater than the ROD RG in deep soil in the vicinity of former UST-2 and UST-2A (near the north end of Root Court) and/or at the south end of Root Court.	No	Yes
5	During the focused Phase II SI performed by Forest City as part of their due diligence inquiries, cPAHs and/or arsenic were detected at concentrations greater than the ROD RGs in shallow soil in the vicinity of NE Rankin Road and adjacent to the bunkers.	Yes	Yes
6	One soil cover area (street waste disposal area) is not identified in the LUC Management Plan.	No	Yes
7	The extent of shallow soil exceeding the ROD RGs in the vicinity of NE Rankin Road and adjacent to the bunkers is not known.	Yes	Yes
8	A large number of chemicals were detected in the 2009 marine tissue collected to support the OU 2 BERA. These detections imply that there are potential data gaps in the human health marine tissue analyte list that could impact the assessment of human health risks.	No	Yes
9	Unresolved questions remain regarding whether ordnance compounds are present in marine tissue, whether risks to human health from these compounds are unacceptable, and whether arsenic concentrations in marine tissue present a risk to human health above background risks.	No	Yes
10	Potential vapor intrusion risk in the NEX convenience store, Building 30, and residential homes located upgradient and cross gradient of the source area were identified as a data gap in the FFS.	Yes	Yes

Table 7-10 (Continued)
Issues

[a]The issues listed below have been identified to require follow-up action prior to the next 5-year review, but do not impact protectiveness:

- OU 1:
  - Shoreline vegetation has been impacted by the ordnance investigation.
  - Deterioration of the seawall surface in areas that had been previously patched has been observed over this 5-year review period, although it does not appear to impact the structural integrity of the seawall.
  - Cracks and depressions have been observed in paved cover areas in front of Bunkers 100 and 101 and walking pathways along the shoreline.
  - It can be difficult to determine whether planned excavation activities are located in land use restriction areas based on the permit applications received.
- OU 3T JPHC
  - LUC audit identified minor compliance issues.
  - Procedures in the LUC Management Plan are not currently up to date, because of the public-private venture between the Navy and Forest City.
  - Combining the required OU 1 and OU 3T JPHC LUC management activities in one LUC Management Plan, as recommended in the last 5-year, complicates the auditing process, because funding for chemical contamination and munitions contamination is separate, and separate contractors perform the audits.

Notes:
BERA - baseline ecological risk assessment
cPAHs - carcinogenic polynuclear aromatic hydrocarbons
Forest City - Forest City Residential Management
OU - operable unit
PQL - practical quantitation limit
RG - remediation goal
ROD - Record of Decision
SI - site investigation
UST - underground storage tank

8.0 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

This section presents the recommendations and follow-up actions identified as a result of the 5-year review process. Table 8-1 summarizes the recommendations. Figure 8-1 shows the locations of additional or expanded areas where LUCs (excavation/construction controls) are recommended.

Legend

- Site Boundary Line
- Naval Hospital Property Line
- Public Private Venture Agreement Lease Boundary
- Former UST
- Existing UST
- Recommended Excavation/Construction Control Area to be Refined through Further Investigation (Shallow Soil)
- Recommended Excavation/Construction Control Area (Deep Soil)

Notes:

1. Areas shown on this figure to be incorporated into the LUC Management Plan.
2. Chemicals shown on this figure were detected at concentrations exceeding conservative screening levels during the Phase II SI performed by Forest City as part of their due diligence inquiries.

J:\GIS\Projects\NAVY\jacks_pk\DIQ\DO 89\3rd 5-YR Review\Fig 8-1 Excav-Construct.dwg
Mod: 08/20/2015, 13:33 | Plotted: 08/20/2015, 13:34 | JOHN_KNOBBS

U.S. NAVY	JPHC/NHB THIRD FIVE-YEAR REVIEW	0 200 400 SCALE IN FEET	**Figure 8-1 Recommended Excavation/Construction Control Areas**

Table 8-1
Recommendations and Follow-Up Actions

No.	Recommendation/Follow-Up Action	Party Responsible	Oversight Agency	Milestone Date	Follow-Up Action: Affects Protectiveness?[a]	
					Current	Future
1	Prior to each seep sampling event, determine the best available cyanide PQL and compare to the cyanide RG (1 µg/L). Ensure that the laboratory uses the best analytical method for achieving the current cyanide PQL (5 µg/L in 2015 using EPA Method 335.4) and that monitoring results are compared to the best available PQL at the time of monitoring.	Navy	EPA	5/31/16	Yes	Yes
2	Restart mercury monitoring at Site 101-A (OF-716 and SP-715).	Navy	EPA	5/31/16	Yes	Yes
3	Revise the mercury RG to the original Record of Decision RG (0.025 µg/L), and ensure that the laboratory uses the best analytical method for achieving the current PQL (0.0005 µg/L in 2015 using EPA Method 1631).	Navy	EPA	5/31/16	Yes	Yes
4	Control excavation and construction in the Root Court area (see Figure 8-1) with deep soil contamination (TPH and cPAHs) above ROD RGs and/or focused Phase II SI screening criteria (if no ROD RG is established) and incorporate the areas into the LUC Management Plan.	Navy	EPA	12/31/15	No	Yes
5	Evaluate whether contamination in shallow soil (arsenic, lead, cPAHs, and explosives) identified during the focused Phase II SI in the vicinity of NE Rankin Road and the bunkers (see Figure 8-1) could pose unacceptable risks to human health.	Navy	EPA	8/31/16	Yes	Yes
6	Control excavation and construction in soil cover area (street waste disposal area in Figure 4-2) and incorporate this area into the LUC Management Plan.	Navy	EPA	12/31/15	No	Yes
7	Investigate the extent of shallow soil exceeding the ROD RGs in the vicinity of NE Rankin Road and the bunkers (see Figure 8-1) and	Navy	EPA	8/31/16	Yes	Yes

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

No.	Recommendation/Follow-Up Action	Party Responsible	Oversight Agency	Milestone Date	Follow-Up Action: Affects Protectiveness?[a]	
					Current	Future
	incorporate areas exceeding RGs into the LUC Management Plan.					
8	Complete the marine tissue data gaps analysis and finalize the analyte list for potential future rounds of marine tissue monitoring.	Navy	EPA	12/31/15	No	Yes
9	Evaluate the results of the 2014 marine tissue monitoring and complete the HHRA to resolve whether ordnance compounds are present in marine tissue, whether risks to human health from these compounds are unacceptable, and whether arsenic concentrations in marine tissue present a risk to human health above background risks.	Navy	EPA	12/31/15	No	Yes
10	Perform indoor air, subslab vapor, and crawlspace sampling at the NEX Gas Station Leak Area and compare to screening levels. If concentrations of chemicals of concern exceed the screening levels, assess whether the remedial design for the NEX Gas Station Leak Area should be modified to mitigate vapor intrusion risks.	Navy	EPA	12/31/15	Yes	Yes

[a]The following recommendations that do not impact protectiveness require follow-up action prior to the next 5-year review (see Sections 6 and 7 for details):

- OU 1
  - Monitoring for total and dissolved metals, 1,1-dichloroethene, and vinyl chloride at outfall OF-705 should be discontinued, because they were either not detected or detected at concentrations much lower than their RGs during the last five sampling events.
  - Monitoring of shoreline vegetation impacted by the ordnance investigation should be continued and replanted and mulched once ordnance investigations are completed.
  - Continued monitoring and maintenance of the seawall where cracks have been observed is needed to protect its integrity.
  - Continued monitoring and maintenance of paved cover areas in front of Bunkers 100 and 101 and walking pathways along the shoreline is needed for remedy effectiveness.

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

- The excavation permitting program should be revised to include a mapping application or a requirement to hand mark the excavation area on a standard map of the vicinity. Either mapping method will be used to quickly and easily identify whether the planned excavation activities are within a land use restriction area.

- OU 3T JPHC
  - Recommendations included in Table 6-3 regarding Operable Unit 3 Terrestrial JPHC LUCs should be implemented.
  - Transition the education and awareness training program for shellfish harvesters to a voluntary program after approval of the remedial action completion report. Once the shellfish harvesting restrictions are lifted, update education and awareness training materials with the tribe and provide the training materials as an informational advisory to the tribe, Washington State Department of Fish and Wildlife, and the Washington State Department of Natural Resources.
  - Procedures in the LUC Management Plan should be updated to reflect the public-private venture between Forest City and the Navy.
  - Keep the LUC Management Plans separate for chemical contamination and munitions contamination and by operable unit, or both.

Notes:
cPAH - carcinogenic polycyclic aromatic hydrocarbon
EPA - U.S. Environmental Protection Agency
LUC - land use control
µg/L - microgram per liter
Navy - U.S. Navy
PQL - practical quantitation limit
RG - remediation goal
SI - site investigation
TPH - total petroleum hydrocarbons

9.0 CERTIFICATION OF PROTECTIVENESS

Protectiveness determinations are required for OU 1, OU 3T JPHC, and OU 3T NHB because RODs are currently in place for these OUs. A protectiveness determination is not required for OU 2 or OU 3 M, because RODs for these OUs are pending.

9.1 OPERABLE UNIT 1

A protectiveness determination for the remedy at OU 1 cannot be made at this time until further information is obtained through the following actions:

- Performing mercury sampling at seeps/outfalls at Site 101-A
- Investigating the extent of shallow soil exceeding ROD RGs and evaluating whether contamination in shallow soil identified during the focused Phase II SI could pose unacceptable risks to human health
- Performing indoor air, subslab vapor, and crawlspace sampling at the NEX Gas Station Leak Area and comparing results to screening levels to evaluate whether there are unacceptable vapor intrusion risks to human health

It is expected that these actions together with the 5-year review addendum will take until approximately March 2017 to complete.

9.2 OPERABLE UNIT 3T JPHC

The remedy at OU 3T JPHC is expected to be protective of human health and the environment upon completion. The substantive elements of the remedy (LUC implementation and anomaly removal) have been completed. Once the RACR for the Intertidal Zone is complete, the remedy is expected to be protective of human health and the environment.

Remedy implementation for OU 3T JPHC has been performed separately for the Upland Zone and Intertidal Zone. The RACR has been completed for the Upland Zone remedy. Therefore, the remedy for the Upland Zone is complete (U.S. Navy 2013b). The on-site activities for the Intertidal Zone have been completed. However, the remedy for the Intertidal Zone will not be considered complete until the RACR is finalized in 2015. The remedy also included implementation of LUCs at the site. A LUC Management Plan was developed for OU 3T JPHC (U.S. Navy 2013c), which constituted the remedial design for the LUC component of the remedies. Therefore, the LUC component is considered complete. These actions effectively meet the following RAOs established in the OU 3T JPHC ROD:

- Allow use of the site for residential housing.
- Minimize the explosive hazard from potential encounters with DMM-HE at the site by requiring munitions education and awareness training for all residents as well as personnel involved in ground-disturbing activities at the site.
- Ensure excavation permits for all ground-disturbing activities conducted in the upland areas are obtained prior to initiation of work at the site.

9.3 OU 3T NHB

The remedy at OU 3T NHB is expected to be protective of human health and the environment upon completion. Remedy implementation consists of formalizing existing LUCs in a LUC Management Plan. The existing LUCs currently address site risks.

Remedy implementation has not been completed for OU 3T NHB, because the ROD was executed on September 19, 2014 after the 5-year review period. Completion of a LUC Management Plan for NHB will constitute remedy implementation. In the interim, LUCs implemented for OU 3T JPHC have already been implemented at NHB. The remedy is expected to be protective of human health and the environment once it is implemented, and the planned actions will effectively meet the following RAO established in the OU 3T NHB ROD: Manage the potential risk to human health from contact with an explosively configured DMM-HE item.

10.0 NEXT REVIEW

The next 5-year review is tentatively scheduled for 2020. Upcoming activities to be performed at JPHC/NHB by OU include the following:

- OU 1:
  - 5-year review addendum documenting protectiveness determination
  - NEX Gas Station Leak Area remedy implementation
  - RACR source area remedy component, NEX Gas Station Leak Area
  - RACR nearshore area remedy component, NEX Gas Station Leak Area

- OU 2:
  - Proposed Plan
  - ROD
  - Remedy implementation
  - RACR

- OU 3T JPHC: RACR for LUCs and Intertidal Zone

- OU 3T NHB:
  - ROD
  - Remedy implementation

- OU 3M:
  - RI/FS
  - Proposed Plan
  - ROD
  - Remedy implementation
  - RACR

11.0 REFERENCES

Landau Associates, Inc. (Landau). 2014. *Phase 1 Environmental Site Assessment Report Jackson Park Naval Reservation, Bremerton, WA.* Prepared for Forest City Military Communities Northwest/Pacific NW Communities LLC. May 2014.

———. 2013. *Focused Phase II Site Investigation Report Jackson Park Naval Reservation, Bremerton, WA.* Prepared for Forest City Military Communities Northwest/Pacific NW Communities LLC. September 2013

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

Talmage, S.S., D.M. Opresko, C.J. Maxwell, C.J.E. Welsh, F.M. Cretella, P.H. Reno, and F.B. Daniel. 1999. "Nitroaromatic Munition Compounds: Environmental Effects and Screening Values." *Rev. Environ. Contam. Toxicol*. 161:1-156.

U.S. Department of Defense (USDoD). 2014. Subject: Five-year Review Procedures – Update to DoD Manual 4715.20, "Defense Environmental Restoration Program (DERP) Management," March 9, 2012. June 2, 2014.

———. 2012. *Defense Environmental Restoration Program (DERP) Management.* Manual No. 4715.20. March 2012.

———. 2008. *DoD Ammunition and Explosives Safety Standards.* Incorporating Change 2, August 21, 2009. DoD 6055.09-STD. February 29, 2008.

U.S. Environmental Protection Agency (USEPA). 2014a. *Streamlining Federal Facility FYRs*, Presented at the 23rd Annual NARPM Training Program, May 2014.

———. 2014b. *National Recommended Water Quality Criteria.* Available at http://water.epa.gov/scitech/swguidance/standards/criteria/ current/index.cfm). Last updated December 3, 2014.

———. 2012. *Clarifying the Use of Protectiveness Determinations for Comprehensive Environmental Response, Compensation, and Liability Act Five-Year Reviews.* OSWER 9200.2-111. September 2012.

———. 2009. Integrated Risk Information System (IRIS) online database. <http://www.epa.gov/iris/index.html>. November 2009.

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

———. 2007b. "Proposed Rule: Withdrawal of Federal Marine Aquatic Life Water Quality Criteria for Toxic Pollutants Applicable to Washington State Pollutants Applicable to Washington State." *Federal Register* 72(130). July 9, 2007. Available at http://www.gpo.gov/fdsys/pkg/FR-2007-07-09/html/E7-13207.htm.

———. 2002. *Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites.* EPA 540-R-01-003. OSWER 9285.7-41. September 2002.

———. 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. *Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories,* Vol. 1, *Fish Sampling and Analysis.* 3d ed. Office of Water. November 2000.

———. 1998. *Risk Assessment Guidance for Superfund,* Vol. 1, *Human Health Evaluation Manual (Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments).* Interim Final. EPA 540-R-97-033. Office of Solid Waste and Emergency Response. Washington, D.C. December 1998.

———. 1997. *Exposure Factors Handbook.* Vols. I–III. *An Update to Exposure Factors Handbook.* EPA/600/P-95-002Fa. August 1997.

———. 1992. "Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants; States' Compliances." *Federal Register* 57(246):60848 (57 FR 60848), December 22, 1992. Available at http://water.epa.gov/ lawsregs/rulesregs/ntr.

———. 1991. *Risk Assessment Guidance for Superfund,* Vol. 1, *Human Health Evaluation Manual.* Part B. *Development of Risk-Based Preliminary Goals.* Interim Final. Publication 9285.7-01B. Office of Emergency and Remedial Response. Washington, D.C. December 1991.

———. 1989. *Risk Assessment Guidance for Superfund: Vol. 1, Human Health Evaluation Manual*. Part A. Interim Final. EPA 540/1-89/002. Office of Emergency and Remedial Response. Washington, D.C.

U.S. Navy. 2015a. *Land Use Control Audit Report, Operable Unit 3-Terrestrial, Jackson Park Housing Complex, Bremerton, Washington*. Prepared by URS Group, Inc., for Naval Facilities Engineering Command Northwest under Contract No. N44255-09-D-4001. January 2015.

———. 2015b. *Draft Final Land Use Control Management Plan, Operable Unit 1 and Operable Unit 3T JPHC, Jackson Park Housing Complex/Naval Hospital Bremerton, Bremerton, Washington.* Prepared by URS Group, Inc., for Naval Facilities Engineering Command Northwest under Contract No. N44255-09-D-4001. May 2015.

———. 2015c. *Summer 2014 Internal Draft Long-Term Monitoring Report, Operable Unit 1, Jackson Park Housing Complex and Naval Hospital Bremerton, Bremerton, Washington.* Prepared by Sealaska Environmental Services, LLC for Naval Facilities Engineering Command Northwest under Contract No. N44255-14-D-9011. Silverdale, Washington. April 2015.

———. 2014a. *Final Project-Specific Sampling and Analysis Plan Operable Unit 1 Long-Term Monitoring of Marine Tissue, Jackson Park Housing Complex/Naval Hospital Bremerton, Bremerton, Washington.* Prepared by URS Group Inc. for Naval Facilities Engineering Command Northwest under Contract No. N44255-09-D-4011. Silverdale, Washington. July 2014.

———. 2014b. *Summer 2013 Final Long-Term Monitoring Report, Operable Unit 1, Jackson Park Housing Complex and Naval Hospital Bremerton, Bremerton, Washington.* Prepared by Sealaska Environmental Services, LLC for Naval Facilities Engineering Command Northwest under Contract No. N44255-09-D-4005. Silverdale, Washington. January 2014.

———. 2014c. *Spring 2013 to Winter 2014 Annual Inspection Report, Long-Term Monitoring for Operable Unit 1, Jackson Park Housing Complex/Naval Hospital Bremerton, Bremerton, Washington.* Prepared by Sealaska Environmental Services, LLC for Naval Facilities Engineering Command Northwest under Contract No. N44255-09-D-4005. Silverdale, Washington. August 2014.

———. 2014d. *Spring 2014 Inspection Report, May 2014 Quarterly/Semiannual Inspection Long-Term Monitoring for Operable Unit 1, Jackson Park Housing Complex/Naval Hospital Bremerton, Bremerton, Washington.* Prepared by Sealaska Environmental Services, LLC for Naval Facilities Engineering Command Northwest under Contract No. N44255-09-D-9011. Silverdale, Washington. August 2014.

———. 2014e. *Summer 2014 Inspection Report, July 2014 Quarterly Inspection Long-Term Monitoring for Operable Unit 1, Jackson Park Housing Complex/Naval Hospital Bremerton, Bremerton, Washington.* Prepared by Sealaska Environmental Services, LLC for Naval Facilities Engineering Command Northwest under Contract No. N44255-09-D-9011. Silverdale, Washington. August 2014.

———. 2014f. *Data Gaps Resolution Plan NEX Gas Station Leak Area.* Prepared by URS Group Inc. for Naval Facilities Engineering Command Northwest under Contract No. N44255-09-D-4011. Silverdale, Washington. January 2014.

———. 2013a. *Toolkit for Preparing Five-Year Reviews*. Naval Facilities Engineering Command Northwest. April 2013.

———. 2013b. *Remedial Action Completion Report, Munitions and Explosives of Concern (MEC) Remedial Action, Jackson Park Housing Complex (JPHC), Upland Areas of Concern (AOC) 1, 2, and 3, Bremerton, Washington.* Prepared by USA Environmental, Inc. for Department of the Navy, Naval Facilities Engineering Command Northwest under Contract No. N62470-11-D-8007. July 2013

———. 2013c. *Land Use Control Management Plan, Operable Unit 3-Terrestrial, Jackson Park Housing Complex, Bremerton, Washington.* Prepared by URS Group, Inc., for Naval Facilities Engineering Command Northwest under Contract No. N44255-09-D-4001. March 2013.

———. 2013d. *Land Use Control Audit Report, Operable Unit 3-Terrestrial, Jackson Park Housing Complex, Bremerton, Washington.* Prepared by URS Group, Inc., for Naval Facilities Engineering Command Northwest under Contract No. N44255-09-D-4001, Delivery Order 0043. June 2013.

———. 2013e. *Proposed Plan for Management of Discarded Military Munitions Within Operable Unit 3T-Naval Hospital Base Bremerton, Bremerton, Washington.* September 2013.

———. 2013f. *Summer 2012 Final Long-Term Monitoring Report, Operable Unit 1, Jackson Park Housing Complex and Naval Hospital Bremerton, Bremerton, Washington.* Prepared by Sealaska Environmental Services, LLC for Naval Facilities Engineering Command Northwest under Contract No. N44255-09-D-4005. Silverdale, Washington. January 2013.

———. 2013g. *Spring 2012 to Winter 2013 Annual Inspection Report, Long-Term Monitoring for Operable Unit 1, Jackson Park Housing Complex/Naval Hospital Bremerton, Bremerton, Washington.* Prepared by Sealaska Environmental Services, LLC for Naval

Facilities Engineering Command Northwest under Contract No. N44255-09-D-4005. Silverdale, Washington. September 2013.

———. 2012a. *Final Focused Feasibility Study, Operable Unit 2, Jackson Park Family Housing/Naval Hospital Bremerton, Bremerton, Washington*. Prepared by URS Group, Inc. for Naval Facilities Engineering Command Northwest under Contract No. N44255-09-D-4001. June 2012.

———. 2012b. *Long-Term Monitoring Project Work Plan, Jackson Park Housing Complex and Naval Hospital Bremerton, Washington.* Prepared by Sealaska Environmental Services, LLC for Naval Facilities Engineering Command Northwest under Contract No. N44255-09-D-4005. Silverdale, Washington. January 2012.

———. 2012c. *2011/2012 Annual Inspection Report, Long-Term Monitoring for Operable Unit 1, Jackson Park Housing Complex/Naval Hospital Bremerton, Bremerton, Washington.* Prepared by Sealaska Environmental Services, LLC for Naval Facilities Engineering Command Northwest under Contract No. N44255-09-D-4005. Silverdale, Washington. August 2012.

———. 2012d. *Proposed Plan Cleanup Action at Benzene Release Area, Jackson Park Housing Complex/Naval Hospital Bremerton, Bremerton, Washington.* Naval Facilities Engineering Command Northwest. Silverdale, Washington. October 2012.

———. 2012e. *Stakeholder Meeting #1 Development of Analyte List for Human Health Shellfish Risk Assessment, Jackson Park Housing Complex/Naval Hospital Bremerton, Bremerton, Washington.* Prepared by URS Group, Inc. for Engineering Field Activity, Northwest, under Contract No. N44255-09-D-4001. Poulsbo, Washington. June 2012.

———. 2011a. *Policy for Conducting Five-Year Reviews.* June 7, 2011.

———. 2011b. *Second Five-Year Review, Jackson Park Housing Complex,/Naval Hospital Bremerton, Bremerton, Washington.* January 4, 2011. Executed by the Navy on January 5 and February 11, 2011.

———. 2011c. *Baseline Ecological Risk Assessment, Tier 2 Step 7, Risk Characterization, Draft Supplemental RI at Operable Unit 2, Jackson Park Housing Complex/Naval Hospital-Bremerton, Bremerton, Washington.* Prepared by Tetra Tech for Naval Facilities Engineering Command Northwest. September 2011.

———. 2011d. *Focused Feasibility Study, Benzene Release Area, Jackson Park Housing Complex/Naval Hospital Bremerton, Bremerton, Washington.* Prepared by URS Group, Inc. for Department of the Navy, Naval Facilities Engineering Command Northwest under Contract No. N44255-05-D-5100. October 2011.

———. 2011e. *Wetland Delineation and Plant Survey, Operable Unit 3 Terrestrial, Naval Hospital, Bremerton, Bremerton, Washington*. Prepared for Naval Facilities Engineering Command Northwest by URS Group, Inc. under Contact No. N44255-09-D- 4001, Delivery Order 0004. Silverdale, Washington. December 2011.

———. 2011f. *Summer 2011 Final Long-Term Monitoring Report, Operable Unit 1, Jackson Park Housing Complex and Naval Hospital Bremerton, Bremerton, Washington.* Prepared by Sealaska Environmental Services, LLC for Naval Facilities Engineering Command Northwest under Contract No. N44255-09-D-4005. Silverdale, Washington. December 2011.

———. 2011g. *Summer 2010 Final Long-Term Monitoring Report, Operable Unit 1, Jackson Park Housing Complex and Naval Hospital Bremerton, Bremerton, Washington.* Prepared by Sealaska Environmental Services, LLC for Naval Facilities Engineering Command Northwest under Contract No. N44255-09-D-4005. Silverdale, Washington. January 2011.

———. 2011h. *2010-2011 Annual Inspection Report, Long-Term Monitoring for Operable Unit 1, Jackson Park Housing Complex/Naval Hospital Bremerton, Bremerton, Washington.* Prepared by Sealaska Environmental Services, LLC for Naval Facilities.

———. 2010a. *Remedial Investigation/Feasibility Study Report, Operable Unit 3—Terrestrial, Jackson Park Housing Complex, Bremerton, Washington.* Prepared by Tetra Tech EC, Inc., for Naval Facilities Engineering Command Northwest under Contract No. N44255-01-D-2000, Task Order 50. January 2010.

———. 2010b. *Addendum to Remedial Investigation/Feasibility Study Report, Operable Unit 3—Terrestrial, Jackson Park Housing Complex, Bremerton, Washington.* Prepared by Tetra Tech EC, Inc., for Naval Facilities Engineering Command Northwest under Contract No. N62473-07-D-3211. January 2010.

———. 2010c. *Ecological Risk Assessment, Tier 2 Step 6, Sediment Chemistry and Toxicity Data Report, Phase 1 and Phase 2, Draft Supplemental RI at Operable Unit 2, Jackson Park Housing Complex/Naval Hospital-Bremerton, Bremerton, Washington.* Prepared by Tetra Tech for Department of the Navy, Naval Facilities Engineering Command Northwest. April 2010.

———. 2010d. *Ecological Risk Assessment, Tier 2 Step 6, Tissue Chemistry Data Report, Draft Supplemental RI at Operable Unit 2, Jackson Park Housing Complex/Naval*

Hospital-Bremerton, Bremerton, Washington. Prepared by Tetra Tech for Department of the Navy, Naval Facilities Engineering Command Northwest. May 2010.

———. 2010e. *Remedial Investigation/Feasibility Study Report, Operable Unit 3—Terrestrial, Naval Hospital Bremerton, Bremerton, Washington.* Prepared by Tetra Tech EC, Inc., for Naval Facilities Engineering Command Northwest under Contract No. N62473-07-D-3211, Task Order KR05. Silverdale, Washington. September 2010.

———. 2010f. *Closure Report for the Time-Critical Mound-Removal Action at Operable Unit 3 Terrestrial, Naval Hospital Bremerton*. Prepared for Naval Facilities Engineering Command Northwest by TetraTech EC, Inc. under Contract No. N62473-07-D-3211, TO KR05. Silverdale, Washington. March 2010.

———. 2010g. *Rev. 1, After-Action Report, Phase 2 Remedial Investigation and Pier Area Pilot Feasibility Study at Operable Unit 3 – Marine, Jackson Park Housing Complex/Naval Hospital Bremerton, Bremerton, Washington.* Prepared for Naval Facilities Engineering Command Northwest by TetraTech EC, Inc. under Contract No. N62473-07-D-3211, TO KR07. Silverdale, Washington. April 2010.

———. 2010h. *Proposed Plan, Discarded Military Munitions Removal and Education at Jackson Park Housing Complex, Jackson Park Housing Complex, Bremerton, Washington.* November 2010.

———. 2010i. *2009-2010 Annual Inspection Report, Long-Term Monitoring for Operable Unit 1, Jackson Park Housing Complex/Naval Hospital Bremerton, Bremerton, Washington.* Prepared by Sealaska Environmental Services, LLC for Naval Facilities Engineering Command Northwest under Contract No. N44255-09-D-4005. Silverdale, Washington. August 2010.

———. 2010j. *Human Health Risk Assessment of Shellfish Ingestion Ostrich Bay, Operable Unit 1, Jackson Park Family Housing and Naval Hospital Bremerton, Bremerton, Washington.* Prepared by URS Group, Inc., for Naval Facilities Engineering Command Northwest under Contract No. N44255-05-D-5100, Delivery Order 61. Silverdale, Washington. February 2010.

———. 2010k. *Technical Memorandum: Groundwater Sampling at Naval Hospital Bremerton, Washington*. Prepared by Sealaska Environmental Services, LLC for Naval Facilities Engineering Command Northwest under Contract No. N44255-09-D-4005. Silverdale, Washington. February 2010.

———. 2010l. *Technical Memorandum: Groundwater Sampling at Naval Hospital Bremerton, Washington*. Prepared by Sealaska Environmental Services, LLC for Naval Facilities

Engineering Command Northwest under Contract No. N44255-09-D-4005. Silverdale, Washington. August 2010.

———. 2009a. *Project-Specific Sampling and Analysis Plan, Additional Data Collection for Site-Wide Focused Feasibility Study at Benzene Release Area, Jackson Park Housing Complex/Naval Hospital Bremerton, Bremerton, Washington.* Prepared by URS Group, Inc. for Naval Facilities Engineering Command Northwest under Contract No. N44255-05-D-5100, DO 0014. November 2009.

———. 2009b. *Draft 2009 Long-Term Monitoring of Marine Tissue, Operable Unit 1, Jackson Park Housing Complex/ Naval Hospital Bremerton, Bremerton, Washington.* Prepared by URS Group Inc., for Naval Facilities Engineering Command Northwest under Contract No. N44255-05-D-5100. Silverdale, Washington. October 2009.

———. 2009c. *Construction Closure Report, Free Product Removal System, NEX Gas Station, Task Order KR02, Jackson Park Housing Complex, Naval Hospital Bremerton, Bremerton, Washington.* Prepared by AGVIQ-CH2M HILL Constructors, Inc. Joint Venture III for Naval Facilities Engineering Command Northwest under Contract No. N62470-08-D-1006. Silverdale, Washington. December 2009.

———. 2009d. *Phase 2 Remedial Investigation/Feasibility Study Work Plan, RI/FS at Operable Unit 3–Marine, Jackson Park Housing Complex/Naval Hospital Bremerton, Bremerton, Washington.* Prepared by TetraTech EC, Inc. for Naval Facilities Engineering Command Northwest under Contract No. N6 2473-07-D-3211, TO KR02. April 2009.

———. 2008a. *Community Relations Plan, Jackson Park Housing Complex/Naval Hospital Bremerton, Bremerton, Washington*. Prepared by URS Group, Inc., for Naval Facilities Engineering Command Northwest under Contract No. N44255-05-D-5100. July 2008.

———. 2008b. *Revision 1, Inspection and Maintenance Plan, Operable Unit 1, Jackson Park Housing Complex/Naval Hospital Bremerton, Bremerton, Washington.* Prepared by SES-TECH for Naval Facilities Engineering Command Northwest under Contract No. N44255-05-D-5101, Task Order 46. August 2008.

———. 2008c. *Underground Storage Tank Site Assessment Report, Naval Hospital Bremerton, Bremerton, Washington.* Prepared by Sound Environmental Strategies Corporation for Naval Facilities Engineering Command Northwest. Silverdale, Washington. November 2008.

———. 2008d. *Groundwater Sampling, Naval Hospital Bremerton, Washington*. Prepared by Environmental Management Services, LLC (EMS) for Naval Facilities Engineering Command Northwest. June 2008.

———. 2007a. *Technical Memorandum, Dual-Phase Extraction Pilot Test at the Benzene Release Area, Jackson Park Housing Complex/Naval Hospital Bremerton, Kitsap County, Washington.* Prepared by URS Group, Inc. for Naval Facilities Engineering Command Northwest under Contract No. N44255-05-D-5100, DO 0014. Silverdale, Washington. May 2007.

———. 2007b. *Phase 2 Remedial Investigation Work Plan, Jackson Park Housing Complex*. Prepared by Tetra Tech EC, Inc., for Naval Facilities Engineering Command Northwest under Contract No. N44255-01-D-2000, RAC 3/Task Order 63. April 2007.

———. 2006a. *Field Report, Installation of Groundwater Monitoring Wells at Benzene Release Area, Jackson Park Housing Complex/Naval Hospital Bremerton, Bremerton, Washington.* Prepared by URS Group, Inc. for Naval Facilities Engineering Command Northwest under Contract No. N44255-02-D-2008, DO 0011. March 2006.

———. 2006b. *Phase 1 Remedial Investigation/Feasibility Study Work Plan, RI/FS at Operable Unit 3–Marine, Jackson Park Housing Complex/Naval Hospital Bremerton, Bremerton, Washington.* Prepared by TetraTech EC, Inc. for Naval Facilities Engineering Command Northwest under Contract No. N44255-01-D-2000, TO 47. June 2006.

———. 2005a. *Phase 1 Remedial Investigation Field Work Summary Report, Jackson Park Housing Complex/Naval Hospital Bremerton*. Prepared by Tetra Tech FW, Inc., for Naval Facilities Engineering Command Northwest under Contract No. N44255-01-D-2000, RAC 3/Task Order 3. March 2005.

———. 2005b. *Phase 1 Remedial Investigation Field Work Summary Report, Jackson Park Housing Complex/Naval Hospital Bremerton.* Prepared by Tetra Tech Foster Wheeler, Inc. for U.S. Navy, Contract No. N44255-01-D-2000, RAC 3/Task Order 3. March 2005.

———. 2005c. *First Five-Year Review of Record of Decision, Jackson Park Housing Complex,/Naval Hospital Bremerton, Bremerton, Washington.* Prepared by URS Group, Inc., for NAVFAC NW under Contract No. N44255-02-D-2008, Delivery Order 0044. Dated August 26, 2005. Executed by the Navy on September 14 and October 27, 2005.

———. 2005d. *Land Use Control Plan, Jackson Park Housing Complex/Naval Hospital Bremerton, Bremerton, Washington*. Prepared by URS Group, Inc. for Naval Facilities

Engineering Command Northwest under Contract No. N44255-02-D-2008, DO 0044. August 2005.

———. 2005e. *Human Health Risk Evaluation on Marine Tissues, Jackson Park Housing Complex and Naval Hospital, Bremerton.* Prepared by The Environmental Company, Inc., CH2M HILL Constructors, Inc., & Pentec Environmental (TEC LTM Team) for Engineering Field Activity, Northwest. Poulsbo, Washington. August 2005.

———. 2003a. *Inspection and Maintenance Plan, Operable Unit 1, Jackson Park Housing Complex/Naval Hospital Bremerton, Washington*. Prepared by Foster Wheeler Environmental Corporation (Foster Wheeler) for Engineering Field Activity, Northwest. Poulsbo, Washington. March 2003.

———. 2003b. *Preliminary Assessment/Site Inspection. Operable Unit 3-Marine. Jackson Park Housing Complex/Naval Hospital Bremerton*. Prepared by Foster Wheeler Environmental Corporation for Contract No. N44255-01-D-2000, RAC III/ Task Order 10. April 2003.

———. 2003c. *Human Health Risk Evaluation on Marine Tissues, Jackson Park Housing Complex and Naval Hospital, Bremerton.* Prepared by The Environmental Company, Inc., CH2M HILL Constructors, Inc., & Pentec Environmental (TEC LTM Team) for Engineering Field Activity, Northwest. Poulsbo, Washington. April 2003.

———. 2002a. *Preliminary Assessment/Site Inspection, Remedial Investigation at Operable Unit 3—Terrestrial, Jackson Park Housing Complex/Naval Hospital Bremerton.* Prepared by Foster Wheeler Environmental Corporation for Engineering Field Activity, Northwest. Poulsbo, Washington, under Contract No. N44255-01-D-2000, RAC 3/Task Order 3. December 2002.

———. 2002b. *Archive Search Report. Jackson Park Housing Complex/Naval Hospital Bremerton.* Prepared by Foster Wheeler Environmental Corporation for Naval Facilities Engineering Command Northwest under Contract No. N44255-95-D-6030, RAC II/Delivery Order 54. April 2002.

———. 2002c. *Abandoned Ordnance Report, Volume 1: June 1998 through March 1999, Jackson Park Housing Complex/Naval Hospital Bremerton.* Prepared by Foster Wheeler Environmental Corporation for Naval Facilities Engineering Command Northwest under Contract No. N44255-95-D-6030, RAC II/Delivery Order 54. October 2002.

———. 2002d. *Remedial Action Closure Report, Remedial Action at Operable Unit 1, Sites 101, 101A, 103, and 110, Jackson Park Housing Complex/Naval Hospital Bremerton, Bremerton, Washington.* Prepared by Foster Wheeler Environmental Corporation for

Engineering Field Activity, Northwest, under Contract No. N44255-95-D-6030, Delivery Order 55. Poulsbo, Washington. October 2002.

———. 2002e. *Abandoned Ordnance Report, Volume 2: November 1999 through December 2001, Jackson Park Housing Complex/Naval Hospital Bremerton.* Prepared by Foster Wheeler Environmental Corporation for Naval Facilities Engineering Command Northwest under Contract No. N44255-95-D-6030, RAC II/Delivery Order 54. October 2002.

———. 2002f. *Long-Term Monitoring Project Work Plan, Jackson Park Housing Complex and Naval Hospital Bremerton, Washington.* Prepared by The Environmental Company, Inc., CH2M Hill Constructors, Inc., & Pentec Environmental (TEC LTM Team) for Engineering Field Activity, Northwest. Poulsbo, Washington. May 2002.

———. 2002g. *Closeout Report, Operable Unit 2, Marine Areas, Jackson Park Housing Complex/Naval Hospital, Bremerton.* Prepared by EA Engineering, Science, and Technology for Environmental Field Activity, Northwest. Poulsbo, Washington. September 2002.

———. 2001. *Post-ROD Groundwater Background Report, Jackson Park Housing Complex/Naval Hospital Bremerton.* Prepared by URS Group, Inc., for Engineering Field Activity, Northwest, under Contract No. N44255-00-D-2476. Poulsbo, Washington. March 2001.

———. 2000. *Data Summary Report for Benzene Source and Initial Conditions Investigation*. Prepared by URS Greiner, Inc., for Engineering Field Activity, Northwest, under CLEAN Contract No. N62474-89-D-9295. Poulsbo, Washington. September 2000.

———. 1998a. *Benzene Release Investigation Jackson Park Housing Complex Bremerton, Washington.* Prepared by Hart Crowser for Engineering Field Activity, Northwest. Poulsbo, Washington. June 1998.

———. 1998b. *Feasibility Study Report, Jackson Park Housing Complex/Naval Hospital Bremerton, Washington.* Prepared by URS Team for Engineering Field Activity, Northwest under Contract No. N62474-89-D-9295. Poulsbo, Washington. April 1998.

———. 1998c. *Remedial Investigation, Jackson Park Housing Complex/Naval Hospital Bremerton, Operable Unit 2, Marine Areas*. Prepared by EA Engineering, Science, and Technology for Environmental Field Activity, Northwest. Poulsbo, Washington. July 1998.

———. 1998d. *Treatability Study for Operable Unit 2, Marine Areas, Jackson Park Housing Complex/Naval Hospital Bremerton*. Prepared by EA Engineering, Science, and Technology for Engineering Field Activity, Northwest. Poulsbo, Washington. April 1998.

———. 1998e. *Feasibility Study Report. Jackson Park Housing Complex/Naval Hospital Bremerton, Operable Unit 2 – Marine Areas.* Prepared by EA Engineering, Science, and Technology for Engineering Field Activity, Northwest, under Contract No. N44255-94-D-7309. Poulsbo, Washington. July 1998.

———. 1998f. *Internal Draft Independent Remedial Action Report. Building 193 Demolition and UST Removal, Pre-Remedial Action at Operable Unit 1, Sites 101, 101A, 103, and 110, Jackson Park Housing Complex/Naval Hospital Bremerton, Bremerton, Washington.* Prepared by Foster Wheeler Environmental Corporation for U.S. Navy under Contract No. N44255-95-D-6030, RAC II/Delivery Order No. 0054. December 1998.

———. 1995. *Phase II Operable Unit 1 Remedial Investigation Supplemental Report, Jackson Park Housing Complex and Naval Hospital Sites 101, 101-A, and 103 Bremerton, Washington.* Prepared by URS Consultants, Inc., for Engineering Field Activity, Northwest, under Contract No. N62474-89-D-9295. Poulsbo, Washington. September 1995.

———. 1994a. *Phase I Remedial Investigation Report, Jackson Park Housing Complex, Sites 101, 101A, and 103, Bremerton, Washington.* Prepared by URS Consultants, Inc. for Engineering Field Activity, Northwest. Poulsbo, Washington. June 1994.

———. 1994b. *Phase II Remedial Investigation, Marine Investigation, Evaluation of Ostrich Bay Sediments, Jackson Park Housing Complex, Bremerton, Washington.* Prepared by URS Consultants, Inc. for Engineering Field Activity, Northwest, under CLEAN Contract No. N62474-89-D-9295. Poulsbo, Washington. December 1994.

———. 1994c. *Site 110 Final Site Inspection Report, Jackson Park Housing Complex.* Prepared by URS Consultants, Inc. for Engineering Field Activity, Northwest. Poulsbo, Washington. April 1994.

———. 1988. "Potential Hazardous Site Preliminary Assessment for Site 101 – Former Wastewater Outfall Area, Jackson Park, Bremerton, Washington." U.S. Environmental Protection Agency Form 2070-12 (7-81) completed by Hart Crowser for U.S. Navy, Naval Submarine Base, Bangor. March 1988.

———. 1983. *Navy Assessment and Control of Installation Pollutants: Initial Assessment Study of Naval Submarine Base Bangor Bremerton, Washington.* Naval Energy and Environmental Support Activity (NEESA). Port Hueneme, California. June 1983.

U.S. Navy and U.S. Environmental Protection Agency (USEPA). 2014a. *Record of Decision, Operable Unit 3 Terrestrial – Naval Hospital Bremerton, Naval Hospital Bremerton, Bremerton, Washington.* Executed on September 29, 2014.

———. 2014b. Statement of Informal Dispute, Operable Unit 2, Jackson Park Housing Complex (JPHC), Draft Final Proposed Plan. October 17, 2014.

———. 2013a. *Declaration of the Record of Decision Amendment No. 1, Operable Unit 1, NEX Gas Station Leak Area, Jackson Park Housing Complex/Naval Hospital Bremerton.* September 20, 2013.

———. 2013b. Statement of Informal Dispute, Operable Unit 3 Marine Jackson Park Housing Complex (JPHC), Draft Final Remedial Investigation Feasibility Study Report. July 22, 2013.

———. 2012. Statement of Resolution of Informal Dispute, Operable Unit 3 Terrestrial (OU-3T), Jackson Park Housing Complex, Bremerton, WA, Draft LAND USE CONTROL MANAGEMENT PLAN (LUC Management Plan). November 2012.

———. 2011. *Record of Decision, Operable Unit 3-Terrestrial, Jackson Park Housing Complex, Bremerton, Washington.* July 6, 2011.

———. 2004. Interagency Agreement Under CERCLA Section 120. IN THE MATTER OF: The U.S. Department of the Navy, Jackson Park Housing Complex, Naval Hospital Bremerton, Washington. Administrative Docket No. CERCLA-10-2005-0023. November 1, 2004.

U.S. Navy, Washington State Department of Ecology (Ecology), and U.S. Environmental Protection Agency (USEPA). 2000. *Declaration of the Record of Decision, Operable Unit 1, Jackson Park Housing Complex/Naval Hospital Bremerton, Washington.* August 8, 2000.

Washington State Department of Ecology (WDOE). 2012. *Trichloroethylene Toxicity* Information and MTCA Cleanup Levels. Available at https://fortress.wa.gov/ecy/clarc. September 2012.

APPENDIX A

Frequently Referenced Documents
(Attached as a Disk Appendix)

APPENDIX B

Data Tables

Table B-1
Summary of Analytical Results for Chlorinated VOCs in Seeps and Outfalls
From November 2002 Through July 2014

Site	Location	Sampling Date	1,1-DCE (µg/L)	TCE (µg/L)	Vinyl Chloride (µg/L)
		Remediation Goal	**1.93**	**55.6**	**2.92**
101	OF-709	06/25/02	0.5 U	0.5 U	0.5 U
		11/06/02	0.5 U	0.5 U	0.5 U
		06/16/03	0.5 U	0.5 U	0.5 U
		06/29/04	0.5 U	0.5 U	0.5 U
		11/16/04	0.5 U	0.5 U	0.5 U
		07/19/05	0.5 U	0.5 U	0.5 U
		08/07/06	0.5 U	0.5 U	0.5 U
		07/30/07	0.5 U	0.5 U	0.5 U
		07/30/08	0.5 U	0.5 U	0.5 U
		07/06/09	0.5 U	0.5 U	0.5 U
		07/14/10	0.5 U	0.5 U	0.5 U
		07/11/11	0.5 U	0.5 U	0.5 U
		07/17/12	None	None	None
		07/09/13	None	None	None
		07/14/14	None	None	None
103	SP-703	06/18/03	0.5 U	0.48 J	0.5 U
		07/01/04	0.5 U	0.49 J	0.5 U
		11/15/04	0.5 U	0.5	0.5 U
		07/20/05	0.5 U	0.77	0.5 U
		08/07/06	0.5 U	1.8	0.5 U
		07/31/07	0.5 U	1.2	0.5 U
		07/30/08	0.5 U	1.1	0.5 U
		07/07/09	0.5 U	1.7	0.5 U
		07/14/10	0.5 U	1.5	0.5 U
		07/12/11	0.5 U	0.98	0.5 U
		07/17/12	None	None	None
		07/09/13	None	None	None
		07/14/14	None	None	None
	OF-705[a]	11/06/02[b]	0.5 U	40	0.5 U
		06/16/03	0.5 U	19	0.5 U
		07/01/04	0.5 U	36	0.5 U
		11/15/04	0.5 U	26	0.5 U
		07/20/05	0.5 U	32	0.5 U
		07/30/07	0.5 U	46	0.21 J
		07/07/09	0.5 U	35	0.12 J

Table B-1 (Continued)
Summary of Analytical Results for Chlorinated VOCs in Seeps and Outfalls
From November 2002 Through July 2014

Site	Location	Sampling Date	1,1-DCE (µg/L)	TCE (µg/L)	Vinyl Chloride (µg/L)
		07/14/10	0.5 U	47	0.5 U
		07/12/11	0.5 U	34	0.5 U
		07/17/12	0.5 U	33	0.5 U
		07/09/13	0.5 U	27J	0.5 U
		07/14/14	0.5 U	22	0.5 U
	SP-707[c]	06/25/02	0.5 U	0.5 U	0.5 U
		11/06/02	0.5 U	0.5 U	0.5 U
		06/16/03	0.5 U	0.5 U	0.5 U
		06/29/04	0.5 U	0.5 U	0.5 U
		11/16/04	0.5 U	0.5 U	0.5 U
		07/19/05	0.5 U	0.5 U	0.5 U
		08/08/06	0.5 U	0.5 U	0.5 U

[a]Samples from this location were inadvertently not analyzed for chlorinated VOCs in 2006 and 2008.
[b]These data were not included in the fall 2002 long-term monitoring report (U.S. Navy 2003d). Data shown for this date and location were downloaded from the Naval Installation Restoration Information Solution database. The chain of custody confirms that a sample from this location was tested for chlorinated VOCs.
[c]No sample from this location was collected in 2007, 2008, and 2009 because salinity was greater than 1%, indicating the water was not representative of groundwater.

Notes:
DCE - dichloroethene
J - The result is an estimated concentration that is less than the MRL but greater than or equal to the MDL.
MDL - method detection limit
MRL - method reporting limit
µg/L - microgram per liter
TCE - trichloroethene
U - The compound was analyzed for, but was not detected ("nondetect") at or above the MRL/MDL.

Table B-2
Summary of Analytical Results for Benzene in Seeps and Outfalls
From November 2002 Through July 2014

Site	Location	Sampling Date	Benzene (µg/L)
		Remediation Goal	**43**
101	SP-710	06/25/02	0.5 U
		11/06/02	0.5 U
		06/30/03	0.5 U
		06/29/04	0.5 U
		11/15/04	0.5 U
		07/19/05	0.5 U
		08/08/06	0.5 U
		07/30/07	0.5 U
		07/30/08	0.5 U
		07/06/09	0.07 J
		07/14/10	0.50 U
		07/11/11	0.50 U
		07/17/12	0.070 J
		07/9/13	0.50 U
		07/14/14	0.50 U
	SP-711[a]	11/06/02	0.50 U
		06/30/04	0.50 U
		11/16/04	0.50 U
	OF-712	06/25/02	**150 J**
		11/05/02	**51**
		06/16/03	**90 J**
		06/29/04	**44**
		11/16/04	27
		07/19/05	**53**
		10/19/06	**50**
		07/30/07	**150**
		07/31/08	**67**
		07/06/09	**59**
		07/14/10	**91**
		07/11/11	**60**
		07/17/12	**63**
		07/9/13	25
		07/14/14	21

[a]No sample was collected from this location in summer 2002 and 2003 because of insufficient flow, and from summer 2005 to 2009 because salinity was greater than 1%, indicating the water was not representative of groundwater.

Table B-2 (Continued)
Summary of Analytical Results for Benzene in Seeps and Outfalls
From November 2002 Through July 2014

Notes:
Bolded value indicates it exceeds or is equal to the remediation goal.
J - The result is an estimated concentration that is less than the MRL but greater than or equal to the MDL.
MDL - method detection limit
MRL - method reporting limit
µg/L - microgram per liter
U - The compound was analyzed for, but was not detected (“nondetect”) at or above the MRL/MDL.

Table B-3
Summary of Analytical Results for Petroleum Hydrocarbons in Seeps and Outfalls From November 2002 Through July 2014

Site	Location	Sampling Date	GRO (µg/L)	DRO (µg/L)	RRO (µg/L)
		Remediation Goal	**1000**	**N/A**	**N/A**
101	SP-710	06/25/02	50 U	100 J	500 U
		11/06/02	50 U	250 U	500 U
		06/16/03	50 U	250 U	500 U
		06/29/04	250 U	240 U	480 U
		11/15/04	250 U	250 U	500 U
		07/19/05	250 U	250 U	500 U
		08/08/06	250 U	260 U	27 J
		07/30/07	250 U	260 U	520 U
		07/30/08	250 U	13 J	29 J
		07/06/09	250 U	620 Z	480 Z
		07/14/10	250 U	110 U	110 U
		07/11/11	250 U	260 U	23 J
		07/17/12	250 U	280 U	560U
		07/9/13	250 U	14 J	27 J
		07/14/14	250 U	24 J	57 J
	SP-711[a]	11/06/02	50 U	250 U	67 J
		06/30/04	250 U	240 U	65 J
		11/16/04	250 U	41 J	110 J
101-A	SP-715	06/25/02	50 U	250 UJ	500 UJ
		11/05/02	44 J	250 U	500 U
		06/16/03	50 U	250 U	500 U
		06/30/04	250 U	250 U	490 U
		11/15/04	250 U	250 U	500 U
		07/20/05	250 U	250 U	500 U
		08/07/06	17 J	250 U	500 U
		07/31/07	250 U	270 U	530 U
		07/31/08	250 U	24 J	32 J
		07/06/09	13 J	230 Z	170 U
		07/14/10	250 U	21 J	110 U
		07/11/11	14 J	20 J	24 J
		07/17/12	None	None	None
		07/9/13	None	None	None
		07/14/14	None	None	None

[a]No sample was collected from this location in summer 2002 and 2003 because of insufficient flow, and from summer 2005 to 2009 because salinity was greater than 1%, indicating the water was not representative of groundwater.

Notes:
DRO - diesel-range organics
GRO - gasoline-range organics
J - The result is an estimated concentration that is less than the MRL but greater than or equal to the MDL.
MDL - method detection limit

Table B-3 (Continued)
Summary of Analytical Results for Petroleum Hydrocarbons in Seeps and Outfalls From November 2002 Through July 2014

MRL - method reporting limit
μg/L - microgram per liter
N/A - not applicable
RRO - residual-range organics
U - The compound was analyzed for, but was not detected ("nondetect") at or above the MRL/MDL.
UJ - The compound was undetected, and the detection limit is estimated.
Z - The pattern of peaks present on the laboratory chromatograms is not indicative of diesel or motor oil.

Table B-4
Summary of Analytical Results for Chlordane in Seeps and Outfalls From November 2002 Through July 2014

Site	Location	Sampling Date	gamma-Chlordane (µg/L)	alpha-Chlordane (µg/L)	Total Chlordane (µg/L)
		Remediation Goal	**N/A**	**N/A**	**0.0022**
101-A	OF-716	06/25/02	0.048 U	0.048 U	**0.048 U**
		11/05/02	0.0096 U	0.0096 U	**0.0096 U**
		06/16/03	0.0096 U	0.0096 U	**0.0096 U**
		06/30/04	0.0096 U	0.0096 U	**0.0096 U**
		11/15/04	0.0098 U	0.0098 U	**0.0098 U**
		07/19/05	0.00048 U	0.00048 U	0.00048 U
		08/07/06	0.00049 Ui	0.00048 Ui	0.00049 Ui
		07/31/07	0.0098 U	0.0098 U	**0.0098 U**
		07/31/08	0.0005 U	0.0005 U	0.0005 U
		07/06/09	0.001 U	0.0009 Ui	0.001 U
		07/15/10	0.0005 U	0.0005 U	0.0005 U
		07/12/11	0.0005 U	0.0005 U	0.0005 U
		07/17/12	None	None	None
		07/9/13	None	None	None
		07/14/14	None	None	None
103	SP-703[a]	07/01/04	0.0096 U	0.0096 U	**0.0096 U**
		11/15/04	0.0097 U	0.0097 U	**0.0097 U**
		07/20/05	0.00049 U	0.00049 U	0.00049 U
		08/07/06	0.00048 Ui	0.00048 Ui	0.00048 Ui
		07/31/07	0.0098 U	0.0098 U	**0.0098 U**
		07/30/08	0.00049 U	0.00049 U	0.00049 U
		07/07/09	0.00097 U	0.00087 U	0.00097 U
		07/14/10	0.0005 U	0.0005 U	0.0005 U
		07/12/11	0.0005 U	0.0005 U	0.0005 U
		07/17/12	None	None	None
		07/9/13	None	None	None
		07/14/14	None	None	None
	OF-705	06/25/02	0.048 U	0.048 U	**0.048 U**
		11/06/02	0.0096 U	0.0096 U	**0.0096 U**
		06/16/03	0.0096 U	0.0096 U	**0.0096 U**
		07/01/04	0.0096 U	0.0096 U	**0.0096 U**
		11/15/04	0.010 U	0.010 U	**0.010 U**
		07/20/05	0.00049 U	0.00049 U	0.00049 U
		08/07/06	0.00048 Ui	0.00048 Ui	0.00048 Ui
		07/30/07	0.00045 J	0.0098 U	**0.0098 U**

Table B-4 (Continued)
Summary of Analytical Results for Chlordane in Seeps and Outfalls
From November 2002 Through July 2014

Site	Location	Sampling Date	gamma-Chlordane (µg/L)	alpha-Chlordane (µg/L)	Total Chlordane (µg/L)
		07/31/08	0.00049 U	0.00049 U	0.00049 U
		07/07/09	0.00098 U	0.00088 U	0.00098 U
		07/14/10	0.00039 J	0.00061 U	0.00039 J
		07/12/11	0.0005 U	0.00088 Ui	0.00098 Ui
		07/17/12	None	None	None
		07/09/13	None	None	None
		07/14/14	None	None	None
	SP-707[b]	06/25/02	0.048 U	0.048 U	**0.048 U**
		11/06/02	0.0096 U	0.0096 U	**0.0096 U**
		06/16/03	0.01 U	0.0097 U	**0.01 U**
		06/29/04	0.0098 U	0.0098 U	**0.0098 U**
		11/16/04	0.0098 U	0.0098 U	**0.0098 U**
		07/19/05	0.0017 U	0.00049 U	0.0017 U
		08/08/06	0.0000096 Ui	0.0000096 Ui	0.0000096 Ui

[a]No sample from this location was analyzed for pesticides in 2003. No explanation for this omission was identified.
[b]No sample was collected from this location in 2007, 2008, and 2009 because salinity was greater than 1%, indicating the water was not representative of groundwater.

Notes:
Bolded value indicates it exceeds or is equal to the remediation goal.
J - The result is an estimated concentration that is less than the MRL but greater than or equal to the MDL.
MDL - method detection limit
MRL - method reporting limit
µg/L - microgram per liter
N/A - not applicable
U - The compound was analyzed for, but was not detected (“nondetect”) at or above the MRL/MDL.
Ui - The compound was analyzed for, but was not detected (“nondetect”) at or above the MRL/MDL. The MRL/MDL was elevated because of a chromatographic interference.

Table B-5
Summary of Analytical Results for Metals and Cyanide in Seeps and Outfalls From November 2002 Through July 2014

Site	Location	Sampling Date	Total Metals (µg/L)				Dissolved Metals (µg/L)					Cyanide (mg/L)
			Arsenic	Beryllium	Mercury	Thallium	Copper	Lead	Nickel	Silver	Zinc	
Remediation Goal			**3.7**	**0.0793**	**0.1**	**1.56**	**4.8 (2.5)[d]**	**5.8**	**7.9**	**1.2**	**81(76.6)[d]**	**0.001**
101	OF-709	06/25/02	0.97 J	0.044	**0.1 U**	0.007 J	2.9 J	0.276 UJ	0.2 J	0.01 UJ	6.2	**0.01 U**
		11/06/02	1.21 J	0.072 J	**0.1 U**	0.011	1.06 J	0.019 U	0.33	0.01 U	10.8 J	**0.01 U**
		06/16/03	1.08 J	0.014 J	**0.1 U**	0.005 J	1.26	0.02 U	0.33	0.008 U	12.2	**0.01 U**
		06/29/04	1.63 J	0.058 J	0.04 U	0.007 J	0.874	0.028	0.29	0.005 U	13.6	**0.01 U**
		11/16/04	0.73 J	0.023	0.06 U	0.004 U	1.25	0.023	0.28	0.005 U	6.86	**0.01 U**
		07/19/05	0.4 J	0.0077 J	0.08 U	0.02 U	0.724	0.008 U	0.3	0.002 U	3.24	**0.08**
		08/07/06	0.39 J	0.0069 J	0.02 U	0.0008 U	1.56	0.013 J	0.42	0.02 U	7.47	**0.007 J**
		07/30/07	1.12	0.003 U	0.03 U	0.02 U	1.04	0.031 U	0.38	0.02 U	2.21 J	**0.01 U**
		07/30/08	0.7 U	0.04 U	0.05 U	0.005 U	1.7	0.022	3.32	0.009 J	4.96	**0.01 U**
		07/06/09	1.58	0.020 U	**0.2 U**	0.02 U	1.16	0.030 U	0.71	0.030 U	1.40 U	**0.01 U**
		07/14/10	2.3	0.026 J	**0.20 UJ**	0.03 U	1.1	0.088	0.49	0.030 U	1.9	**0.01 U**
		07/11/11	3	**0.15U**	**0.2 U**	0.15 U	1.34	0.15 U	1.10 J	0.15 U	2.23 J	**0.01 U**
		07/17/12	None	None	None	None	None	None	None	None	None	**0.01 U**
		07/09/13	None	None	None	None	None	None	None	None	None	**0.01 U**
		07/14/14	None	None	None	None	None	None	None	None	None	**0.01 U**
	SP-710	06/25/02	1.52 J	0.046	**0.1 U**	0.013 J	0.84 UJ	0.094 UJ	0.3 J	0.01 UJ	1.1	**0.01 U**
		11/06/02	0.2 J	0.011 J	**0.1 U**	0.006	0.26 J	0.03 U	0.5	0.01 U	0.5 J	**0.01 U**
		06/16/03	0.44 J	0.004 J	**0.1 U**	0.005 J	0.18	0.02	0.41	0.014 U	0.8	**0.01 U**
		06/29/04	0.86 J	0.013 J	0.04 U	0.008 J	0.542	0.048	0.4	0.005 U	0.57	**0.01 U**
		11/15/04	0.42 J	0.003 U	0.06 U	0.002 U	0.25	0.043	0.4	0.005 U	0.57	**0.01 U**
		07/19/05	0.56 J	0.0095 J	0.08 U	0.02 U	0.616	0.022	0.66	0.003 J	1.11	**0.04**
		08/08/06	0.43 J	0.0046 J	0.02 U	0.0008 U	0.33	0.009 J	0.61	0.02 U	0.59	**0.01 U**
		07/30/07	0.82	0.003 U	0.03 U	0.02 U	0.29	0.022 U	0.89	0.02 U	0.57 UJ	**0.01 U**
		07/30/08	0.7 U	0.04 U	0.05 U	0.007 U	0.62	0.033	3.41	0.009 U	1.74 U	**0.01 U**
		07/06/09	1.76	0.020 U	**0.2 U**	0.02 U	0.33 U	0.030 U	1.05	0.030 U	0.63 U	**0.01 U**

Table B-5 (Continued)
Summary of Analytical Results for Metals and Cyanide in Seeps and Outfalls From November 2002 Through July 2014

Site	Location	Sampling Date	Total Metals (µg/L)				Dissolved Metals (µg/L)					Cyanide (mg/L)
			Arsenic	Beryllium	Mercury	Thallium	Copper	Lead	Nickel	Silver	Zinc	
Remediation Goal			3.7	0.0793	0.1	1.56	4.8 (2.5)[d]	5.8	7.9	1.2	81(76.6)[d]	0.001
		07/14/10	1.2 U	0.010 J	**0.20 UJ**	0.252	0.52	0.015 J	0.72	0.030 U	0.8 J	**0.01 U**
		07/11/11	1.6	0.030 U	**0.20 U**	0.030 U	0.69	0.048	1.04	0.030 U	0.54J	**0.01 U**
		07/17/12	None	None	None	None	None	None	None	None	None	**0.01 U**
		07/9/13	None	None	None	None	None	None	None	None	None	**0.02**
		07/14/14	None	None	None	None	None	None	None	None	None	**0.01 U**
	SP-711[a]	11/06/02[b]	2.91 J	**0.151 J**	**0.34**	0.07	0.91 J	0.044 U	1.26	0.03 U	4.3 J	**0.01 U**
		06/30/04	1.41 J	0.014 J	0.04 U	0.014 J	0.76	0.148	1.46	0.005 J	2.78	**0.01 U**
		11/16/04	2.64 J	0.071	**0.12 J**	0.016 J	1.24	0.026	0.91	0.033	4.35	**0.01 U**
	OF-712	06/25/02	0.69 J	0.002 J	**0.1 U**	0.002 U	0.13 UJ	0.018 UJ	0.3 J	0.01 UJ	0.4 U	**0.01 U**
		11/05/02[b]	0.8 J	0.004 J	**0.1 U**	0.002 J	0.13 J	0.011 U	1.3	0.01 U	1 J	**0.01 U**
		06/16/03	0.88 J	0.006 UJ	**0.1 U**	0.004 U	0.08 J	0.05	0.63	0.014 U	0.4 J	**0.006 J**
		06/29/04	0.9 J	0.015 J	0.04 U	0.001 U	0.135	0.009 U	0.66	0.005 U	0.65	**0.01 U**
		11/16/04	1.04 J	0.006 J	0.06 U	0.001 U	0.11	0.009 U	0.62	0.005 U	0.28 J	**0.01 U**
		07/19/05	0.34 J	0.0024 J	**0.2 U**	0.02 U	0.048 J	0.008 U	0.82	0.002 U	0.29 J	**0.06**
		08/08/06	0.48 J	0.0036 J	0.02 U	0.0008 U	0.06 J	0.061	0.84	0.023 U	0.52	**0.003 J**
		07/30/07	1.6	0.003 U	0.03 U	0.02 U	0.22	0.056 U	1.06	0.02 U	0.95 UJ	**0.01 U**
		07/31/08	0.7 U	0.04 U	0.05 U	0.005 U	1.78	0.045	5.5	0.02	3.31 U	**0.01**
		07/06/09	2.19	0.020 U	**0.2 U**	0.02 U	0.37 U	0.031 U	1.25	0.030 U	0.76 U	**0.01 U**
		07/14/10	1.2	0.030 U	**0.20 UJ**	0.030 U	0.19 J	0.043	0.86	0.030 U	0.4 U	**0.01 U**
		07/11/11	2.1	0.030 U	**0.20 U**	0.030 U	0.43	0.028 J	1.92	0.030 U	0.93	**0.01 U**
		07/17/12	None	None	None	None	None	None	None	None	None	**0.01 U**
		07/9/13	None	None	None	None	None	None	None	None	None	**0.044**
		07/14/14	None	None	None	None	None	None	None	None	None	**0.01 U**
	SP-713	06/25/02	0.49 J	**0.104**	**0.1 U**	0.01 J	0.18 UJ	0.049 UJ	0.3 J	0.01 UJ	0.6 U	**0.004 J**
		11/05/02[b]	1.31 J	0.066 J	**0.1 U**	0.019 J	0.43 J	0.024 U	0.43	0.01 U	1.1 J	**0.01 U**

Table B-5 (Continued)
Summary of Analytical Results for Metals and Cyanide in Seeps and Outfalls From November 2002 Through July 2014

Site	Location	Sampling Date	Total Metals (µg/L)				Dissolved Metals (µg/L)					Cyanide (mg/L)
			Arsenic	Beryllium	Mercury	Thallium	Copper	Lead	Nickel	Silver	Zinc	
Remediation Goal			**3.7**	**0.0793**	**0.1**	**1.56**	**4.8 (2.5)[d]**	**5.8**	**7.9**	**1.2**	**81(76.6)[d]**	**0.001**
		06/16/03	0.4 J	0.01 J	**0.1 U**	0.005 J	0.23	0.02 U	0.42	0.008 U	0.8	**0.01 U**
		06/30/04	0.44 J	0.012 J	0.04 U	0.006 J	0.14	0.077	0.48	0.005 U	0.57	**0.01 U**
		11/16/04	0.55 J	0.015 J	0.06 U	0.009 J	0.22	0.014 J	0.36	0.005 U	0.9	**0.01 U**
		07/20/05	0.9 J	0.01 J	0.08 U	0.004 U	0.51 J	0.03 J	2.49	0.004 U	1.76	**0.01**
		08/08/06	0.79	0.02 U	0.02 U	0.003 U	0.61	0.015 J	0.79	0.004 U	4.2 J	**0.01 U**
		07/31/07	0.58	0.003 U	0.03 U	0.02 U	0.2	0.02 U	0.74	0.003 U	0.66 UJ	**0.01 U**
		07/31/08	0.7 U	0.04 U	0.05 U	0.006 J	0.39	0.015 J	3.81	0.009 U	1.45 U	**0.01 U**
		07/07/09	0.5 J	0.020 U	**0.2 U**	0.02 U	0.24 U	0.030 U	1.13	0.030 U	0.50 U	**0.01 U**
		07/14/10	0.5 U	0.030 U	**0.20 UJ**	0.030 U	0.22 J	0.030 U	0.71	0.030 U	0.4 J	**0.01 U**
		07/12/11	0.55	0.030 U	**0.20 U**	0.030 U	0.68	0.030 U	1.19	0.030 U	2.91	**0.01 U**
		07/17/12	None	None	None	None	None	None	None	None	None	**0.01 U**
		07/9/13	None	None	None	None	None	None	None	None	None	**0.005 J**
		07/14/14	None	None	None	None	None	None	None	None	None	**0.01 U**
101-A	SP-715	06/25/02	1.02 J	0.002 U	**0.1 U**	0.002 U	0.1 UJ	0.019 UJ	0.5 J	0.01 UJ	10.4	**0.01 U**
		11/05/02[b]	2.36 J	0.004 J	**0.1 U**	0.004 J	0.21 J	0.019 U	0.89	0.01 U	21 J	**0.01 U**
		06/16/03	0.65 J	0.006 UJ	**0.1 U**	0.004 U	0.14	0.02 U	0.59	0.008 U	12.4	**0.01 U**
		06/30/04	1.09 J	0.002 UJ	0.04 U	0.001 U	0.07 J	0.023	0.74	0.005 U	12.5	**0.01 U**
		11/15/04	1.29 J	0.002 U	0.06 U	0.001 U	0.27	0.009 U	0.84	0.005 U	13.9	**0.01 U**
		07/20/05	0.83 J	0.002 J	0.08 U	0.02 U	0.093 J	0.008 U	0.73	0.002 U	14.9	**0.02**
		08/07/06	1.76	0.02 U	0.02 U	0.003 U	0.22	0.03	0.78	0.004 U	21.2 J	**0.01 U**
		07/31/07	1.62	0.003 U	0.03 U	0.02 U	0.17 J	0.021 U	0.82	0.02 U	24.5 J	**0.004 J**
		07/31/08	1.7 J	0.04 U	0.05 U	0.005 U	0.27	0.024	3.68	0.072	80.4	**0.01 U**
		07/06/09	1.67	0.020 U	**0.2 U**	0.02 U	0.16 U	0.030 U	1.1	0.030 U	46.6	**0.01 U**
		07/14/10	1.9	0.030 U	**0.20 UJ**	0.030 U	0.17 J	0.012 J	0.76	0.030 U	33.3	**0.01 U**
		07/11/11	1.3	0.030 U	**0.2 U**	0.030 U	0.48	0.071	1.08	0.030 U	30.8	**0.01 U**
		07/17/12	None	None	None	None	None	None	None	None	None	**0.01 U**

Table B-5 (Continued)
Summary of Analytical Results for Metals and Cyanide in Seeps and Outfalls From November 2002 Through July 2014

Site	Location	Sampling Date	Total Metals (µg/L)				Dissolved Metals (µg/L)					Cyanide (mg/L)
			Arsenic	Beryllium	Mercury	Thallium	Copper	Lead	Nickel	Silver	Zinc	
Remediation Goal			**3.7**	**0.0793**	**0.1**	**1.56**	**4.8 (2.5)[d]**	**5.8**	**7.9**	**1.2**	**81(76.6)[d]**	**0.001**
		07/9/13	None	None	None	None	None	None	None	None	None	**0.01 U**
		07/14/14	None	None	None	None	None	None	None	None	None	**0.01 U**
	OF-716	06/25/02	0.5 J	0.002 J	**0.1 U**	0.002 U	0.35 UJ	0.06 UJ	0.3 J	0.01 UJ	1.1	**0.01 U**
		11/05/02[b]	0.51 J	0.003 J	**0.1 U**	0.005 J	0.27 J	0.031 U	0.49	0.01 U	1.2 J	**0.01 U**
		06/16/03	0.64 J	0.003 UJ	**0.1 U**	0.003 J	0.46	0.05	0.59	0.01 U	1.3	**0.01 U**
		06/30/04	0.56 J	0.002 UJ	0.04 U	0.001 U	0.29	0.009 U	0.56	0.005 U	0.62	**0.01 U**
		11/15/04	0.49 J	0.001 U	0.06 U	0.001 U	0.76	0.021	0.59	0.005 U	1.38	**0.01 U**
		07/19/05	0.46 J	0.0011 J	0.08 U	0.02 U	0.3	0.009 J	0.69	0.002 U	1.09	**0.1**
		08/07/06	0.57 J	0.0029 J	0.02 U	0.0008 U	0.23	0.017 J	0.63	0.048 U	1.06	**0.01**
		07/31/07	1.02	0.003 U	0.03 U	0.02 U	1.34	0.048 U	0.79	0.02 U	1.79 J	**0.005 J**
		07/31/08	0.7 U	0.04 U	0.05 U	0.017 J	0.58	0.023	2.51	0.009	2.91	**0.002 J**
		07/06/09	1.06	0.020 U	**0.2 U**	0.02 U	0.76	0.030 U	1.05	0.030 U	1.68 U	**0.01 U**
		07/15/10	1.1 U	0.007 J	**0.20 UJ**	0.030 U	0.42 U	0.011 J	0.73	0.030 U	2	**0.01 U**
		07/12/11	1.1	0.030 U	**0.20 U**	0.030 U	0.52	0.030 U	1.22	0.030 U	2.07	**0.01 U**
		07/17/12	None	None	None	None	None	None	None	None	None	**0.01 U**
		07/9/13	None	None	None	None	None	None	None	None	None	**0.01 U**
		07/14/14	None	None	None	None	None	None	None	None	None	**0.01 U**
103	SP-703	06/16/03	0.37 J	0.004 J	**0.19 U**	0.017 J	0.19	0.04	0.97	0.008 U	0.7	**0.01 U**
		07/01/04	0.32 J	0.001 UJ	0.04 U	0.001 U	0.12	0.013 J	1.14	0.005 U	0.17 J	**0.01 U**
		11/15/04	0.27 J	0.002 U	0.06 U	0.01 J	0.17	0.049	1.17	0.005 U	0.34 J	**0.01 U**
		07/20/05	0.6 J	0.008 U	0.08 U	0.004 U	0.43 J	0.026 J	2.35	0.004 U	0.34 J	**0.05**
		08/07/06	0.51	0.02 U	0.02 U	0.003 U	0.24	0.014 J	1.23	0.004 U	5.3 J	**0.01 U**
		07/31/07	0.38 J	0.003 U	0.03 U	0.02 U	0.26	0.043 U	1.31	0.003 U	1.24 UJ	**0.01 U**
		07/30/08	0.7 U	0.04 U	0.05 U	0.009 J	0.34	0.02 J	2.98	0.009 U	1.43 U	**0.01 U**
		07/07/09	0.44 J	0.020 U	**0.2 U**	0.02 U	0.23 U	0.030 UJ	1.67	0.030 U	0.53 U	**0.01 U**
		07/14/10	0.5 U	0.030 U	**0.20 UJ**	0.030 U	0.19 J	0.012 J	1.34	0.030 U	0.8 U	**0.01 U**

Table B-5 (Continued)
Summary of Analytical Results for Metals and Cyanide in Seeps and Outfalls From November 2002 Through July 2014

Site	Location	Sampling Date	Total Metals (µg/L)				Dissolved Metals (µg/L)					Cyanide (mg/L)
			Arsenic	Beryllium	Mercury	Thallium	Copper	Lead	Nickel	Silver	Zinc	
Remediation Goal			**3.7**	**0.0793**	**0.1**	**1.56**	**4.8 (2.5)[d]**	**5.8**	**7.9**	**1.2**	**81(76.6)[d]**	**0.001**
		07/12/11	0.51	0.030 U	**0.20 U**	0.030 U	0.35	0.032	1.63	0.030 U	0.8	**0.01 U**
		07/17/12	None	None	None	None	None	None	None	None	None	**0.01 U**
		07/09/13	None	None	None	None	None	None	None	None	None	**0.004 J**
		07/14/14	None	None	None	None	None	None	None	None	None	**0.01 U**
	OF-705	06/25/02	0.34 UJ	0.003 J	**0.1 U**	0.005 J	0.35 UJ	0.031 UJ	0.6 J	0.01 UJ	4.3	**0.01**
		11/06/02	0.58 J	0.003 J	**0.1 U**	0.004	1.53 J	0.066 U	1.37	0.02 U	10.7 J	**0.01 U**
		06/16/03	0.43 J	0.004 J	**0.1 U**	0.011 J	0.22	0.04	1.19	0.008 U	4.4	**0.01 U**
		07/01/04	0.75 J	0.002 UJ	0.04 U	0.002 U	0.53	0.009 U	2.15	0.005 U	9.31	**0.01 U**
		11/15/04	0.97 J	0.003 U	0.06 U	0.004 U	1.9	0.064	1.43	0.005 U	15.2	**0.01 U**
		07/20/05	0.56 J	0.0018 J	0.08 U	0.02 U	0.625	0.008 U	1.22	0.002 J	5	**0.03**
		08/07/06	0.61 J	0.0037 J	0.02 U	0.0008 U	0.45	0.02	1.16	0.063 U	4.94	**0.01 U**
		07/30/07	1.72	0.003 U	0.03 U	0.02 U	0.76	0.556	1.03	0.02 U	5.42 J	**0.01 U**
		07/31/08	1.1 J	0.04 U	0.05 U	0.005 U	3.65	0.036	**10.5**	0.052 U	10.8	**0.01 U**
		07/07/09	2.61	0.020 U	**0.2 U**	0.02 U	0.81	0.046 U	1.94	0.030 U	7.18	**0.01 U**
		07/14/10	0.9 U	0.030 U	**0.20 UJ**	0.030 U	0.36 U	0.011 J	1.23	0.030 U	3.9	**0.01 U**
		07/12/11	1.5	0.030 U	**0.20 U**	0.030 U	0.65	0.56 U	1.48	0.030 U	4.36	**0.01 U**
		07/17/12	1.6	0.007 J	**0.02 J**	0.030 U	0.86	0.031	1.4	0.030 U	4.82	**0.01 U**
		07/09/13	0.72	0.020 U	**0.20 U**	0.020 U	0.22	0.007 J	0.74	0.020 U	2.46	**0.011**
		07/14/14	1.2	0.020 U	**0.20 U**	0.020 U	0.85	0.036	2.0	0.020 U	6.7	**0.01 U**
	SP-707[c]	06/25/02	1.03 J	0.046	**0.1 U**	0.067	0.37 UJ	0.047 UJ	1.8 J	0.03 UJ	13.3	**0.01 U**
		11/06/02	2.46 J	**0.097 J**	**0.2**	0.043	0.4 J	0.023 U	1.62	0.03 U	1.4 J	**0.01 U**
		06/16/03	**4.05 J**	**0.083 J**	**0.61 U**	0.031	0.79	0.03	1.09	0.075	0.8	**0.01 U**
		06/29/04	2.45 J	0.034 J	0.04 U	0.007 J	0.291	0.124	1.32	0.031	0.65	**0.01 U**
		11/16/04	1.54 J	0.016 J	0.06 U	0.005 U	0.57	0.009 U	2.03	0.005 U	2.72	**0.01 U**
		07/19/05	1.4 J	0.0339	**0.2 U**	0.0197 J	1.35	0.036	2.68	0.008 J	6.78	**0.03**
		08/08/06	1.28 J	0.0039 J	0.02 U	0.0143 J	0.28	0.033	1.28	0.055 U	0.52	**0.01 U**

Table B-5 (Continued)
Summary of Analytical Results for Metals and Cyanide in Seeps and Outfalls From November 2002 Through July 2014

[a]No sample was collected from this location in summer 2002 and 2003 because of insufficient flow, and from summer 2005 to 2009 because salinity was greater than 1%, indicating the water was not representative of groundwater.
[b]Data from these locations and dates were obtained from the Naval Installation Restoration Information Solution (NIRIS) database and not the fall 2002 long-term monitoring report (U.S. Navy 2003d). Analytical results from these two sources were not consistent. Based on a review of the chain-of-custody forms, the values in NIRIS appear to be correct.
[c]No sample was collected from this location in 2007, 2008, and 2009 because salinity was greater than 1%, indicating the water was not representative of groundwater.
[d]Basis of cleanup level was revised from the Washington State AWQC at the time of the metals background study (U.S. Navy 2001) to the current Washington State AWQC during the second 5-year review. Dissolved copper is based on acute exposure.

Notes:
Bolded value indicates it exceeds or is equal to the remediation goal.
J - The result is an estimated concentration that is less than the MRL but greater than or equal to the MDL.
MDL - method detection limit
MRL - method reporting limit
µg/L - microgram per liter
mg/L - milligram per liter
U - The compound was analyzed for, but was not detected (“nondetect”)

Table B-6
Groundwater Sampling Results for DRO and RRO, Site 110, Naval Hospital Bremerton

Well Location	Analyte and Sample Date			
	DRO 6/17/2008 (µg/L)	**DRO 10/16/2009 (µg/L)**	**DRO 7/15/2010 (µg/L)**	**RRO 7/15/2010 (µg/L)**
MW-1	200 U	110 U	NA	NA
MW-1 Duplicate	NA	110 U	NA	NA
MW-3	200 U	110 U	NA	NA
SB-7	200 U	**740 HJ**	NA	NA
SB-7 Duplicate	200 U	NA	NA	NA
SB-7 (After redevelopment)	NA	NA	110 U	110 U
MTCA Method A Cleanup Level	500	500	500	500

Notes:
Bolded value indicates it exceeds or is equal to the cleanup level.
µg/L - micrograms per liter
U - The compound was undetected (“nondetect”) at or above the MRL shown.
J - The result is an estimated concentration that is less than the MRL, but greater than or equal to the MDL
H - The result is within the diesel range, however the chromatogram indicates that the reported concentration is due to the presence of heavy oil petroleum.
MDL - method detection limit
MRL - method reporting limit
NA - not analyzed

Table B-7
Groundwater Sampling Results for Benzene, Toluene, Ethylbenzene, and Xylenes, Site 110, Naval Hospital Bremerton

Well Location	Sample Date	Analyte Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (µg/L)
MW-1	10/16/2009	0.50 U	0.28 J	0.50 U	0.50 U
MW-1 Duplicate	10/16/2009	0.50 U	0.17 J	0.50 U	0.50 U
MW-3	10/16/2009	0.50 U	0.22 J	0.50 U	0.50 U
SB-7	10/16/2009	0.50 U	0.25 J	0.50 U	0.50 U
MTCA Method A Cleanup Level	--	5	1000	700	1000

Notes:
µg/L - micrograms per liter
U - The compound was undetected (“nondetect”) at or above the MRL shown.
J - The result is an estimated concentration that is less than the MRL, but greater than or equal to the MDL.
MDL - method detection limit
MRL - method reporting limit

Table B-8
Summary of 2013 Soil, Groundwater, and Soil Gas Exceedances Detected at OU 1 JPHC During Focused Phase II SI Performed as Part of Due Diligence Inquiries (Landau 2013)

Area	Media	Sample/Depth (ft bgs)	Chemical	Result	Screening Level[a]	Unit	ROD RG	Current LTM Reporting Limit/Method Detection Limit
Root Court Underground Storage Tanks	Soil	RC-4 (7.5-9.0)	TPH-C	470	200	mg/kg	--	NA
	GW	RC-3	Cyanide	0.009	0.005	mg/L	0.001	0.01
		RC-4	Cyanide	0.013	0.005	mg/L	0.001	0.01
		RC-5	Cyanide	0.016	0.005	mg/L	0.001	0.01
	Soil Gas[b]	RC-1	1,3-Butadiene	94	2.78	µg/m3	NA	NA
		RC-2	1,3-Butadiene	53	2.78	µg/m3	NA	NA
		RC-1	Benzene	31	10.7	µg/m3	NA	NA
		RC-2	Benzene	18	10.7	$\mu g/m^3$	NA	NA
Root Court Construction Debris Landfill	Soil	RC-9 (10-11)	TPH-D	300	200	mg/kg	--	NA
		RC-9 (10-11)	TPH-O	2,400	2,000	mg/kg	--	NA
		RC-9 (10-11)	TPH-C	760	200	mg/kg	--	NA
		RC-11 (20.5-21.5)	TPH-C	290	200	mg/kg	--	NA
		RC-9 (10-11)	cPAH	179	140	µg/kg	137	NA
	GW	RC-10	RDX	1.2	0.8	µg/L	--	NA
	Soil Gas[b]	RC-8	1,3-Butadiene	67	2.78	µg/m3	NA	NA
		RC-11	1,3-Butadiene	12	2.78	µg/m3	NA	NA
		RC-8	Benzene	25	10.7	µg/m3	NA	NA
		RC-11	Benzene	12	10.7	µg/m3	NA	NA
Bldg. 575	Soil Gas[b]	RC-14	1,3-Butadiene	42	2.78	µg/m3	NA	NA
		RC-15	1,3-Butadiene	110	2.78	µg/m3	NA	NA
		RC-14	Benzene	26	10.7	µg/m3	NA	NA
		RC-15	Benzene	36	10.7	µg/m3	NA	NA
		RC-14	Chloroform	130	3.62	µg/m3	NA	NA

Table B-8 (Continued)
Summary of 2013 Soil, Groundwater, and Soil Gas Exceedances Detected at OU 1 JPHC During Focused Phase II SI Performed as Part of Due Diligence Inquiries (Landau 2013)

Area	Media	Sample/Depth (ft bgs)	Chemical	Result	Screening Level[a]	Unit	ROD RG	Current LTM Reporting Limit/Method Detection Limit
Seeps adjacent to Root Court	GW	Seep 1	Mercury	41.9	25	ng/L	25/100[c]	200/20
		Seep 2	Mercury	66.7	25	ng/L	25/100[c]	200/20
Stream	SW	Stream Sample	Copper	0.008	0.0024	mg/L	0.0058	NA
			Nickel	0.01	0.0082	mg/L	0.0079	NA
Street Waste Investigation	Soil	ST-5 (3-4)	TPH-G	36	30	mg/kg	100	NA
NE of Rankin Road	Soil	RR-1 (2-3)	cPAH	165	140	ug/kg	137	NA
		RR-4 (1-2)	lead	74	50	mg/kg	250	NA
		RR-8 (1-2)	lead	170	50	mg/kg	250	NA
NEX Gas Station Leak Area	Soil Gas[b]	BP-2	1,3-Butadiene	15	2.78	$\mu g/m^3$	NA	NA
		BP-4	1,3-Butadiene	84	2.78	$\mu g/m^3$	NA	NA
		BP-5	1,3-Butadiene	91	2.78	$\mu g/m^3$	NA	NA
		BP-6	1,3-Butadiene	92	2.78	$\mu g/m^3$	NA	NA
		BP-7	1,3-Butadiene	6.2	2.78	$\mu g/m^3$	NA	NA
		BP-1	Benzene	15	10.7	$\mu g/m^3$	NA	NA
		BP-2	Benzene	20	10.7	$\mu g/m^3$	NA	NA
		BP-4	Benzene	35	10.7	$\mu g/m^3$	NA	NA
		BP-5	Benzene	18	10.7	$\mu g/m^3$	NA	NA
		BP-6	Benzene	38	10.7	$\mu g/m^3$	NA	NA
Bunkers 98, 99, 100, 101, 103, and 104	Soil	B98-1 (2-3)	cPAH	193	140	µg/kg	137	NA
		B101-5 (1-2)	cPAH	173	140	µg/kg	137	NA
		B100-5 (0.5-1.5)	4-Nitrotoluene	0.15	0.027	mg/kg	--	NA
		B103-2 (0.5-2.0)	4-Nitrotoluene	0.13	0.027	mg/kg	--	NA
		B103-3 (0.5-2.5)	4-Nitrotoluene	0.14	0.027	mg/kg	--	NA
		B103-7 (0.5-1.5)	4-Nitrotoluene	0.14	0.027	mg/kg	--	NA

Table B-8 (Continued)
Summary of 2013 Soil, Groundwater, and Soil Gas Exceedances Detected at OU 1 JPHC During Focused Phase II SI Performed as Part of Due Diligence Inquiries (Landau 2013)

Area	Media	Sample/Depth (ft bgs)	Chemical	Result	Screening Level[a]	Unit	ROD RG	Current LTM Reporting Limit/Method Detection Limit
		B104-2 (0.5-2.0)	4-Nitrotoluene	0.088	0.027	mg/kg	--	NA
		B104-5 (0.5-1.5)	4-Nitrotoluene	0.095	0.027	mg/kg	--	NA
		B99-3(0.5-1.5)	Arsenic	170	20	mg/kg	8.6	NA
		B101-5 (1.0-2.0)	Lead	126	50	mg/kg	250	NA
		B101-6 (0.5-1.5)	Lead	113	50	mg/kg	250	NA
Drum Disposal Area	Soil Gas[b]	DD-1	1,3-Butadiene	17	2.78	$\mu g/m^3$	NA	NA
		DD-2	1,3-Butadiene	46	2.78	$\mu g/m^3$	NA	NA
		DD-1	Benzene	34	10.7	$\mu g/m^3$	NA	NA
		DD-2	Benzene	39	10.7	$\mu g/m^3$	NA	NA

[a]Tables 14 through 18 of the Phase II SI (Landau Associates 2013) present the screening level evaluation tables, showing the potentially applicable regulatory sources and values used in the development of soil, groundwater, soil gas, surface water, and indoor air screening levels.
[b]Soil gas was not identified in the ROD as a medium of concern.
[c]The mercury ROD RG was revised from original RG of 25 to 100 ng/L after completion of metal background study (U.S. Navy 2001).

Notes:
Bolded text are areas and chemicals of concern.
Yellow highlighted texts indicate exceedances of a ROD RG.
-- - Not identified as a COC in the ROD. Therefore, no ROD RG established.
cPAH - carcinogenic polycyclic aromatic hydrocarbons by method SW8270-SIM
ft bgs - foot below ground surface
LTM - long-term monitoring
$\mu g/m^3$ - microgram per cubic meter
mg/kg - milligram per kilogram
ng/L - nanogram per liter
NA - not applicable
RG - remediation goal
ROD - Record of Decision
SI - site investigation
TPH-O - heavy oil range total petroleum hydrocarbons by method NWTPH-Dx
TPH-D - diesel range total petroleum hydrocarbons by method NWTPH-Dx
TPH-C - creosote range total petroleum hydrocarbons by method NWTPH-Dx
TPH-G - gasoline range total petroleum hydrocarbons by method NWTPH-Gx

Source: Landau 2013

APPENDIX C

Stakeholder Meeting #1 Handout

STAKEHOLDER MEETING #1
DEVLOPMENT OF ANALYTE LIST FOR
HUMAN HEALTH SHELLFISH RISK ASSESSMENT

JACKSON PARK HOUSING COMPLEX/
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Prepared by
URS Group, Inc.
Seattle, Washington

Prepared for
Naval Facilities Engineering Command Northwest
Silverdale, Washington

U.S. Navy Contract No. N44255-09-D-4001
Delivery Order 0026

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CONTENTS

HUMAN HEALTH TISSUE ANALTYE LIST DEVELOPMENT

The two main tasks under this delivery order are to develop a human health risk assessment work plan for the ingestion of shellfish, followed by development of a sampling plan designed to fill data gaps for the human health assessment. In previous meetings with stakeholders, the Navy was asked to review the chemicals detected in marine tissue data collected in 2009 for the Baseline Ecological Risk Assessment (BERA). The purpose of the review was to assess whether any chemicals detected in the BERA tissue data set should be added to the human health tissue analyte list. The human health tissue analyte list is based on the chemicals of concern (COCs) for human health identified in the ROD. The original ROD COC list has been modified based on recommendations in previous five-year reviews. Several of the ROD COCs were dropped from analysis because they were never detected in three rounds of post-ROD monitoring, or were detected below concentrations found in reference areas (PCP, antimony, vanadium, 3,3-dichlorobenzidine). The current human health analyte list includes arsenic and ordnance compounds.

The process used to assess whether a chemical detected in the BERA tissue sampling should be added to the human health analyte list was as follows:

1. Does the chemical's maximum tissue concentration exceed a Suquamish-specific screening level?
2. If a screening level is exceeded, is the chemical related to historical activities at the Jackson Park Housing Complex?

1.0 Exceedances of Tissue Screening Levels

Table 1 presents a summary of the results of the screening level evaluation. Attachment A presents the details of the screening calculations and Attachment B provides detail tables of the screening process for each species. Excluding ordnance compounds (which are automatically assumed to be included on the human health analyte list), 35 chemicals were detected in at least one of the four species sampled for the BERA. 12 chemicals out of the 35 did not have a maximum concentration exceeding a screening level. The remaining 23 chemicals were evaluated further as to whether they were related to historical Jackson Park activities. By chemical class, chemicals exceeding screening levels are as follows:

- 10 metals (including lead, which has no screening level)
- 7 carcinogenic polycyclic aromatic hydrocarbons (cPAHs)
- 1 semi-volatile organic compound
- 2 polychlorinated biphenyl compounds (PCBs)

- 3 pesticides (aldrin was only found above a screening level in starry flounder, not shellfish)

2.0 Assessment of Whether the Chemical is Site Related

The assessment process to decide whether a chemical exceeding a tissue screening level was site related used a weight of evidence approach. Three general categories of evidence were examined:

1. Is the chemical currently present in Ostrich Bay sediment at background levels?
2. Was the chemical historically found to be a COPC or COC in any media at Jackson Park?
3. Is there an on-going source to the environment?

Figure 1 presents a flow chart of the process, Table 2 presents a summary of the weight of evidence assessment.

2.1 BERA Sediment Background

Of the 10 metals that exceed screening levels (including lead which has no screening level), two metals, chromium and arsenic, were found to be below sediment background levels in the 2011 BERA report. Five metals were found to be above background in sediment: cadmium, copper, mercury, selenium, and zinc. The remaining three metals, lead, nickel, and silver, were not evaluated for sediment background in the BERA.

2.2 Historical Site Evaluation

Environmental sampling investigations began at Jackson Park in 1991. Since 1991 hundreds of samples have been collected of soils, groundwater, seep/outfalls, and sediment. The Remedial Investigation (RI) was conducted in the 1993-1996 timeframe, the feasibility study in 1998, followed by the ROD in 2000. Tables summarizing the dates and analyte lists for the many sampling events for outfalls, seeps, and sediments are included in Attachment C (Tables C-1 through C-3). Similar lists could be developed for soil and groundwater; however those are not included in this handout because they are less directly relevant to the marine environment. The historical review examined whether a chemical was selected as a COPC in the RI, and whether it was selected as a COC in the ROD. The results are summarized on Table 2. If the chemical was found to be at background in soil, sediment, or water during the RI investigation, that information is included in the "details" portion of Table 2.

The human health risk assessment for shellfish, conducted in 1995-1996 as part of the RI, was reviewed for the following:

- What chemicals were detected in shellfish (clams and crabs) in 1995, before any remedial activities occurred at the site?

- What metals were found to be at background in tissue at the time of the RI?

As shown on Table 2, of the 23 chemicals that exceeded a Suquamish screening level in 2009 tissue data, all, except pesticides and PCBs, were detected in tissue in the 1996 HHRA. Seven of the 10 metals on Table 2 were found to be at background in tissue during in the 1996 HHRA: arsenic, cadmium, chromium, lead, mercury, and zinc. For the remaining three metals, nickel, selenium, and silver, no tissue background evaluation was done. Note that the 1996 HHRA followed current EPA guidelines (EPA 2002) regarding evaluating chemicals for background after they have been carried through the baseline risk assessment. Because of this historical effort, and due to the large body of data for this site from over 20 years of environmental monitoring, use of previous background assessments findings in the weight of evidence evaluation is appropriate.

2.3 Post-ROD Activities

Remedial activities for the COCs are summarized on Table 2. Also included on Table 2 is whether the LTM program for seeps/outfalls has included the chemical on the LTM analyte list. For the chemicals that were found to be COCs in soil (arsenic, lead, cPAHs, and PCBs), the soil was covered with a cap, and measures were taken to prevent shoreline erosion. The four chemicals identified as COCs in seeps/outfalls – arsenic, mercury, nickel, and silver, have been part of the on-going long-term monitoring (LTM) program at Jackson Park. Remedial activities related to the one compound identified as a COC in marine tissue, pentachlorophenol (PCP), involved removing creosote-treated piers/pilings. PCP has not been detected in post-ROD clam and crab tissue sampling.

Table C-4 presents summary statistics for the seep/outfall data for selected metals, and the shoreline groundwater well data for mercury. The pre-ROD TPH-D seep/outfall data is also included as part of the evaluation to assess the potential for sources of cPAHs to the marine environment besides soil. There are no post-ROD TPH-D data and TPH-D was only detected in 1/39 seep/outfalls samples pre-ROD.

3.0 Conclusions of Weight of Evidence Evaluation

The Navy’s conclusions as to whether a chemical detected above a tissue screening level should be added to the human health tissue analyte list are presented on Table 2. The basis for the Navy’s conclusions can be found in the “details” and “reason” columns of the table.

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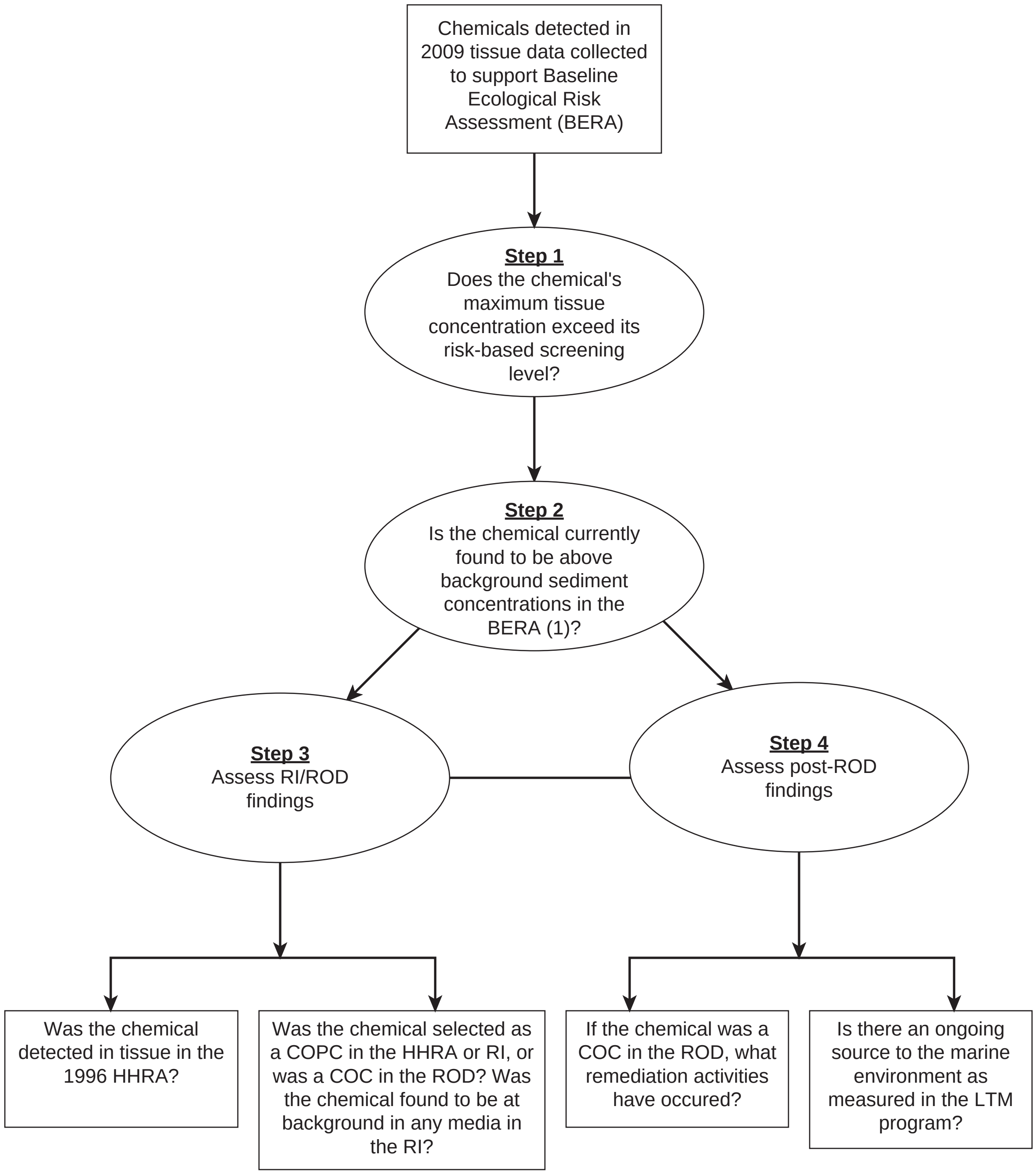

Notes:

1 Comparison of OU 2 sediment metal concentrations with background as listed on Table 7-6 in the Final Baseline Ecological Risk Assessment Tier 2, Step 7 (2011).

BERA	Baseline Ecological Risk Assessment
HHRA	Human Health Risk Assessment
RI	Remedial Investigation
ROD	Record of Decision
COPC	Chemical of Potential Concern
COC	Chemical of Concern
LTM	Long Term Monitoring

U.S. NAVY

Figure 1
Process Used for Weight of Evidence Evaluation of 2009 BERA Tissue Data

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JPHC/NHB
STAKEHOLDER MEETING #1
RISK ASSESSMENT
WORKPLAN

Table 1. Summary of Chemicals by Species Exceeding Tissue Screening Levels

Chemical	Combined Shellfish	Bent-nose Clam	Whole Body Crab	Muscle Only Crab	Sea Cucumber	Starry Flounder
Metals						
Arsenic	X	X	X	X	X	X
Cadmium	X	X	X	X	X	
Chromium	X	X	X	X	X	X
Copper	X	X	X	X	X	
Lead[a]						
Mercury	X	X	X	X	X	X[b]
Nickel	X	X			X	
Selenium	X	X	X	X	X	
Silver	X	X	X	X		
Zinc	X	X	X	X	X	
Polycyclic Aromatic Hydrocarbons (PAHs)						
Acenaphthene						
Acenaphthylene						
Anthracene						
Benz(a)anthracene	X	X			X	
Benzo(a)pyrene	X	X			X	
Benzo(b)fluoranthene	X	X			X	
Benzo(ghi)perylene[a]						
Benzo(k)fluoranthene	X	X				
Chrysene						
Dibenzo(a,h)anthracene	X	X			X	
Fluoranthene						
Fluorene						
Indeno(1,2,3-cd)pyrene	X	X			X	
Phenanthrene						
Pyrene						
Semi-Volatile Organic Compounds (SVOCs)						
Benzoic Acid						
Diethyl phthalate						
Di-n-butyl phthalate						
N-Nitrosodiphenylamine						
Pentachlorophenol	X	X				
Polychlorinated Biphenyls (PCBs)						
PCB-Aroclor 1254						X
PCB-Aroclor 1260	X		X	X	X	X
Pesticides						
4,4'-DDE	X		X	X		X[b]
4,4'-DDT	X	X	X	X		X
Aldrin						X
Ordnance Compounds						
1,3,5-Trinitrobenzene						
2,4-Dinitrophenol						
3-Nitrotoluene						X
4-Nitrotoluene	X				X	
Nitrobenzene	X		X		X	
Nitroglycerin	X	X			X	X
Picramic Acid						
Picric Acid[a]						

Notes:

[a] No screening value available

[b] This chemical is selected if combined pelagic and bottom fish ingestion rates are used in screening, it would not be selected if screened only using the calculated bottom fish screening value.

Table 2

Weight of Evidence Evaluation of Chemicals in the 2009 BERA Tissue Data Exceeding Suquamish Screening Levels

ALL ORDNANCE COMPOUNDS AUTOMATICALLY INCLUDED ON HUMAN HEALTH ANALYTE LIST

STEP 1	STEP 2	STEP 3: RI/ROD FINDINGS							STEP 4: POST-ROD FINDINGS					
These chemicals have maximum tissue concentrations above Suquamish Shellfish Screening Levels	Identified as above background in sediment in 2011 BERA?	Chemical selected as a COPC in the RI (open circle) or a COC in the ROD (closed circle)					Was the Chemical detected in tissue (clams or crabs) in the 1996 HHRA?	Identified as above background in clams in the 1996 HHRA?	If the chemical was a COC in the ROD, what remediation activities occurred?	On-going Source? Detected in post-ROD Monitoring 2002 to 2009?		Details	Navy Proposal for Inclusion in Analyte List	Reason
		Soil	Sed	Clam/ Crab Tissue	Seeps/ Outfalls	GW				Seeps/ Outfalls	Clam/ Crab Tissue			
Arsenic (As)	No	●	○	○	●	●	Yes	No	1-foot cap on surface soil, shoreline erosion prevention	√	√	The 1996 HHRA found As levels in clam tissues were at background. The 2011 BERA concluded site sediment data for As are not different from background sediment data. In all the seep/outfall/groundwater data (1991 - 2009) only 6% (110/1750) seep/outfall samples exceed the background value of 3.7 ug/L. All exceedances were less than 2 x background, and there have been no exceedances since 2003. As has been detected in post-ROD tissue data. Post-ROD analysis indicates tissue concentrations were likely background, but the data were not conclusive.	No	Weight of evidence indicates the chemical is at background in tissue, sediment, and in seeps and outfalls. Discuss not including on list with stakeholders.
Cadmium (Cd)	Yes			○			Yes	No	--	not analyzed	not analyzed	The 1996 HHRA found levels in clam tissue were at background. The 2011 BERA found Cd in sediment above background based on a comparison of the site 95%UCL (1.2 mg/kg) with the 90th percentile (0.7 mg/kg) and 95%UCL (0.3 mg/kg) of the BOLD data. This comparison exceeds background by less than two-fold to just over two-fold. However, all sediment concentrations were below the SQS, indicating relatively low levels of contamination. The chemical was not identified as a COPC in the RI in any media besides tissue. The chemical was not selected as a COC in the ROD.	No	Not a site-related chemical. Not found to be above tissue background during 1996 HHRA.
Chromium (screening levels based on hexavalent)	No			○			Yes	No	--	not analyzed	not analyzed	The 1996 HHRA found levels in clam tissue were at background. The 2011 BERA concluded site sediment data for chromium are not different from background sediment data. The chemical was not identified as a COPC in the RI in any media besides tissue. The chemical was not selected as a COC in the ROD.	No	Not a site-related chemical. Not found to be above tissue background in the 1996 HHRA. Not found to be above sediment background in 2011.
Copper (Cu)	Yes			○			Yes	No	--	√	not analyzed	The 1996 HHRA found levels in clam tissue were at background. The 2011 BERA found Cu in sediment above background based on a comparison of the site 95%UCL (51.2 mg/kg) with the 90th percentile (36.1 mg/kg) and 95%UCL (20.5 mg/kg) of the BOLD data. This comparison exceeds background by less than two-fold based on the 90th percentile. No sediment concentrations exceeded the SQS, indicating low levels of contamination. The chemical was not identified as a COPC in the RI in any media besides tissue. The chemical was not selected as a COC in the ROD. Although not a COC in seeps/outfalls, the LTM program has analyzed seeps/outfalls for copper. Few values ever exceeded the acute marine WQS of 4.8 ug/L in seeps/outfalls sampled during the RI, and there have been no exceedance in the seep/outfall post-ROD data (maximum value in post-ROD data is 3.7 ug/L, 88 samples 2002-2009). Copper is of relatively low toxicity to humans compared to marine organism an is not bioaccumulative.	No	Not a site-related chemical. Not found to be above tissue background in the 1996 HHRA. Low toxicity to humans compared to marine organisms, and marine-based cleanup levels in water and sediment are not exceeded.
Lead (no screening level available)	No background comparison conducted	●		○			Yes	No	1-foot cap on surface soil, shoreline erosion prevention	√	not analyzed	The 1996 HHRA found levels in clam tissue were at background. During the RI, a limited, well-defined, area of sub-surface soil in Area 103 was found to exceed 250 mg/kg - the maximum concentration was only 334 mg/kg. On this basis, lead was included as a COC in the ROD for soil and the area was capped. Although not a COC in seeps/outfalls, the LTM program has analyzed seeps/outfalls for lead. In the post-ROD seep/outfall data (2002 - 2009), the maximum detection was 0.55 ug/L in 2007, frequency of detection of 43/88.	No	No significant historical source based on limited soil contamination and low concentrations in seeps/outfalls. Not found to be above tissue background in the 1996 HHRA.
Mercury (Hg) (screening level based on methyl mercury)	Yes			○	●		Yes	No	None	√	not analyzed	The 1996 HHRA found Hg in tissue, soil, and sediment to be at background (background levels from the RI). The 2011 BERA found Hg in sediment above background based on a comparison of the site 95%UCL (0.4 mg/kg) with the 90th percentile (0.2 mg/kg) and 95%UCL (0.09 mg/kg) of the BOLD data. This comparison exceeds background by two-fold to four-fold. Hg was selected as a COC in seeps/outfalls (all three Sites: 101, 101-A, and 103) in the ROD based on limited exceedances above the WQS of 0.025 ug/L in one round of sampling (5 detections). The ROD indicated the Hg exceedances were not reproducible. Post-ROD, mercury was detected in 3% (3/88) of samples (2002- 2009) from 0.12 ug/L to 0.34 ug/L (2002). Over-all in the 234 seep/outfall samples that have been collected at the site since 1991, mercury has only been detected 8 times (3.4%). Analytical methodology has not been able to reliably achieve a detection limit of 0.025 ug/L, the ROD cleanup level of 0.1 ug/L was based on a PQL. The range of detection limits reported in the seep/outfall database is 0.02 - 0.61 ug/L. It is possible that low level of mercury, below 0.1 ug/L are present in seep/outfall water. If that is the case there does not appear to be a site soil source based on the soil data (maximum soil concentration was 1.2 mg/kg in subsurface soil at Site 103, maximum surface soil concentration was 0.5 mg/kg also at Site 103). Mercury is present in all marine media due to many historical sources and atmospheric deposition from coal burning world-wide.	No	Weight of evidence indicates the chemical is unlikely to be site-related based on the very limited detections in seep/outfall, no defined source at Jackson Park, and the HHRA/RI findings of background levels in tissue, soil, and sediment. Several detection limits in the water samples were above the WQS indicating levels of Hg below 0.1 ug/L may have been present in the water. The 2011 BERA found Hg above BOLD background in sediment, but no sediment toxicity to benthos. The 2011 BERA also found negligible/low risk to great blue herons and osprey from sediment contamination. Risks to surf scoters and river otters are uncertain.
Nickel (Ni) (screening level based on soluble salts)	No background comparison conducted			○	●	●	Yes	No background comparison conducted	None	√	not analyzed	The 1996 HHRA did not evaluate background levels of nickel in clams; however, Ni was found to be at background in sediment in the RI. The 2011 BERA did not evaluate Ni in background sediment. Ni was selected as a COC in seeps/outfalls at Site 101 based one 1 exceedance in 12 samples above the WQS of 7.9 ug/L. The ROD indicated the exceedance was not reproducible. In post-ROD monitoring Ni was detected in 1/88 samples (2002- 2009) above the WQS , maximum of 10.5 ug/L (2008). In the 2009 BERA tissue data, exceedances above a Suquamish screening level occurred only in bent nose clams.	No	The chemical is unlikely to be site-related based on only two exceedances ever found above the WQS in seep/outfall data, and no known source at Jackson Park.
Selenium (Se)	Yes			○			Yes	No background comparison conducted	--	not analyzed	not analyzed	No background tissue or sediment evaluation conducted during the HHRA or the RI. The 2011 BERA found Se in sediment above background based on a comparison of the site 95%UCL (1.2 mg/kg) with the 90th percentile (0.8 mg/kg) and 95%UCL (0.4 mg/kg) of the BOLD data. This comparison exceeds background by less than two-fold based on 90th percentile. All sediment concentrations were less than the SQS, indicating low levels of contamination. Not selected as a COPC in any media except tissue, not a COC in the ROD.	No	No site-related source.
Silver (Ag)	No background comparison conducted			○	●		Yes	No background comparison conducted	None	√	not analyzed	No background tissue or sediment evaluation conducted during the RI. The 2011 BERA did not evaluate Ag in background sediment. Identified as a COC in seeps/outfalls for Site 103, based on 1 exceedance out of 9 samples of the state's WQS of 1.2 ug/L. The ROD indicated the exceedance was not reproducible. Ag has been detected in 8/11 samples in post-ROD monitoring (2002-2009), no detections exceeded 1.2 ug/L.	No	The chemical is unlikely to be site-related based on only one exceedance ever found above the WQS in seep/outfall data, and no known source at Jackson Park.
Zinc (Zn)	Yes			○			Yes	No	--	√	not analyzed	The 1996 HHRA found levels in clam tissue were at background. The 2011 BERA found Zn in sediment above background based on a comparison of the site 95%UCL (97.6 mg/kg) with the 90th percentile (81.4 mg/kg) and 95%UCL (53.1 mg/kg) of the BOLD data. This comparison exceeds background by less than two-fold for the 90th percentile and 95%UCL. All sediment concentrations were less than the SQS, indicating low levels of contamination. The chemical was not identified as a COPC in the RI in any media besides tissue. The chemical was not selected as a COC in the ROD. Although not a COC in seeps/outfalls, the LTM program has analyzed seeps/outfalls for zinc. No values have ever exceeded the WQS of 81 ug/L. The maximum value in post-ROD data is 80.4 ug/L (2008), average value is 5.6 ug/L (based on 88 samples 2002-2009). Zinc is of relatively low toxicity to humans compared to marine organisms and is not bioaccumulative.	No	No site-related source. Not found to be above tissue background in the 1996 HHRA. Low toxicity to humans compared to marine organisms, and marine-based cleanup levels for water and sediment are not exceeded.

Table 2

Weight of Evidence Evaluation of Chemicals in the 2009 BERA Tissue Data Exceeding Suquamish Screening Levels

ALL ORDNANCE COMPOUNDS AUTOMATICALLY INCLUDED ON HUMAN HEALTH ANALYTE LIST

STEP 1	STEP 2	STEP 3: RI/ROD FINDINGS							STEP 4: POST-ROD FINDINGS					
These chemicals have maximum tissue concentrations above Suquamish Shellfish Screening Levels	Identified as above background in sediment in 2011 BERA?	Chemical selected as a COPC in the RI (open circle) or a COC in the ROD (closed circle)					Was the Chemical detected in tissue (clams or crabs) in the 1996 HHRA?	Identified as above background in clams in the 1996 HHRA?	If the chemical was a COC in the ROD, what remediation activities occurred?	On-going Source? Detected in post-ROD Monitoring 2002 to 2009?		Details	Navy Proposal for Inclusion in Analyte List	Reason
		Soil	Sed	Clam/ Crab Tissue	Seeps/ Outfalls	GW				Seeps/ Outfalls	Clam/ Crab Tissue			
Carcinogenic PAHs (cPAHs)	No background comparison conducted	●	○	○			Yes	No background comparison conducted	1-foot cap on surface soil, shoreline erosion prevention, soil removals.	not analyzed	not analyzed	No background comparisons previously conducted. cPAHs were selected as COCs for soil for all four terrestrial sites in the ROD. Cleanup actions involved soil removals and the development of engineered covers in the early 2000's. Seep/outfall data collected during the RI (1991, 1992, 1996, and 1998) did not detect cPAHs in any sample, indicating no significant historical source to the marine environment. Seep/outfall data for TPH-D (possible source of cPAHs) had only 1 detection and there were data quality issues with that sample. cPAHs were detected in 43/43 sediment samples in 2009 BERA data, but most detections were below the lowest SQS, indicating low levels of contamination. Petroleum contamination has many sources and low levels would be expected in near-shore sediments.	No	Weight of evidence indicates significant sources to the marine environment were unlikely. No detections in seep/outfall data for cPAHs and infrequent low detections of TPH-D. cPAHs detected in 2009 BERA sediment data but mostly below SQS's, indicating relatively low levels of contamination. Sediment concentrations likely reflective of regional sources due to the ubiquitous use of petroleum compounds.
Pesticides (DDE and DDT)	No background comparison conducted						No; DLs > RBSLs	No background comparison conducted	--	not analyzed	not analyzed	No background comparisons previously conducted. Not identified as a COPC or COC in any media. Seep/outfall data collected in 1991, 1992, 1996, and 1998 were analyzed for DDD/DDE/DDT and there were no detections. In 2011 BERA: DDE detected in 11 out of 43 samples in sediment (0.15 to 0.72 ug/kg dw); DDT detected in 17 out of 43 samples in sediment (0.17 to 1.9 ug/kg dw). No concentrations were above ecological screening criteria. DDT and breakdown products are ubiquitous contaminants due to their wide-spread historical use and environmental persistence. The chemicals' presence in sediments/tissue is likely due to regional anthropogenic background.	No	No site-related source. Never detected in seeps/outfalls during the RI. Sediment concentrations likely reflective of regional sources due to the ubiquitous historical use of DDT and its persistence in the environment.
PCBs (Aroclor 1254 and Aroclor 1260)	No background comparison conducted	●					No; DLs > RBSLs	No background comparison conducted	1-foot cap on surface soil, shoreline erosion prevention	not analyzed	not analyzed	No background comparisons previously conducted. PCBs were identified as a COC in a limited area of soil at Site 103 (6 detections of Aroclor 1254 out of 62 soil samples at Site 103, detections in only two locations; one "NJ" qualified detection of Aroclor 1260 in subsurface soil). Impacted soil was covered with an engineered cover. No detections of any Aroclors at other locations in any media. Seep/outfall data collected in 1991, 1992, 1996, and 1998 did not detect Aroclors. In 2009 BERA data: Aroclor 1260 not detected in bent nose clams (but DL exceeds screening level), detected in sea cucumber and crab muscle each 1/6 (DLs exceed screening levels). In 2009 BERA data, 22 out of 43 samples detected Aroclor 1260 in sediment (2.9 to 11 ug/kg dw), Aroclor 1254 was detected in 31 out of 43 samples (2.7 to 16 ug/kg dw). No sediment or tissues concentrations were above ecological screening criteria. PCBs are ubiquitous compounds and low levels are found in most media in urban/suburban areas.	No	Weight of evidence indicates significant sources to the marine environment from Jackson Park were unlikely, based on very limited soil contamination and no detections in seep/outfall data during the RI.
Pentachlorophenol (PCP)	No background comparison conducted			●			Yes	No background comparison conducted	Removal of pilings/piers	not analyzed	Not detected in post-ROD samples	No background comparisons previously conducted. PCP was a COC in the ROD for marine tissue, based on a single detection in pre-ROD crab data. PCP were not detected in clams or any other media during the RI. During the RI the seep/outfall data collected in 1991, 1992, 1996, and 1998 had no detections of PCP. In the ROD, a possible PCP source was thought to be creosote-treated pilings/piers in the bay, and pilings/piers were removed in 2001. PCP was not been detected in any of the clam (littleneck) or crab tissue samples collected during the 2002, 2004, or 2009 HHRA sampling events. In the 2009 BERA tissue data, PCP was detected only in bent nose clams (4/6 detections, all above the screening level), but not in sea cucumber, crabs, or starry flounder. In the 2009 BERA sediment data, PCP was not detected (43 samples).	No	Weight of evidence indicates no significant historical source. Only one detection in crab pre-ROD, detections in no other media. PCP has not been detected in shellfish tissue samples in Post-ROD monitoring. 2011 BERA did not detect PCP in sediment, bent nose clams only species with tissue concentrations above a screening level.

Notes:

● - Solid circle is a COC in ROD
○ - Open circle is a COPC as listed in 1996 HHRA
√ - Indicates chemical detected in post-ROD sampling.
-- Not applicable
95%UCL - 95 percent upper confidence limit
BERA - baseline ecological risk assessment
BOLD - Ocean Survey Vessel (OSV) Bold Survey Report (DMMP 2009) as cited in the 2011 BERA
COC - chemical of concern
COPC - chemical of potential concern

DL - detection limit
HHRA - human health risk assessment
LTM - long term monitoring program
MDL - method detection limit
PQL - practical quantitation limit
RBSL - risk-based screening level
RI - Remedial Investigation
ROD - Record of Decision (signed in 2000)
SQS - sediment quality standard
WQS - Water Quality Standard

Data Sources:
2011 BERA - Final Baseline Ecological Risk Assessment Tier 2 Step 7 Risk Characterization (September 2011)
2009 DMMP (Dredged Material Management Program). 2009. *OSV Bold* Summer 2008 Survey. Data Report. U.S. Army Corps of Engineers, Seattle District; U.S. EPA Region 10; Washington State Department of Natural Resources; Washington State Department of Ecology. June 25.
2009 BERA data - Tissue and sediment data collected in 2009. Draft Final Ecological Risk Assessment Tier 2 Step 6, Data Analysis Phase 2 Tissue Chemistry Data Report (October 2010) and Draft Final Ecological Risk Assessment Tier 2 Step 6, Data Analysis Phase 1/ Phase 2 Sediment Chemistry and Toxicity Data Report (October 2010)
2000 ROD - U.S. Navy, Ecology, and USEPA. 2000. *Declaration of the Record of Decision, Operable Unit 1, Jackson Park Housing Complex/Naval Hospital Bremerton, Washington.* August 8, 2000.
1996 HHRA - Final Human Health Risk Assessment for OU 1 - Jackson Park Housing Complex and Naval Hospital Bremerton (September 1996)
1995 RI - *Phase II OU 1 RI Supplemental Report Jackson Park Housing Complex and Naval Hospital Sites 101, 101 -A, and 103 Bremerton, Washington.* September 1995.
1994 RI - Final Phase I Remedial Investigation Report, Jackson Park Housing Complex, Sites 101, 101A, and 103, Bremerton, Washington. June 1994.

Attachment A
Seafood Tissue Screening Level Calculations

Table A1: Subsistence Exposures to Shellfish Tissues in Liberty Bay - Risk-Based Level Results
Ingestion of Shellfish
Future

Exposure Medium: Shellfish Tissue
Exposure Point: Shellfish in Liberty Bay
Receptor Population: Tribal Subsistence
Receptor Age: Adults and Children

Noncancer SL = RfD x THQ / SIFnc
Cancer SL = TCR / (CSF x SIFc)

Parameter	Unit	RME Adult Total Shellfish	RME Child Total Shellfish
Chemical Conc'n in Tissue (CTi)	mg/kg	chem-specific	chem-specific
Ingestion Rate of Shellfish Tissue (IR)[a]	g/day	498.4	57.50
Fracton of Clam from Contaminated Source (FC)	unitless	1	1
Exposure Frequency (EF)	days/year	365	365
Exposure Duration (ED)	years	64	6
Conversion Factor (CF)	kg/g	1.00E-03	1.00E-03
Body Weight (BW)	kg	79	16.8
Averaging Time (noncancer) (ATnc)	days	23,360	2,190
Averaging Time (cancer) (ATc)	days	25,550	25,550
SIFnc = (IR*FC*EF*ED*CF)/(BW*Atnc)	$(day)^{-1}$	6.31E-03	3.42E-03
IngFadj (Ingestion Adjusted Factor)= (IRc*EDc/BWc)+(IRa*EDa/BWa)		4.24E+02	
SIFnc (child/adult) = ((InhFadj*EF)/(ATnc))		6.06E-03	
SIFc = (IngFadj*FC*EF*CF)/ATc	$(day)^{-1}$	6.1E-03	

[a] Adult shellfish ingestion rate is from Table B-2 from the EPA framework document (EPA 2007) and the child ingestion rate is from Page 3-4 of the BNC OUB Marine Final Tech Memo HH Evaluation of Mercury in

Chemical	RfDo (mg/kg-d)	CSFo (mg/kg-d)-1
3,3'-Dichlorobenzidine	--	4.5E-01
Pentachlorophenol	5.0E-03	4.0E-01
Antimony (metallic)	4.0E-04	--
Arsenic (total)	3.0E-04	1.5E+00
Vanadium	5.0E-03	--
Chromium (based on CRVI)	3.0E-03	5.0E-01
Total Chromium (based on CR III)	1.5E+00	--
Cadmium (Diet)	1.0E-03	--
Copper	4.0E-02	--
Lead	--	--
Nickel (soluble salts)	2.0E-02	--
Silver	5.0E-03	--
Zinc	3.0E-01	--
Mercury (methyl)	1.0E-04	--
Selenium	5.0E-03	--
Acenaphthene	6.0E-02	--
Acenaphthylene	6.0E-02	--
Anthracene	3.0E-01	--
Benza(a)anthracene	--	7.3E-01
Benzo(a)pyrene	--	7.3E+00
Benzo(b)fluoranthene	--	7.3E-01
Benzo(ghi)perylene	--	--
Benzo(k)fluoranthene	--	7.3E-02
Chrysene	--	7.3E-03
Dibenzo(a,h)anthracene	--	7.3E+00
Fluoranthene	4.0E-02	--
Fluorene	4.0E-02	--
Indeno(1,2,3-cd)pyrene	--	7.3E-01
Phenanthrene	3.0E-01	--
Pyrene	3.0E-02	--
Benzoic Acid	4.0E+00	--
Phenol	3.0E-01	--
Diethyl phthalate	8.0E-01	--
Di-n-butyl phthalate	1.0E-01	--
Arochlor 1016	7.0E-05	7.0E-02
Arochlor 1221	--	2.0E+00
Arochlor 1232	--	2.0E+00
Arochlor 1242	--	2.0E+00
Arochlor 1248	--	2.0E+00
Arochlor 1254	2.0E-05	2.0E+00
Arochlor 1260	--	2.0E+00
4-4'-DDE	--	3.4E-01
4-4'-DDT	5.0E-04	3.4E-01
Aldrin	3.0E-05	1.7E+01
1,3,5-Trinitrobenzene	3.0E-02	--
1,3-Dinitrobenzene	1.0E-04	--
3,5-Dinitroaniline	--	--
2,4,6-Trinitrotoluene	5.0E-04	3.0E-02
2,4-Dinitrotoluene	2.0E-03	3.1E-01
2,6-Dinitrotoluene	1.0E-03	--
2-Amino-4,6-dinitrotoluene	2.0E-03	--
4-Amino-2,6-dinitrotoluene	2.0E-03	--
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	5.0E-02	--
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	3.0E-03	1.1E-01
Tetryl	4.0E-03	--
Pentaerythritol Tetranitrate (PETN)	2.0E-03	4.0E-03
2,4-Diamino-6-nitrotoluene	--	--
2,6-Diamino-4-nitrotoluene	--	--
2-Nitrotoluene	9.0E-04	2.2E-01
3-Nitrotoluene	1.0E-04	--
4-Nitrotoluene	4.0E-03	1.6E-02
Nitroglycerin	1.0E-04	1.7E-02
Nitrobenzene	2.0E-03	--
N-Nitrosodiphenylamine	--	4.9E-03
Picric Acid	--	--
Picramic acid	1.0E-04	--
2,4-Dinitrophenol	2.0E-03	--

Reasonable Maximum Exposure					
Chemical	**HQ Adult**	**Cancer Risk Lifetime**	**Child Noncancer Risk-based Level (mg/kg)**	**Adult and Child Noncancer Risk-based Level (mg/kg)**	**Cancer Risk-based Level (mg/kg)**
3,3'-Dichlorobenzidine	0.1	1.0E-06	--	--	0.00037
Pentachlorophenol	0.1	1.0E-06	0.15	0.082	0.00041
Antimony (metallic)	0.1	1.0E-06	0.012	0.0066	--
Arsenic (total)	0.1	1.0E-06	0.0088	0.0049	0.00011
Vanadium	0.1	1.0E-06	0.15	0.0825	--
Chromium (based on CRVI)	0.1	1.0E-06	0.088	0.049	0.00033
Total Chromium (based on CR III)	0.1	1.0E-06	43.8	24.75	--
Cadmium (Diet)	0.1	1.0E-06	0.03	0.016	--
Copper	0.1	1.0E-06	1.2	0.66	--
Lead	0.1	1.0E-06	--	--	--
Nickel (soluble salts)	0.1	1.0E-06	0.6	0.33	--
Silver	0.1	1.0E-06	0.15	0.0825	--
Zinc	0.1	1.0E-06	8.8	4.9493	--
Mercury (methyl)	0.1	1.0E-06	0.0029	0.0016	--
Selenium	0.1	1.0E-06	0.15	0.0825	--
Acenaphthene	0.1	1.0E-06	1.8	0.99	--
Acenaphthylene	0.1	1.0E-06	1.8	0.99	--
Anthracene	0.1	1.0E-06	8.8	4.95	--
Benza(a)anthracene	0.1	1.0E-06	--	--	0.00023
Benzo(a)pyrene	0.1	1.0E-06	--	--	0.00002
Benzo(b)fluoranthene	0.1	1.0E-06	--	--	0.00023
Benzo(ghi)perylene	0.1	1.0E-06	--	--	--
Benzo(k)fluoranthene	0.1	1.0E-06	--	--	0.00226
Chrysene	0.1	1.0E-06	--	--	0.02260
Dibenzo(a,h)anthracene	0.1	1.0E-06	--	--	0.00002
Fluoranthene	0.1	1.0E-06	1.2	0.660	--
Fluorene	0.1	1.0E-06	1.2	0.660	--
Indeno(1,2,3-cd)pyrene	0.1	1.0E-06	--	--	0.0002
Phenanthrene	0.1	1.0E-06	8.8	4.9	--
Pyrene	0.1	1.0E-06	0.88	0.49	--
Benzoic Acid	0.1	1.0E-06	116.9	65.99	--
Phenol	0.1	1.0E-06	8.8	4.95	--
Diethyl phthalate	0.1	1.0E-06	23.4	13.20	--
Di-n-butyl phthalate	0.1	1.0E-06	2.9	1.65	--
Arochlor 1016	0.1	1.0E-06	0.0020	0.00115	0.00236
Arochlor 1221	0.1	1.0E-06	--	--	0.00008
Arochlor 1232	0.1	1.0E-06	--	--	0.00008
Arochlor 1242	0.1	1.0E-06	--	--	0.00008
Arochlor 1248	0.1	1.0E-06	--	--	0.00008
Arochlor 1254	0.1	1.0E-06	0.00058	0.000330	0.00008
Arochlor 1260	0.1	1.0E-06	--	--	0.00008
4-4'-DDE	0.1	1.0E-06	--	--	0.00049
4-4'-DDT	0.1	1.0E-06	0.015	0.0082	0.00049
Aldrin	0.1	1.0E-06	0.00088	0.000495	0.000010
1,3,5-Trinitrobenzene	0.1	1.0E-06	0.88	0.49	--
1,3-Dinitrobenzene	0.1	1.0E-06	0.0029	0.001650	--
3,5-Dinitroaniline	0.1	1.0E-06	--	--	--
2,4,6-Trinitrotoluene	0.1	1.0E-06	0.0146	0.0082	0.0055
2,4-Dinitrotoluene	0.1	1.0E-06	0.058	0.0330	0.00053
2,6-Dinitrotoluene	0.1	1.0E-06	0.029	0.0165	--
2-Amino-4,6-dinitrotoluene	0.1	1.0E-06	0.058	0.0330	--
4-Amino-2,6-dinitrotoluene	0.1	1.0E-06	0.058	0.0330	--
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	0.1	1.0E-06	1.461	0.8249	--
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	0.1	1.0E-06	0.088	0.0495	0.0015
Tetryl	0.1	1.0E-06	0.117	0.0660	--
Pentaerythritol Tetranitrate (PETN)	0.1	1.0E-06	0.058	0.0330	0.041
2,4-Diamino-6-nitrotoluene	0.1	1.0E-06	--	--	--
2,6-Diamino-4-nitrotoluene	0.1	1.0E-06	--	--	--
2-Nitrotoluene	0.1	1.0E-06	0.0263	0.014848	0.00075
3-Nitrotoluene	0.1	1.0E-06	0.0029	0.001650	--
4-Nitrotoluene	0.1	1.0E-06	0.12	0.065991	0.010
Nitroglycerin	0.1	1.0E-06	0.0029	0.001650	0.010
Nitrobenzene	0.1	1.0E-06	0.058	0.032995	--
N-Nitrosodiphenylamine	0.1	1.0E-06	--	--	0.034
Picric Acid	0.1	1.0E-06	--	--	--
Picramic acid	0.1	1.0E-06	0.00292	0.001650	--
2,4-Dinitrophenol	0.1	1.0E-06	0.05843	0.032995	--

Table A2: Subsistence Exposures to Bottom Fish Tissues in Liberty Bay - Risk-Based Level Results

Ingestion of Bottom Fish Tissue

Future

Exposure Medium: Bottom Fish Tissue
Exposure Point: Bottom Fish in Liberty Bay
Receptor Population: Tribal Subsistence
Receptor Age: Adults and Children

Noncancer SL = RfD x THQ / SIFnc
Cancer SL = TCR / (CSF x SIFc)

Parameter	Unit	RME Adult Total Shellfish	RME Child Total Shellfish
Chemical Conc'n in Tissue (CTi)	mg/kg	chem-specific	chem-specific
Ingestion Rate of Bottom Fish Tissue (IR)[a]	g/day	29.1	3.20
Fracton of Clam from Contaminated Source (FC)	unitless	1	1
Exposure Frequency (EF)	days/year	365	365
Exposure Duration (ED)	years	64	6
Conversion Factor (CF)	kg/g	1.00E-03	1.00E-03
Body Weight (BW)	kg	79	16.8
Averaging Time (noncancer) (ATnc)	days	23,360	2,190
Averaging Time (cancer) (ATc)	days	25,550	25,550
SIFnc = (IR*FC*EF*ED*CF)/(BW*Atnc)	$(day)^{-1}$	3.68E-04	1.90E-04
IngFadj (Ingestion Adjusted Factor)= (IRc*EDc/BWc)+(IRa*EDa/BWa)		2.47E+01	
SIFnc (child/adult) = ((InhFadj*EF)/(ATnc))		3.53E-04	
SIFc = (IngFadj*FC*EF*CF)/ATc	$(day)^{-1}$	3.5E-04	

[a] Adult bottom fish (Group D) ingestion rate is from Table B-2 from the EPA framework document (EPA 2007) and the child ingestion rate is from Page 3-4 of the BNC OUB Marine Final Tech Memo HH Evaluation of Mercury in Seafood

Reasonable Maximum Exposure					
Chemical	HQ Adult	Cancer Risk Lifetime	Child Noncancer Risk-based Level (mg/kg)	Adult and Child Noncancer Risk-based Level (mg/kg)	Cancer Risk-based Level (mg/kg)
3,3'-Dichlorobenzidine	0.1	1.0E-06	--	--	0.00629
Pentachlorophenol	0.1	1.0E-06	2.6	1.416	0.0071
Antimony (metallic)	0.1	1.0E-06	0.2	0.11328	--
Arsenic (total)	0.1	1.0E-06	0.2	0.08496	0.0019
Vanadium	0.1	1.0E-06	2.6	1.41600	--
Chromium (based on CRVI)	0.1	1.0E-06	1.6	0.85	0.0057
Total Chromium (based on CR III)	0.1	1.0E-06	787.5	424.80	--
Cadmium (Diet)	0.1	1.0E-06	0.5	0.28	--
Copper	0.1	1.0E-06	21.0	11.33	--
Lead	0.1	1.0E-06	--	--	--
Nickel (soluble salts)	0.1	1.0E-06	10.5	5.66	--
Silver	0.1	1.0E-06	2.6	1.4160	--
Zinc	0.1	1.0E-06	157.5	84.9599	--
Mercury (methyl)	0.1	1.0E-06	0.053	0.0283	--
Selenium	0.1	1.0E-06	2.6	1.4160	--
Acenaphthene	0.1	1.0E-06	31.5	16.99	--
Acenaphthylene	0.1	1.0E-06	31.5	16.99	--
Anthracene	0.1	1.0E-06	157.5	84.96	--
Benza(a)anthracene	0.1	1.0E-06	--	--	0.0039
Benzo(a)pyrene	0.1	1.0E-06	--	--	0.00039
Benzo(b)fluoranthene	0.1	1.0E-06	--	--	0.0039
Benzo(ghi)perylene	0.1	1.0E-06	--	--	--
Benzo(k)fluoranthene	0.1	1.0E-06	--	--	0.039
Chrysene	0.1	1.0E-06	--	--	0.388
Dibenzo(a,h)anthracene	0.1	1.0E-06	--	--	0.00039
Fluoranthene	0.1	1.0E-06	21.0	11.328	--
Fluorene	0.1	1.0E-06	21.0	11.328	--
Indeno(1,2,3-cd)pyrene	0.1	1.0E-06	--	--	0.0039
Phenanthrene	0.1	1.0E-06	157.5	85.0	--
Pyrene	0.1	1.0E-06	15.8	8.5	--
Benzoic Acid	0.1	1.0E-06	2100.0	1132.80	--
Phenol	0.1	1.0E-06	157.5	84.96	--
Diethyl phthalate	0.1	1.0E-06	420.0	226.56	--
Di-n-butyl phthalate	0.1	1.0E-06	52.5	28.32	--
Arochlor 1016	0.1	1.0E-06	0.04	0.01982	0.040
Arochlor 1221	0.1	1.0E-06	--	--	0.0014
Arochlor 1232	0.1	1.0E-06	--	--	0.0014
Arochlor 1242	0.1	1.0E-06	--	--	0.0014
Arochlor 1248	0.1	1.0E-06	--	--	0.0014
Arochlor 1254	0.1	1.0E-06	0.0105	0.005664	0.0014
Arochlor 1260	0.1	1.0E-06	--	--	0.0014
4-4'-DDE	0.1	1.0E-06	--	--	0.0083
4-4'-DDT	0.1	1.0E-06	0.263	0.142	0.0083
Aldrin	0.1	1.0E-06	0.016	0.008	0.00017
1,3,5-Trinitrobenzene	0.1	1.0E-06	15.8	8.496	--
1,3-Dinitrobenzene	0.1	1.0E-06	0.053	0.028	--
3,5-Dinitroaniline	0.1	1.0E-06	--	--	--
2,4,6-Trinitrotoluene	0.1	1.0E-06	0.26	0.142	0.094
2,4-Dinitrotoluene	0.1	1.0E-06	1.05	0.566	0.0091
2,6-Dinitrotoluene	0.1	1.0E-06	0.53	0.283	--
2-Amino-4,6-dinitrotoluene	0.1	1.0E-06	1.05	0.566	--
4-Amino-2,6-dinitrotoluene	0.1	1.0E-06	1.05	0.566	--
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	0.1	1.0E-06	26.25	14.160	--
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	0.1	1.0E-06	1.58	0.850	0.026
Tetryl	0.1	1.0E-06	2.10	1.133	--
Pentaerythritol Tetranitrate (PETN)	0.1	1.0E-06	1.05	0.566	0.708
2,4-Diamino-6-nitrotoluene	0.1	1.0E-06	--	--	--
2,6-Diamino-4-nitrotoluene	0.1	1.0E-06	--	--	--
2-Nitrotoluene	0.1	1.0E-06	0.47	0.254880	0.013
3-Nitrotoluene	0.1	1.0E-06	0.05	0.028320	--
4-Nitrotoluene	0.1	1.0E-06	2.10	1.132799	0.177
Nitroglycerin	0.1	1.0E-06	0.05	0.028320	0.167
Nitrobenzene	0.1	1.0E-06	1.05	0.566399	--
N-Nitrosodiphenylamine	0.1	1.0E-06	--	--	0.577958563
Picric Acid	0.1	1.0E-06	--	--	--
Picramic acid	0.1	1.0E-06	0.05250	0.028320	--
2,4-Dinitrophenol	0.1	1.0E-06	1.05000	0.566399	--

Chemical	RfDo (mg/kg-d)	CSFo (mg/kg-d)-1
3,3'-Dichlorobenzidine	--	4.5E-01
Pentachlorophenol	5.0E-03	4.0E-01
Antimony (metallic)	4.0E-04	--
Arsenic (total)	3.0E-04	1.5E+00
Vanadium	5.0E-03	--
Chromium (based on CRVI)	3.0E-03	5.0E-01
Total Chromium (based on CR III)	1.5E+00	--
Cadmium (Diet)	1.0E-03	--
Copper	4.0E-02	--
Lead	--	--
Nickel (soluble salts)	2.0E-02	--
Silver	5.0E-03	--
Zinc	3.0E-01	--
Mercury (methyl)	1.0E-04	--
Selenium	5.0E-03	--
Acenaphthene	6.0E-02	--
Acenaphthylene	6.0E-02	--
Anthracene	3.0E-01	--
Benza(a)anthracene	--	7.3E-01
Benzo(a)pyrene	--	7.3E+00
Benzo(b)fluoranthene	--	7.3E-01
Benzo(ghi)perylene	--	--
Benzo(k)fluoranthene	--	7.3E-02
Chrysene	--	7.3E-03
Dibenzo(a,h)anthracene	--	7.3E+00
Fluoranthene	4.0E-02	--
Fluorene	4.0E-02	--
Indeno(1,2,3-cd)pyrene	--	7.3E-01
Phenanthrene	3.0E-01	--
Pyrene	3.0E-02	--
Benzoic Acid	4.0E+00	--
Phenol	3.0E-01	--
Diethyl phthalate	8.0E-01	--
Di-n-butyl phthalate	1.0E-01	--
Arochlor 1016	7.0E-05	7.0E-02
Arochlor 1221	--	2.0E+00
Arochlor 1232	--	2.0E+00
Arochlor 1242	--	2.0E+00
Arochlor 1248	--	2.0E+00
Arochlor 1254	2.0E-05	2.0E+00
Arochlor 1260	--	2.0E+00
4-4'-DDE	--	3.4E-01
4-4'-DDT	5.0E-04	3.4E-01
Aldrin	3.0E-05	1.7E+01
1,3,5-Trinitrobenzene	3.0E-02	--
1,3-Dinitrobenzene	1.0E-04	--
3,5-Dinitroaniline	--	--
2,4,6-Trinitrotoluene	5.0E-04	3.0E-02
2,4-Dinitrotoluene	2.0E-03	3.1E-01
2,6-Dinitrotoluene	1.0E-03	--
2-Amino-4,6-dinitrotoluene	2.0E-03	--
4-Amino-2,6-dinitrotoluene	2.0E-03	--
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	5.0E-02	--
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	3.0E-03	1.1E-01
Tetryl	4.0E-03	--
Pentaerythritol Tetranitrate (PETN)	2.0E-03	4.0E-03
2,4-Diamino-6-nitrotoluene	--	--
2,6-Diamino-4-nitrotoluene	--	--
2-Nitrotoluene	9.0E-04	2.2E-01
3-Nitrotoluene	1.0E-04	--
4-Nitrotoluene	4.0E-03	1.6E-02
Nitroglycerin	1.0E-04	1.7E-02
Nitrobenzene	2.0E-03	--
N-Nitrosodiphenylamine	--	4.9E-03
Picric Acid	--	--
Picramic acid	1.0E-04	--
2,4-Dinitrophenol	2.0E-03	--

Table A3: Subsistence Exposures to Non-Salmon Finfish Tissues in Liberty Bay - Risk-Based Level Results
Ingestion of Non-Salmon Finfish Tissue
Future

Exposure Medium: Non-Salmon Finfish Tissue
Exposure Point: Non-Salmon Finfish in Liberty Bay
Receptor Population: Tribal Subsistence
Receptor Age: Adults and Children

Noncancer SL = RfD x THQ / SIFnc
Cancer SL = TCR / (CSF x SIFc)

Parameter	Unit	RME Adult Total Shellfish	RME Child Total Shellfish
Chemical Conc'n in Tissue (CTi)	mg/kg	chem-specific	chem-specific
Ingestion Rate of Nonsalmon Finfish Tissue (IR)[a]	g/day	85.1	17.90
Fracton of Clam from Contaminated Source (FC)	unitless	1	1
Exposure Frequency (EF)	days/year	365	365
Exposure Duration (ED)	years	64	6
Conversion Factor (CF)	kg/g	1.00E-03	1.00E-03
Body Weight (BW)	kg	79	16.8
Averaging Time (noncancer) (ATnc)	days	23,360	2,190
Averaging Time (cancer) (ATc)	days	25,550	25,550
SIFnc = (IR*FC*EF*ED*CF)/(BW*Atnc)	$(day)^{-1}$	1.08E-03	1.07E-03
IngFadj (Ingestion Adjusted Factor)= (IRc*EDc/BWc)+(IRa*EDa/BWa)		7.53E+01	
SIFnc (child/adult) = ((InhFadj*EF)/(ATnc))		1.08E-03	
SIFc = (IngFadj*FC*EF*CF)/ATc	$(day)^{-1}$	1.1E-03	

[a] Adult non-salmon finfish (Group B, C and D combined) ingestion rate is from Table B-2 from the EPA framework document (EPA 2007) and the child ingestion rate is from Page 3-4 of the BNC OUB Marine Final Tech Memo HH Evaluation of Mercury in Seafood (Pelagic and Bottom Fish combined)

Reasonable Maximum Exposure

Chemical	HQ Adult	Cancer Risk Lifetime	Child Noncancer Risk-based Level (mg/kg)	Adult and Child Noncancer Risk-based Level (mg/kg)	Cancer Risk-based Level (mg/kg)
3,3'-Dichlorobenzidine	0.1	1.0E-06	--	--	0.0021
Pentachlorophenol	0.1	1.0E-06	0.4693	0.4646	0.0023
Antimony (metallic)	0.1	1.0E-06	0.0375	0.0372	--
Arsenic (total)	0.1	1.0E-06	0.0282	0.0279	0.0006
Vanadium	0.1	1.0E-06	0.4693	0.4646	--
Chromium (based on CRVI)	0.1	1.0E-06	0.2816	0.2788	0.0019
Total Chromium (based on CR III)	0.1	1.0E-06	140.7821	139.3781	--
Cadmium (Diet)	0.1	1.0E-06	0.0939	0.0929	--
Copper	0.1	1.0E-06	3.7542	3.7168	--
Lead	0.1	1.0E-06	--	--	--
Nickel (soluble salts)	0.1	1.0E-06	1.8771	1.8584	--
Silver	0.1	1.0E-06	0.4693	0.4646	--
Zinc	0.1	1.0E-06	28.1564	27.8756	--
Mercury (methyl)	0.1	1.0E-06	0.0094	0.0093	--
Selenium	0.1	1.0E-06	0.4693	0.4646	--
Acenaphthene	0.1	1.0E-06	5.6313	5.5751	--
Acenaphthylene	0.1	1.0E-06	5.6313	5.5751	--
Anthracene	0.1	1.0E-06	28.1564	27.8756	--
Benza(a)anthracene	0.1	1.0E-06	--	--	0.0013
Benzo(a)pyrene	0.1	1.0E-06	--	--	0.00013
Benzo(b)fluoranthene	0.1	1.0E-06	--	--	0.0013
Benzo(ghi)perylene	0.1	1.0E-06	--	--	--
Benzo(k)fluoranthene	0.1	1.0E-06	--	--	0.0127
Chrysene	0.1	1.0E-06	--	--	0.1273
Dibenzo(a,h)anthracene	0.1	1.0E-06	--	--	0.00013
Fluoranthene	0.1	1.0E-06	3.7542	3.7168	--
Fluorene	0.1	1.0E-06	3.7542	3.7168	--
Indeno(1,2,3-cd)pyrene	0.1	1.0E-06	--	--	0.0013
Phenanthrene	0.1	1.0E-06	28.1564	27.8756	--
Pyrene	0.1	1.0E-06	2.8156	2.7876	--
Benzoic Acid	0.1	1.0E-06	375.4190	371.6750	--
Phenol	0.1	1.0E-06	28.1564	27.8756	--
Diethyl phthalate	0.1	1.0E-06	75.0838	74.3350	--
Di-n-butyl phthalate	0.1	1.0E-06	9.3855	9.2919	--
Arochlor 1016	0.1	1.0E-06	0.0066	0.0065	0.0133
Arochlor 1221	0.1	1.0E-06	--	--	0.0005
Arochlor 1232	0.1	1.0E-06	--	--	0.0005
Arochlor 1242	0.1	1.0E-06	--	--	0.0005
Arochlor 1248	0.1	1.0E-06	--	--	0.0005
Arochlor 1254	0.1	1.0E-06	0.0019	0.0019	0.0005
Arochlor 1260	0.1	1.0E-06	--	--	0.0005
4-4'-DDE	0.1	1.0E-06	--	--	0.0027
4-4'-DDT	0.1	1.0E-06	0.0469	0.0465	0.0027
Aldrin	0.1	1.0E-06	0.0028	0.0028	0.00005
1,3,5-Trinitrobenzene	0.1	1.0E-06	2.8156	2.7876	--
1,3-Dinitrobenzene	0.1	1.0E-06	0.0094	0.0093	--
3,5-Dinitroaniline	0.1	1.0E-06	--	--	--
2,4,6-Trinitrotoluene	0.1	1.0E-06	0.0469	0.0465	0.0310
2,4-Dinitrotoluene	0.1	1.0E-06	0.1877	0.1858	0.0030
2,6-Dinitrotoluene	0.1	1.0E-06	0.0939	0.0929	--
2-Amino-4,6-dinitrotoluene	0.1	1.0E-06	0.1877	0.1858	--
4-Amino-2,6-dinitrotoluene	0.1	1.0E-06	0.1877	0.1858	--
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	0.1	1.0E-06	4.6927	4.6459	--
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	0.1	1.0E-06	0.2816	0.2788	0.0084
Tetryl	0.1	1.0E-06	0.3754	0.3717	--
Pentaerythritol Tetranitrate (PETN)	0.1	1.0E-06	0.1877	0.1858	0.2323
2,4-Diamino-6-nitrotoluene	0.1	1.0E-06	--	--	--
2,6-Diamino-4-nitrotoluene	0.1	1.0E-06	--	--	--
2-Nitrotoluene	0.1	1.0E-06	0.0845	0.0836	0.0042
3-Nitrotoluene	0.1	1.0E-06	0.0094	0.0093	--
4-Nitrotoluene	0.1	1.0E-06	0.3754	0.3717	0.0581
Nitroglycerin	0.1	1.0E-06	0.0094	0.0093	0.0547
Nitrobenzene	0.1	1.0E-06	0.1877	0.1858	--
N-Nitrosodiphenylamine	0.1	1.0E-06	--	--	0.1896
Picric Acid	0.1	1.0E-06	--	--	--
Picramic acid	0.1	1.0E-06	0.0094	0.0093	--
2,4-Dinitrophenol	0.1	1.0E-06	0.1877	0.1858	--

Chemical	RfDo (mg/kg-d)	CSFo (mg/kg-d)-1
3,3'-Dichlorobenzidine	--	4.5E-01
Pentachlorophenol	5.0E-03	4.0E-01
Antimony (metallic)	4.0E-04	--
Arsenic (total)	3.0E-04	1.5E+00
Vanadium	5.0E-03	--
Chromium (based on CRVI)	3.0E-03	5.0E-01
Total Chromium (based on CR III)	1.5E+00	--
Cadmium (Diet)	1.0E-03	--
Copper	4.0E-02	--
Lead	--	--
Nickel (soluble salts)	2.0E-02	--
Silver	5.0E-03	--
Zinc	3.0E-01	--
Mercury (methyl)	1.0E-04	--
Selenium	5.0E-03	--
Acenaphthene	6.0E-02	--
Acenaphthylene	6.0E-02	--
Anthracene	3.0E-01	--
Benza(a)anthracene	--	7.3E-01
Benzo(a)pyrene	--	7.3E+00
Benzo(b)fluoranthene	--	7.3E-01
Benzo(ghi)perylene	--	--
Benzo(k)fluoranthene	--	7.3E-02
Chrysene	--	7.3E-03
Dibenzo(a,h)anthracene	--	7.3E+00
Fluoranthene	4.0E-02	--
Fluorene	4.0E-02	--
Indeno(1,2,3-cd)pyrene	--	7.3E-01
Phenanthrene	3.0E-01	--
Pyrene	3.0E-02	--
Benzoic Acid	4.0E+00	--
Phenol	3.0E-01	--
Diethyl phthalate	8.0E-01	--
Di-n-butyl phthalate	1.0E-01	--
Arochlor 1016	7.0E-05	7.0E-02
Arochlor 1221	--	2.0E+00
Arochlor 1232	--	2.0E+00
Arochlor 1242	--	2.0E+00
Arochlor 1248	--	2.0E+00
Arochlor 1254	2.0E-05	2.0E+00
Arochlor 1260	--	2.0E+00
4-4'-DDE	--	3.4E-01
4-4'-DDT	5.0E-04	3.4E-01
Aldrin	3.0E-05	1.7E+01
1,3,5-Trinitrobenzene	3.0E-02	--
1,3-Dinitrobenzene	1.0E-04	--
3,5-Dinitroaniline	--	--
2,4,6-Trinitrotoluene	5.0E-04	3.0E-02
2,4-Dinitrotoluene	2.0E-03	3.1E-01
2,6-Dinitrotoluene	1.0E-03	--
2-Amino-4,6-dinitrotoluene	2.0E-03	--
4-Amino-2,6-dinitrotoluene	2.0E-03	--
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	5.0E-02	--
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	3.0E-03	1.1E-01
Tetryl	4.0E-03	--
Pentaerythritol Tetranitrate (PETN)	2.0E-03	4.0E-03
2,4-Diamino-6-nitrotoluene	--	--
2,6-Diamino-4-nitrotoluene	--	--
2-Nitrotoluene	9.0E-04	2.2E-01
3-Nitrotoluene	1.0E-04	--
4-Nitrotoluene	4.0E-03	1.6E-02
Nitroglycerin	1.0E-04	1.7E-02
Nitrobenzene	2.0E-03	--
N-Nitrosodiphenylamine	--	4.9E-03
Picric Acid	--	--
Picramic acid	1.0E-04	--
2,4-Dinitrophenol	2.0E-03	--

Attachment B
Tissue Screening Detail

Table B1
Occurrence, Distribution, and Selection of Shellfish Tissue in Marine Area OU 2 of JPHC

Chemical	Minimum Detected Concentration[a] (mg/kg-ww)	Minimum Qualifier	Maximum Detected Concentration[a] (mg/kg-ww)	Maximum Qualifier	Location of Maximum Detected Concentration	Detection Frequency	Range of Detection Limits (mg/kg)	Concentration Used for Screening (mg/kg-ww)	Screening Value 1 (HQ=0.1 or risk of 10^{-6}) (mg/kg)	Exceeds Screening Value 1[b]	Screening Value 2 (HQ=1) (mg/kg)	Exceeds Screening Value 2	Rationale for Contaminant Deletion or Selection[c]
Metals													
Arsenic[d]	**0.46**	**J**	**7.1**		**OU2-CRAB-02WB**	**24/24**	--	**7.1**	**0.00011 c**	**Yes**	--	--	**ASL**
Cadmium	**0.134**		**1.2**		**OU2-CRAB-01WB**	**24/24**	--	**1.2**	**0.016**	**Yes**	**0.165**	**Yes**	**ASL**
Chromium	**0.18**	**J**	**26.9**		**OU2-OA-02-BNC**	**24/24**	--	**26.9**	**0.00033 c**	**Yes**	--	--	**ASL**
Copper	**2.29**	**J**	**253**	**J**	**OU2-OA-03-BNC**	**24/24**	--	**253**	**0.66**	**Yes**	**6.599**	**Yes**	**ASL**
Lead	0.124		18.5		OU2-OA-04-BNC	24/24	--	18.5	NE	--	--	--	--
Mercury	**0.026**		**0.978**		**OU2-OA-03-BNC**	**24/24**	--	**0.978**	**0.0016**	**Yes**	**0.016**	**Yes**	**ASL**
Nickel	**0.65**		**26.4**	**J**	**OU2-BA-02-BNC/ OU2-OA-04-BNC**	**24/24**	--	**26.4**	**0.33**	**Yes**	**3.30**	**Yes**	**ASL**
Selenium	**1.04**		**8.06**		**OU2-OA-02-SC**	**24/24**	--	**8.06**	**0.082**	**Yes**	**0.82**	**Yes**	**ASL**
Silver	**0.025**		**3.23**		**OU2-CRAB-02WB**	**23/24**	**0.02**	**3.23**	**0.082**	**Yes**	**0.82**	**Yes**	**ASL**
Zinc	**41.9**	**J**	**217**	**J**	**OU2-CRAB-05M**	**24/24**	--	**217**	**4.95**	**Yes**	**49.49**	**Yes**	**ASL**
Polycyclic Aromatic Hydrocarbons (PAHs)													
Acenaphthene	0.000052	J	0.00013	J	OU2-CRAB-01M	12/24	0.005 - 0.01	0.00013	0.99	No	--	--	BSL
Acenaphthylene	0.000068	J	0.0001	J	OU2-CRAB-02M	9/24	0.000047 - 0.01	0.0001	0.99	No	--	--	BSL
Anthracene	0.00024	J	0.0005	J	OU2-OA-02-BNC/ OU2-OA-04-BNC	7/24	0.00019 - 0.00038	0.0005	4.95	No	--	--	BSL
Benz(a)anthracene	**0.00026**	**J**	**0.002**	**J**	**OU2-OA-02-BNC**	**10/24**	**0.00016 - 0.0048**	**0.002**	**0.00023 c**	**Yes**	--	--	**ASL**
Benzo(a)pyrene	**0.00017**	**J**	**0.0016**	**J**	**OU2-OA-02-BNC**	**9/24**	**0.000061 - 0.0048**	**0.0016**	**0.000023 c**	**Yes**	**0.00023**	**Yes**	**ASL**
Benzo(b)fluoranthene	**0.00028**	**J**	**0.0051**		**OU2-OA-02-BNC**	**9/24**	**0.00014 - 0.0048**	**0.0051**	**0.00023 c**	**Yes**	**0.0023**	**Yes**	**ASL**
Benzo(ghi)perylene	0.00038	J	0.0029	J	OU2-OA-02-BNC	4/24	0.000058 - 0.01	0.0029	NE	--	--	--	--
Benzo(k)fluoranthene	**0.00014**	**J**	**0.0031**	**J**	**OU2-OA-02-BNC**	**9/24**	**0.000092 - 0.00018**	**0.0031**	**0.0023 c**	**Yes**	--	--	**ASL**
Chrysene	0.00034	J	0.0024	J	OU2-OA-02-BNC	8/24	0.0002 - 0.00038	0.0024	0.023 c	No	--	--	BSL
Dibenzo(a,h)anthracene	**0.000078**	**J**	**0.00032**	**J**	**OU2-OA-02-BNC**	**4/24**	**0.000045 - 0.0048**	**0.00032**	**0.000023 c**	**Yes**	--	--	**ASL**
Fluoranthene	0.00016	J	0.0036	J	OU2-OA-04-BNC	16/24	0.00015 - 0.00028	0.0036	0.66	No	--	--	BSL
Fluorene	0.0001	J	0.00078	J	OU2-OA-04-BNC	20/24	0.000095 - 0.00018	0.00078	0.66	No	--	--	BSL
Indeno(1,2,3-cd)pyrene	**0.00012**	**J**	**0.0035**	**J**	**OU2-OA-02-BNC**	**9/24**	**0.0001 - 0.0048**	**0.0035**	**0.00023 c**	**Yes**	--	--	**ASL**
Phenanthrene	0.00034	J	0.0013	J	OU2-OA-04-BNC	14/24	0.00032 - 0.0006	0.0013	4.95	No	--	--	BSL
Pyrene	0.00012	J	0.0032	J	OU2-OA-04-BNC	16/24	0.00012 - 0.00023	0.0032	0.49	No	--	--	BSL
Semi-Volatile Organic Compounds (SVOCs)													
Benzoic Acid	0.59	J	17	J	OU2-OA-04-BNC	11/24	0.58 - 0.77	17	65.99	No	--	--	BSL
Diethyl phthalate	0.0071	J	0.016	J	OU2-OA-03-BNC	11/24	0.0068 - 0.036	0.016	13.20	No	--	--	BSL
Di-n-butyl phthalate	0.019	J	0.046	J	OU2-OA-04-BNC	10/24	0.016 - 0.17	0.046	1.65	No	--	--	BSL
N-Nitrosodiphenylamine	0.0057	J	0.0057	J	OU2-OA-04-BNC	1/24	0.0027 - 0.005	0.0057	0.034 c	No	--	--	BSL
Pentachlorophenol	**0.0063**	**J**	**0.075**	**J**	**OU2-OA-03-BNC**	**4/24**	**0.0045 - 0.0067**	**0.075**	**0.00041 c**	**Yes**	--	--	**ASL**
Polychlorinated Biphenyls (PCBs)													
PCB-Aroclor 1260	**0.0044**	**J**	**0.0082**	**J**	**OU2-CRAB-03WB**	**5/24**	**0.0028 - 0.0099**	**0.0082**	**0.000082 c**	**Yes**	--	--	**ASL**
Pesticides													
4,4'-DDE	**0.00063**	**J**	**0.0016**		**OU2-CRAB-05WB**	**9/24**	**0.00045 - 0.001**	**0.0016**	**0.00049 c**	**Yes**	--	--	**ASL**
4,4'-DDT	**0.001**		**0.0025**		**OU2-CRAB-05WB**	**10/24**	**0.00049 - 0.002**	**0.0025**	**0.00049 c**	**Yes**	--	--	**ASL**
Munition Constituents													
1,3,5-Trinitrobenzene	0.0022	J	0.0022	J	OU2-CRAB-01WB	1/24	0.00191 - 0.00875	0.0022	0.49 c	No	--	--	BSL
2,4-Dinitrophenol	0.000499	J	0.000499	J	OU2-CRAB-03M	1/24	0.00042 - 0.0313	0.000499	0.033	No	--	--	BSL
4-Nitrotoluene	**0.33**	**NJ**	**0.33**	**NJ**	**OU2-OA-02-SC**	**1/24**	**0.2 - 0.77**	**0.33**	**0.010 c**	**Yes**	--	--	**ASL**
Nitrobenzene	**0.48**	**NJ**	**0.95**	**NJ**	**OU2-OA-03-SC**	**6/24**	**0.18 - 1.4**	**0.95**	**0.033**	**Yes**	**0.33**	**Yes**	**ASL**
Nitroglycerin	**0.29**	**NJ**	**0.52**	**NJ**	**OU2-OA-02-SC**	**2/24**	**0.28 - 0.82**	**0.52**	**0.0016**	**Yes**	**0.016**	**Yes**	**ASL**
Picramic Acid	0.00587	J	0.0109	J	OU2-OA-01-BNC	3/24	0.0003 - 0.00594	0.0109	0.0016	Yes	0.016	No	BSL
Picric Acid	0.000348	J	0.00106	J	OU2-CRAB-01M	4/24	0.000124 - 0.00157	0.00106	NE	--	--	--	--

Notes:

[a] Shellfish tissue concentrations include bent-nose clam, crab-whole body, crab-muscle, and sea cucumber combined.

[b] Shellfish screening values were calculated based on a Hazard Quotient of 0.1 and the equation and input parameters detailed in Attachment A.

[c] Rationale codes:

Selection reason: ASL - above screening level

Deletion reason: BSL - below screening level

[d] Because only 10% of the total arsenic in fish tissue is inorganic, the total arsenic concentrations in tissue were divided by a factor of 10 for screening purposes.

Bolded chemical exceeded its screening value.
-- - 100 percent detection frequency
c - cancer

J - estimated value
mg/kg - milligram per kilogram
N - Analyte was tentatively identified but confirmation not performed. The result is presumptive.

NE - not established
ww - wet weight

Table B2

Occurrence, Distribution, and Selection of Bent-nose Clam Whole Body Tissue in Marine Area OU 2 of JPHC

Chemical	Minimum Detected Concentration (mg/kg-ww)	Minimum Qualifier	Maximum Detected Concentration (mg/kg-ww)	Maximum Qualifier	Location of Maximum Detected Concentration	Detection Frequency	Range of Detection Limits (mg/kg)	Concentration Used for Screening (mg/kg-ww)	Screening Value 1 (HQ=0.1 or risk of 10^{-6}) (mg/kg)	Exceeds Screening Value 1[a]	Screening Value 2 (HQ=1) (mg/kg)	Exceeds Screening Value 2	Rationale for Contaminant Deletion or Selection[b]
Metals													
Arsenic[c]	**1.2**	**J**	**3.9**	**J**	**OU2-OA-01-BNC**	**6/6**	**--**	**3.9**	**0.00011 c**	**Yes**	**--**	**--**	**ASL**
Cadmium	**0.198**		**0.262**		**OU2-BA-02-BNC**	**6/6**	**--**	**0.262**	**0.016**	**Yes**	**0.165**	**Yes**	**ASL**
Chromium	**11.8**		**26.9**		**OU2-OA-02-BNC**	**6/6**	**--**	**26.9**	**0.00033 c**	**Yes**	**--**	**--**	**ASL**
Copper	**82.8**	**J**	**253**	**J**	**OU2-OA-03-BNC**	**6/6**	**--**	**253**	**0.66**	**Yes**	**6.60**	**Yes**	**ASL**
Lead	9.46		18.5		OU2-OA-04-BNC	**6/6**	--	18.5	NE	--	--	--	--
Mercury	**0.225**		**0.978**		**OU2-OA-03-BNC**	**6/6**	**--**	**0.978**	**0.0016**	**Yes**	**0.016**	**Yes**	**ASL**
Nickel	**16**	**J**	**26.4**	**J**	**OU2-BA-02-BNC/ OU2-OA-04-BNC**	**6/6**	**--**	**26.4**	**0.33**	**Yes**	**3.30**	**Yes**	**ASL**
Selenium	**1.04**		**2.88**		**OU2-BA-02-BNC**	**6/6**	**--**	**2.88**	**0.082**	**Yes**	**0.82**	**Yes**	**ASL**
Silver	**0.56**		**2.2**		**OU2-OA-03-BNC**	**6/6**	**--**	**2.2**	**0.082**	**Yes**	**0.82**	**Yes**	**ASL**
Zinc	**109**	**J**	**205**	**J**	**OU2-OA-01-BNC**	**6/6**	**--**	**205**	**4.95**	**Yes**	**49.49**	**Yes**	**ASL**
Polycyclic Aromatic Hydrocarbons (PAHs)													
Anthracene	0.00027	J	0.0005	J	OU2-OA-02-BNC/ OU2-OA-04-BNC	5/6	0.00038	0.0005	4.95	No	--	--	BSL
Benz(a)anthracene	**0.0003**	**J**	**0.002**	**J**	**OU2-OA-02-BNC**	**6/6**	**--**	**0.002**	**0.00023 c**	**Yes**	**--**	**--**	**ASL**
Benzo(a)pyrene	**0.00032**	**J**	**0.0016**	**J**	**OU2-OA-02-BNC**	**6/6**	**--**	**0.0016**	**0.000023 c**	**Yes**	**--**	**--**	**ASL**
Benzo(b)fluoranthene	**0.00064**	**J**	**0.0051**		**OU2-OA-02-BNC**	**6/6**	**--**	**0.0051**	**0.00023 c**	**Yes**	**--**	**--**	**ASL**
Benzo(ghi)perylene	0.00055	J	0.0029	J	OU2-OA-02-BNC	3/6	0.005 - 0.01	0.0029	NE	--	--	--	--
Benzo(k)fluoranthene	**0.00025**	**J**	**0.0031**	**J**	**OU2-OA-02-BNC**	**6/6**	**--**	**0.0031**	**0.0023 c**	**Yes**	**--**	**--**	**ASL**
Chrysene	0.00034	J	0.0024	J	OU2-OA-02-BNC	6/6	--	0.0024	0.023 c	No	--	--	BSL
Dibenzo(a,h)anthracene	**0.000078**	**J**	**0.00032**	**J**	**OU2-OA-02-BNC**	**3/6**	**0.000045 - 0.00009**	**0.00032**	**0.000023 c**	**Yes**	**--**	**--**	**ASL**
Fluoranthene	0.0014	J	0.0036	J	OU2-OA-04-BNC	6/6	--	0.0036	0.66	No	--	--	BSL
Fluorene	0.00025	J	0.00078	J	OU2-OA-04-BNC	6/6	--	0.00078	0.66	No	--	--	BSL
Indeno(1,2,3-cd)pyrene	**0.00023**	**J**	**0.0035**	**J**	**OU2-OA-02-BNC**	**6/6**	**--**	**0.0035**	**0.00023 c**	**Yes**	**--**	**--**	**ASL**
Phenanthrene	0.00055	J	0.0013	J	OU2-OA-04-BNC	6/6	--	0.0013	4.95	No	--	--	BSL
Pyrene	0.001	J	0.0032	J	OU2-OA-04-BNC	6/6	--	0.0032	0.49	No	--	--	BSL
Semi-Volatile Organic Compounds (SVOCs)													
Benzoic Acid	3.2	J	17	J	OU2-OA-04-BNC	6/6	--	17	65.99	No	--	--	BSL
Diethyl phthalate	0.0075	J	0.016	J	OU2-OA-03-BNC	6/6	--	0.016	13.20	No	--	--	BSL
Di-n-butyl phthalate	0.019	J	0.046	J	OU2-OA-04-BNC	5/6	0.016	0.046	1.65	No	--	--	BSL
N-Nitrosodiphenylamine	0.0057	J	0.0057	J	OU2-OA-04-BNC	1/6	0.0027 - 0.005	0.0057	0.034 c	No	--	--	BSL
Pentachlorophenol	**0.0063**	**J**	**0.075**	**J**	**OU2-OA-03-BNC**	**4/6**	**0.0045**	**0.075**	**0.00041 c**	**Yes**	**--**	**--**	**ASL**
Pesticides													
4,4'-DDT	**0.0017**		**0.0017**		**OU2-BA-02-BNC**	**1/6**	**0.00049 - 0.002**	**0.0017**	**0.00049 c**	**Yes**	**--**	**--**	**ASL**
Munition Constituents													
Nitroglycerin	**0.29**	**NJ**	**0.29**	**NJ**	**OU2-BA-01-BNC**	**1/6**	**0.28 - 0.82**	**0.29**	**0.0016**	**Yes**	**0.016**	**Yes**	**ASL**
Picramic Acid	0.0109	J	0.0109	J	OU2-OA-01-BNC	1/6	0.00191 - 0.00594	0.0109	0.0016	Yes	0.016	No	BSL

Notes:

[a] Shellfish screening values were calculated based on a Hazard Quotient of 0.1 and risk of 10^{-6}; the equation and input parameters are detailed in Attachment A.

[b] Rationale codes:
Selection reason: ASL - above screening level
Deletion reason: BSL - below screening level

[c] Because only 10% of the total arsenic in fish tissue is inorganic, the total arsenic concentrations in tissue were divided by a factor of 10 for screening purposes.

Bolded chemical exceeded its screening value.
-- - 100 percent detection frequency
c - cancer

J - estimated value
mg/kg - milligram per kilogram
N - Analyte was tentatively identified but confirmation not performed. The result is presumptive.

NE - not established
ww - wet weight

Table B3
Occurrence, Distribution, and Selection of Crab Whole Body in Marine Area OU 2 of JPHC

Chemical	Minimum Detected Concentration (mg/kg-ww)	Minimum Qualifier	Maximum Detected Concentration (mg/kg-ww)	Maximum Qualifier	Location of Maximum Detected Concentration	Detection Frequency	Range of Detection Limits (mg/kg)	Concentration Used for Screening (mg/kg-ww)	Screening Value 1 (HQ=0.1 or risk of 10^{-6}) (mg/kg)	Exceeds Screening Value 1[a]	Screening Value 2 (HQ=1) (mg/kg)	Exceeds Screening Value 2	Rationale for Contaminant Deletion or Selection[b]
Metals													
Arsenic[c]	**4.5**		**7.1**		**OU2-CRAB-02WB**	**6/6**	**--**	**7.1**	**0.00011 c**	**Yes**	**--**	**--**	**ASL**
Cadmium	**0.584**		**1.2**		**OU2-CRAB-01WB**	**6/6**	**--**	**1.2**	**0.016**	**Yes**	**0.16**	**Yes**	**ASL**
Chromium	**0.85**		**1.72**		**OU2-CRAB-02WB**	**6/6**	**--**	**1.72**	**0.00033 c**	**Yes**	**--**	**--**	**ASL**
Copper	**53**		**96.8**		**OU2-CRAB-01WB**	**6/6**	**--**	**96.8**	**0.66**	**Yes**	**6.60**	**Yes**	**ASL**
Lead	1.94		4.1		OU2-CRAB-01WB	6/6	--	4.1	NE	--	--	--	--
Mercury	**0.229**		**0.65**		**OU2-CRAB-02WB**	**6/6**	**--**	**0.65**	**0.0016**	**Yes**	**0.016**	**Yes**	**ASL**
Nickel	1.3		1.96		OU2-CRAB-02WB	6/6	--	1.96	0.33	Yes	3.30	No	BSL
Selenium	**2.5**		**3.94**		**OU2-CRAB-04WB**	**6/6**	**--**	**3.94**	**0.082**	**Yes**	**0.82**	**Yes**	**ASL**
Silver	**1.77**		**3.23**		**OU2-CRAB-02WB**	**6/6**	**--**	**3.23**	**0.082**	**Yes**	**0.82**	**Yes**	**ASL**
Zinc	**169**	**J**	**196**	**J**	**OU2-CRAB-02WB/ OU2-CRAB-01WB**	**6/6**	**--**	**196**	**4.95**	**Yes**	**49.49**	**Yes**	**ASL**
Polycyclic Aromatic Hydrocarbons (PAHs)													
Acenaphthene	0.000084	J	0.00011	J	OU2-CRAB-01WB	6/6	--	0.00011	0.99	No	--	--	BSL
Acenaphthylene	0.000071	J	0.000089	J	OU2-CRAB-01WB	6/6	--	0.000089	0.99	No	--	--	BSL
Fluoranthene	0.00016	J	0.00031	J	OU2-CRAB-01WB	6/6	--	0.00031	0.66	No	--	--	BSL
Fluorene	0.00012	J	0.00017	J	OU2-CRAB-01WB	6/6	--	0.00017	0.66	No	--	--	BSL
Semi-Volatile Organic Compounds (SVOCs)													
Benzoic Acid	0.67	J	0.67	J	OU2-CRAB-02WB	1/6	0.58 - 0.58	0.67	65.99	No	--	--	BSL
Polychlorinated Biphenyls (PCBs)													
PCB-Aroclor 1260	**0.0061**	**J**	**0.0082**	**J**	**OU2-CRAB-03WB**	**3/6**	**0.0046 - 0.0099**	**0.0082**	**0.000082 c**	**Yes**	**--**	**--**	**ASL**
Pesticides													
4,4'-DDE	**0.00093**	**J**	**0.0016**		**OU2-CRAB-05WB**	**6/6**	**--**	**0.0016**	**0.00049 c**	**Yes**	**--**	**--**	**ASL**
4,4'-DDT	**0.0015**		**0.0025**		**OU2-CRAB-05WB**	**6/6**	**--**	**0.0025**	**0.00049 c**	**Yes**	**--**	**--**	**ASL**
Munition Constituents													
1,3,5-Trinitrobenzene	0.0022	J	0.0022	J	OU2-CRAB-01WB	1/6	2.1 - 2.1	0.0022	0.49 c	No	--	--	BSL
Nitrobenzene	**0.48**	**NJ**	**0.58**	**NJ**	**OU2-CRAB-01WB**	**3/6**	**0.18 - 0.18**	**0.58**	**0.033**	**Yes**	**0.33**	**Yes**	**ASL**
Picramic Acid	0.00587	J	0.00587	J	OU2-CRAB-01WB	1/6	0.0032 - 0.0032	0.00587	0.0016	Yes	0.016	No	BSL

Notes:

[a] Shellfish screening values were calculated based on a Hazard Quotient of 0.1 and risk of 10^{-6}; the equation and input parameters are detailed in Attachment A.

[b] Rationale codes:
Selection reason: ASL - above screening level
Deletion reason: BSL - below screening level

[c] Because only 10% of the total arsenic in fish tissue is inorganic, the total arsenic concentrations in tissue were divided by a factor of 10 for screening purposes.

Bolded chemical exceeded its screening value.
-- - 100 percent detection frequency
c - cancer

J - estimated value
mg/kg - milligram per kilogram
N - Analyte was tentatively identified but confirmation not performed. The result is presumptive.

NE - not established
ww - wet weight

Table B4
Occurrence, Distribution, and Selection of Crab Muscle Tissue in Marine Area OU 2 of JPHC

Chemical	Minimum Detected Concentration (mg/kg-ww)	Minimum Qualifier	Maximum Detected Concentration (mg/kg-ww)	Maximum Qualifier	Location of Maximum Detected Concentration	Detection Frequency	Range of Detection Limits (mg/kg)	Concentration Used for Screening (mg/kg-ww)	Screening Value 1 (HQ=0.1 or risk of 10^{-6}) (mg/kg)	Exceeds Screening Value 1[a]	Screening Value 2 (HQ=1) (mg/kg)	Exceeds Screening Value 2	Rationale for Contaminant Deletion or Selection[b]
Metals													
Arsenic[c]	**4.6**		**6.5**		**OU2-CRAB-05M**	**6/6**	**--**	**6.5**	**0.00011 c**	**Yes**	**--**	**--**	**ASL**
Cadmium	**0.134**		**0.208**		**OU2-CRAB-06M**	**6/6**	**--**	**0.208**	**0.016**	**Yes**	**0.16**	**Yes**	**ASL**
Chromium	**0.18**	**J**	**0.48**		**OU2-CRAB-01M**	**6/6**	**--**	**0.48**	**0.00033 c**	**Yes**	**--**	**--**	**ASL**
Copper	**37.3**		**47.7**		**OU2-CRAB-05M**	**6/6**	**--**	**47.7**	**0.66**	**Yes**	**6.60**	**Yes**	**ASL**
Lead	0.124		0.19		OU2-CRAB-01M	6/6	--	0.19	NE	--	--	--	--
Mercury	**0.323**		**0.577**		**OU2-CRAB-06M**	**6/6**	**--**	**0.577**	**0.0016**	**Yes**	**0.016**	**Yes**	**ASL**
Nickel	0.65		1		OU2-CRAB-02M	6/6	--	1	0.33	Yes	3.30	No	BSL
Selenium	**1.79**		**3.58**		**OU2-CRAB-01M**	**6/6**	**--**	**3.58**	**0.082**	**Yes**	**0.82**	**Yes**	**ASL**
Silver	**0.961**		**1.49**		**OU2-CRAB-05M**	**6/6**	**--**	**1.49**	**0.082**	**Yes**	**0.82**	**Yes**	**ASL**
Zinc	**182**	**J**	**217**	**J**	**OU2-CRAB-05M**	**6/6**	**--**	**217**	**4.95**	**Yes**	**49.49**	**Yes**	**ASL**
Polycyclic Aromatic Hydrocarbons (PAHs)													
Acenaphthene	0.000052	J	0.00013	J	OU2-CRAB-01M	6/6	--	0.00013	0.99	No	--	--	BSL
Acenaphthylene	0.000068	J	0.0001	J	OU2-CRAB-02M	3/6	0.000047 - 0.000088	0.0001	0.99	No	--	--	BSL
Fluorene	0.00012	J	0.00025	J	OU2-CRAB-02M	3/6	0.000095 - 0.00018	0.00025	0.66	No	--	--	BSL
Semi-Volatile Organic Compounds (SVOCs)													
Benzoic Acid	0.59	J	1.1	J	OU2-CRAB-01M	3/6	0.58 - 0.77	1.1	65.99	No	--	--	BSL
Polychlorinated Biphenyls (PCBs)													
PCB-Aroclor 1260	**0.0044**	**J**	**0.0044**	**J**	**OU2-CRAB-06M**	**1/6**	**0.0028 - 0.0099**	**0.0044**	**0.000082 c**	**Yes**	**--**	**--**	**ASL**
Pesticides													
4,4'-DDE	**0.00063**	**J**	**0.00086**	**J**	**OU2-CRAB-03M**	**3/6**	**0.00083 - 0.00089**	**0.00086**	**0.00049 c**	**Yes**	**--**	**--**	**ASL**
4,4'-DDT	**0.001**		**0.0016**		**OU2-CRAB-06M**	**3/6**	**0.0009 - 0.00097**	**0.0016**	**0.00049 c**	**Yes**	**--**	**--**	**ASL**
Munition Constituents													
2,4-Dinitrophenol	0.000499	J	0.000499	J	OU2-CRAB-03M	1/6	0.0010 - 0.0164	0.000499	0.033	No	--	--	BSL
Picramic Acid	0.0097	J	0.0097	J	OU2-CRAB-04M	1/6	0.0025 - 0.0041	0.0097	0.0016	Yes	0.02	No	BSL
Picric Acid	0.000732	J	0.00106	J	OU2-CRAB-01M	2/6	0.00043 - 0.000642	0.00106	NE	--	--	--	--

Notes:

[a] Shellfish screening values were calculated based on a Hazard Quotient of 0.1 and risk of 10^{-6}; the equation and input parameters are detailed in Attachment A.

[b] Rationale codes:
- Selection reason: ASL - above screening level
- Deletion reason: BSL - below screening level

[c] Because only 10% of the total arsenic in fish tissue is inorganic, the total arsenic concentrations in tissue were divided by a factor of 10 for screening purposes.

Bolded chemical exceeded its screening value.
-- - 100 percent detection frequency
c - cancer

J - estimated value
mg/kg - milligram per kilogram
N - Analyte was tentatively identified but confirmation not performed. The result is presumptive.

NE - not established
ww - wet weight

Table B5
Occurrence, Distribution, and Selection of Sea Cucumber Whole Body Tissue in Marine Area OU 2 of JPHC

Chemical	Minimum Detected Concentration (mg/kg-ww)	Minimum Qualifier	Maximum Detected Concentration (mg/kg-ww)	Maximum Qualifier	Location of Maximum Detected Concentration	Detection Frequency	Range of Detection Limits (mg/kg)	Concentration Used for Screening (mg/kg-ww)	Screening Value 1 (HQ=0.1 or risk of 10^{-6}) (mg/kg)	Exceeds Screening Value 1[a]	Screening Value 2 (HQ=1) (mg/kg)	Exceeds Screening Value 2	Rationale for Contaminant Deletion or Selection[b]
Metals													
Arsenic[c]	**0.46**	**J**	**1.98**	**J**	**OU2-CA-01-SC**	**6/6**	**--**	**1.98**	**0.00011 c**	**Yes**	**--**	**--**	**ASL**
Cadmium	**0.35**		**0.724**		**OU2-CA-01-SC**	**6/6**	**--**	**0.724**	**0.016**	**Yes**	**0.16**	**Yes**	**ASL**
Chromium	**0.64**		**10.5**		**OU2-OA-02-SC**	**6/6**	**--**	**10.5**	**0.00033 c**	**Yes**	**--**	**--**	**ASL**
Copper	**2.29**	**J**	**78.6**	**J**	**OU2-OA-02-SC**	**6/6**	**--**	**78.6**	**0.66**	**Yes**	**6.60**	**Yes**	**ASL**
Lead	0.435		4.61		OU2-OA-02-SC	6/6	--	4.61	NE	--	--	--	--
Mercury	**0.026**		**0.054**		**OU2-OA-03-SC**	**6/6**	**--**	**0.054**	**0.0016**	**Yes**	**0.016**	**Yes**	**ASL**
Nickel	**1.4**	**J**	**11**	**J**	**OU2-OA-02-SC**	**6/6**	**--**	**11**	**0.33**	**Yes**	**3.30**	**Yes**	**ASL**
Selenium	**1.48**		**8.06**		**OU2-OA-02-SC**	**6/6**	**--**	**8.06**	**0.082**	**Yes**	**0.82**	**Yes**	**ASL**
Silver	0.025		0.084		OU2-OA-02-SC	5/6	0.02	0.084	0.082	Yes	0.82	No	BSL
Zinc	**41.9**	**J**	**91.5**	**J**	**OU2-OA-02-SC**	**6/6**	**--**	**91.5**	**4.95**	**Yes**	**49.49**	**Yes**	**ASL**
Polycyclic Aromatic Hydrocarbons (PAHs)													
Anthracene	0.00024	J	0.00031	J	OU2-CA-03-SC	2/6	0.00019 - 0.00019	0.00031	4.95	No	--	--	BSL
Benz(a)anthracene	**0.00026**	**J**	**0.00061**	**J**	**OU2-OA-03-SC**	**4/6**	**0.00016 - 0.00016**	**0.00061**	**0.00023 c**	**Yes**	**--**	**--**	**ASL**
Benzo(a)pyrene	**0.00017**	**J**	**0.00051**	**J**	**OU2-OA-03-SC**	**3/6**	**0.000061 - 0.000061**	**0.00051**	**0.000023 c**	**Yes**	**--**	**--**	**ASL**
Benzo(b)fluoranthene	**0.00028**	**J**	**0.0011**	**J**	**OU2-OA-03-SC**	**3/6**	**0.00014 - 0.00014**	**0.0011**	**0.00023 c**	**Yes**	**--**	**--**	**ASL**
Benzo(ghi)perylene	0.00038	J	0.00038	J	OU2-OA-03-SC	1/6	0.000058 - 0.005	0.00038	NE	--	--	--	--
Benzo(k)fluoranthene	0.00014	J	0.00038	J	OU2-OA-03-SC	3/6	0.000092 - 0.000092	0.00038	0.0023 c	No	--	--	ASL
Chrysene	0.00065	J	0.0011	J	OU2-CA-03-SC	2/6	0.0002 - 0.0002	0.0011	0.023 c	No	--	--	BSL
Dibenzo(a,h)anthracene	**0.00011**	**J**	**0.00011**	**J**	**OU2-OA-03-SC**	**1/6**	**0.000045 - 0.000045**	**0.00011**	**0.000023 c**	**Yes**	**--**	**--**	**ASL**
Fluoranthene	0.00023	J	0.00044	J	OU2-OA-02-SC	4/6	0.00015 - 0.00015	0.00044	0.66	No	--	--	BSL
Fluorene	0.0001	J	0.00013	J	OU2-CA-02-SC/ OU2-OA-02-SC/ OU2-OA-03-SC	5/6	0.000095	0.00013	0.66	No	--	--	BSL
Indeno(1,2,3-cd)pyrene	**0.00012**	**J**	**0.00049**	**J**	**OU2-OA-03-SC**	**3/6**	**0.0001 - 0.0001**	**0.00049**	**0.00023 c**	**Yes**	**--**	**--**	**ASL**
Semi-Volatile Organic Compounds (SVOCs)													
Benzoic Acid	0.59	J	0.59	J	OU2-OA-02-SC	1/6	0.58 - 0.58	0.59	65.99	No	--	--	BSL
Diethyl phthalate	0.0071	J	0.0076	J	OU2-OA-01-SC	5/6	0.0068	0.0076	13.20	No	--	--	BSL
Di-n-butyl phthalate	0.021	J	0.031	J	OU2-OA-01-SC	5/6	0.016	0.031	1.65	No	--	--	BSL
Polychlorinated Biphenyls (PCBs)													
PCB-Aroclor 1260	**0.0068**	**J**	**0.0068**	**J**	**OU2-CA-02-SC**	**1/6**	**0.0028 - 0.0028**	**0.0068**	**0.000082 c**	**Yes**	**--**	**--**	**ASL**
Munition Constituents													
4-Nitrotoluene	**0.33**	**NJ**	**0.33**	**NJ**	**OU2-OA-02-SC**	**1/6**	**0.2 - 0.34**	**0.33**	**0.010 c**	**Yes**	**--**	**--**	**ASL**
Nitrobenzene	**0.67**	**NJ**	**0.95**	**NJ**	**OU2-OA-03-SC**	**3/6**	**0.2 - 0.34**	**0.95**	**0.033**	**Yes**	**0.33**	**Yes**	**ASL**
Nitroglycerin	**0.52**	**NJ**	**0.52**	**NJ**	**OU2-OA-02-SC**	**1/6**	**0.44 - 0.73**	**0.52**	**0.0016**	**Yes**	**0.016**	**Yes**	**ASL**
Picric Acid	0.000348	J	0.000412	J	OU2-CA-02-SC	2/6	0.000124 - 0.000167	0.000412	NE	--	--	--	--

Notes:

[a] Shellfish screening values were calculated based on a Hazard Quotient of 0.1 and risk of 10^{-6}; the equation and input parameters are detailed in Attachment A.

[b] Rationale codes:

Selection reason: ASL - above screening level

Deletion reason: BSL - below screening level

[c] Because only 10% of the total arsenic in fish tissue is inorganic, the total arsenic concentrations in tissue were divided by a factor of 10 for screening purposes.

Bolded chemical exceeded its screening value.
-- - 100 percent detection frequency
c - cancer

J - estimated value
mg/kg - milligram per kilogram
N - Analyte was tentatively identified but confirmation not performed. The result is presumptive.

NE - not established
ww - wet weight

Table B6
Occurrence, Distribution, and Selection of Starry Flounder Fish in Marine Area OU 2 of JPHC Using Non-Salmon Finfish Ingestion Rates

Chemical	Minimum Detected Concentration (mg/kg-ww)	Minimum Qualifier	Maximum Detected Concentration (mg/kg-ww)	Maximum Qualifier	Location of Maximum Detected Concentration	Detection Frequency	Range of Detection Limits (mg/kg)	Concentration Used for Screening (mg/kg-ww)	Screening Value 1 (HQ=0.1 or risk of 10^{-6}) (mg/kg)	Exceeds Screening Value 1[a]	Screening Value 2 (HQ=1) (mg/kg)	Exceeds Screening Value 2	Rationale for Contaminant Deletion or Selection[b]
Metals													
Arsenic[c]	**0.26**		**1.66**		**OU2-SF-05**	**6/6**	**--**	**1.66**	**0.00062 c**	**Yes**	**--**	**--**	**ASL**
Cadmium	0.008	J	0.034		OU2-SF-02	6/6	--	0.034	0.093	No	--	--	BSL
Chromium	**0.37**		**2.69**		**OU2-SF-02**	**5/6**	**0.08**	**2.69**	**0.0019 c**	**Yes**	**--**	**--**	**ASL**
Copper	1.72		9.16		OU2-SF-04	6/6	--	9.16	3.7	Yes	37.2	No	BSL
Lead	0.45		0.815		OU2-SF-02	6/6	--	0.815	NE	--	--	--	--
Mercury	**0.071**		**0.26**		**OU2-SF-05**	**6/6**	**--**	**0.26**	**0.0093**	**Yes**	**0.093**	**Yes**	**ASL**
Nickel	1.55		5.4		OU2-SF-02	6/6	--	5.4	1.86	Yes	18.6	No	BSL
Selenium	0.35		1.01		OU2-SF-02	6/6	--	1.01	0.46	Yes	4.6	No	BSL
Silver	0.021		0.069		OU2-SF-01	6/6	--	0.069	0.46	No	--	--	BSL
Zinc	72.1	J	101	J	OU2-SF-02	6/6	--	101	27.9	Yes	278.8	No	BSL
Polycyclic Aromatic Hydrocarbons (PAHs)													
Acenaphthene	0.00021	J	0.0012	J	OU2-SF-03, OU2-SF-05, OU2-SF-02	6/6	--	0.0012	5.58	No	--	--	BSL
Acenaphthylene	0.00014	J	0.00065	J	OU2-SF-05	6/6	--	0.00065	5.58	No	--	--	BSL
Anthracene	0.00019	J	0.00031	J	OU2-SF-05	3/6	0.00019 - 0.00022	0.00031	27.9	No	--	--	BSL
Fluoranthene	0.0002	J	0.00035	J	OU2-SF-05	5/6	0.00017	0.00035	3.72	No	--	--	BSL
Fluorene	0.0002	J	0.00085	J	OU2-SF-03, OU2-SF-05	6/6	--	0.00085	3.72	No	--	--	BSL
Phenanthrene	0.00046	J	0.00092	J	OU2-SF-05	5/6	0.00036	0.00092	27.88	No	--	--	BSL
Pyrene	0.00016	J	0.00017	J	OU2-SF-05	2/6	0.00012-0.00014	0.00017	2.79	No	--	--	BSL
Semi-Volatile Organic Compounds (SVOCs)													
Benzoic Acid	1	J	1.7	J	OU2-SF-02	6/6	--	1.7	372	No	--	--	BSL
Diethyl phthalate	0.0071	J	0.0071	J	OU2-SF-02	1/6	0.0068 - 0.034	0.0071	74	No	--	--	BSL
Polychlorinated Biphenyls (PCBs)													
PCB-Aroclor 1254	**0.02**		**0.087**		**OU2-SF-05**	**6/6**	**--**	**0.087**	**0.00046 c**	**Yes**	**--**	**--**	**ASL**
PCB-Aroclor 1260	**0.0098**		**0.045**		**OU2-SF-02**	**6/6**	**--**	**0.045**	**0.00046 c**	**Yes**	**--**	**--**	**ASL**
Pesticides													
4,4'-DDE	**0.0015**		**0.005**		**OU2-SF-05**	**6/6**	**--**	**0.005**	**0.0027 c**	**Yes**	**--**	**--**	**ASL**
4,4'-DDT	**0.0023**		**0.011**		**OU2-SF-02**	**6/6**	**--**	**0.011**	**0.0027 c**	**Yes**	**--**	**--**	**ASL**
Aldrin	**0.00084**	**J**	**0.00084**	**J**	**OU2-SF-03**	**1/6**	**0.00074 - 0.00078**	**0.00084**	**0.000055 c**	**Yes**	**--**	**--**	**ASL**
Munition Constituents													
3-Nitrotoluene	**0.46**	**NJ**	**0.46**	**NJ**	**OU2-SF-02**	**1/6**	**0.36 - 0.36**	**0.46**	**0.0093**	**Yes**	**0.093**	**Yes**	**ASL**
Nitrobenzene	0.22	NJ	0.32	NJ	OU2-SF-05	3/6	0.22 - 0.22	0.32	0.19	Yes	1.86	No	BSL
Nitroglycerin	**0.65**	**NJ**	**0.65**	**NJ**	**OU2-SF-05**	**1/6**	**0.5 - 0.5**	**0.65**	**0.0093**	**Yes**	**0.093**	**Yes**	**ASL**

Notes:

[a] Fish screening values were calculated based on Non-Salmon Finfish, a Hazard Quotient of 0.1 or risk of 10^{-6}, and the equation and input parameters are detailed in

[b] Rationale codes:
Selection reason: ASL - above screening level
Deletion reason: BSL - below screening level

[c] Because only 10% of the total arsenic in fish tissue is inorganic, the total arsenic concentrations in tissue were divided by a factor of 10 for screening purposes.

Bolded chemical exceeded its screening value.
-- - 100 percent detection frequency
c - cancer

J - estimated value
mg/kg - milligram per kilogram
N - Analyte was tentatively identified but confirmation not performed. The result is presumptive.

NE - Not Established
ww - wet weight

Table B7
Occurrence, Distribution, and Selection of Starry Flounder Fish in Marine Area OU 2 of JPHC Using Bottom Fish Ingestion Rates

Chemical	Minimum Detected Concentration (mg/kg-ww)	Minimum Qualifier	Maximum Detected Concentration (mg/kg-ww)	Maximum Qualifier	Location of Maximum Detected Concentration	Detection Frequency	Range of Detection Limits (mg/kg)	Concentration Used for Screening (mg/kg-ww)	Screening Value 1 (HQ=0.1 or risk of 10^{-6}) (mg/kg)	Exceeds Screening Value 1[a]	Screening Value 2 (HQ=1) (mg/kg)	Exceeds Screening Value 2	Rationale for Contaminant Deletion or Selection[b]
Metals													
Arsenic[c]	**0.26**		**1.66**		**OU2-SF-05**	**6/6**	**--**	**1.66**	**0.0019 c**	**Yes**	**--**	**--**	**ASL**
Chromium	**0.37**		**2.69**		**OU2-SF-02**	**5/6**	**0.08**	**2.69**	**0.0057 c**	**Yes**	**--**	**--**	**ASL**
Copper	1.72		9.16		OU2-SF-04	6/6	--	9.16	11.3	No	--	--	BSL
Mercury	0.071		0.26		OU2-SF-05	6/6	--	0.26	0.028	Yes	0.28	No	BSL
Nickel	1.55		5.4		OU2-SF-02	6/6	--	5.4	5.7	No	--	--	BSL
Selenium	0.35		1.01		OU2-SF-02	6/6	--	1.01	1.42	No	--	--	BSL
Zinc	72.1	J	101	J	OU2-SF-02	6/6	--	101	85.0	Yes	850	No	BSL
Polychlorinated Biphenyls (PCBs)													
PCB-Aroclor 1254	**0.02**		**0.087**		**OU2-SF-05**	**6/6**	**--**	**0.087**	**0.0014 c**	**Yes**	**--**	**--**	**ASL**
PCB-Aroclor 1260	**0.0098**		**0.045**		**OU2-SF-02**	**6/6**	**--**	**0.045**	**0.0014 c**	**Yes**	**--**	**--**	**ASL**
Pesticides													
4,4'-DDE	0.0015		0.005		OU2-SF-05	6/6	--	0.005	0.0083 c	No	--	--	BSL
4,4'-DDT	**0.0023**		**0.011**		**OU2-SF-02**	**6/6**	**--**	**0.011**	**0.0083 c**	**Yes**	**--**	**--**	**ASL**
Aldrin	**0.00084**	**J**	**0.00084**	**J**	**OU2-SF-03**	**1/6**	**0.00074 - 0.00078**	**0.00084**	**0.00017 c**	**Yes**	**--**	**--**	**ASL**
Munition Constituents													
3-Nitrotoluene	**0.46**	**NJ**	**0.46**	**NJ**	**OU2-SF-02**	**1/6**	**0.36 - 0.36**	**0.46**	**0.028**	**Yes**	**0.28**	**Yes**	**ASL**
Nitrobenzene	0.22	NJ	0.32	NJ	OU2-SF-05	3/6	0.22 - 0.22	0.32	0.57	No	--	--	BSL
Nitroglycerin	**0.65**	**NJ**	**0.65**	**NJ**	**OU2-SF-05**	**1/6**	**0.5 - 0.5**	**0.65**	**0.028**	**Yes**	**0.28**	**Yes**	**ASL**

Notes:
[a] Fish screening values were calculated based on ingestion of Bottom Fish tissue, a Hazard Quotient of 0.1 or risk of 10^{-6}, and the equation and input parameters are detailed in Attachment A.
[b] Rationale codes:
Selection reason: ASL - above screening level
Deletion reason: BSL - below screening level
[c] Because only 10% of the total arsenic in fish tissue is inorganic, the total arsenic concentrations in tissue were divided by a factor of 10 for screening purposes.

Bolded chemicals exceeded both the Non-Salmon Finfish and Bottom Fish screening values.
-- - 100 percent detection frequency
c - cancer

J - estimated value
mg/kg - milligram per kilogram
N - Analyte was tentatively identified but confirmation not performed. The result is presumptive.

ww - wet weight

Attachment C
Additional Details of Analytical and Sampling History

Table C1
Analytical and Sampling History for Outfalls

Date	Site (Locations)	Analytes	Method
1991 (February)	101A (OUT-01, 02, 03) 101 (OUT-04, 05, 06, 08, 09 103 (OUT-10 to 16)	Metals	ILM-MET
		Ordance	ORD-GC/ECD
		Pesticides and Aroclors	OLM-P/A
		Semi-Volatiles	OLM-SV
		Volatiles	OLM-V
1992 (November)	101 (OUT-17)	Metals	ILM-MET
		Ordance	ORD-GC/ECD
		Pesticides and Aroclors	OLM-P/A
		Semi-Volatiles	OLM-SV-LOW
		Volatiles	OLM-V
1993 (December)	103 (OUT-13)	Volatiles	OLM-V-LOW
1996 (September, October)	101A (OF-716) 101 (OF-709, 712, 714) 103 (OF-705, 708)	Metals	ILC-MET
		Ordance	8330, ORD-HPLC
		Pesticides and Aroclors	OLM-P/A-LOW
		Semi-Volatiles	OLM-SV-LOW
		TPH	418.1, WTPH-D, WTPH-G
		Volatiles	OLM-V-LOW
1998 (June)	101A (OF-716) 101 (OF-709, 712, 714) 103 (OF-705, 708)	Inorganic (Cyanide)	ILC-INO
		Metals	ILC-MET
		Ordance	8330, ORD-HPLC
		Pesticides and Aroclors	OLM-P/A-LOW
		Semi-Volatiles	OLM-SV-LOW
		TPH	WTPH-D, WTPH-G
		Volatiles	OLM-V-LOW
2002 (June, November)	101A (OF-716) 101 (OF-709, 712) 103 (OF-705) OU 1 (OF-705, 709, 712, 716)	Inorganic (Cyanide)	335.3
		Metals	6010, 6020, 7470
		Pesticides and Aroclors	8081
		Volatiles	8260
2003 (June)	101A (OF-716) 101 (OF-709, 712) 103 (OF-705)	Inorganic (Cyanide)	335.3
		Metals	6020, 7470
		Pesticides and Aroclors	8081
		Volatiles	8260
2004	101A (OF-716) 101 (OF-709, 712) 103 (OF-705)	Inorganic (Cyanide)	335.3
		Metals	6020, 7470
		Pesticides and Aroclors	8081
		Volatiles	8260
2005 (June, July)	101A (OF-716) 101 (OF-709, 712) 103 (OF-705) OU 1 (OF-712)	Inorganic (Cyanide)	335.3
		Metals	6020, 7470
		Pesticides and Aroclors	8081
		TPH	NWTPH-Gx
		Volatiles	8260
2006 (August, October)	101A (OF-716) 101 (OF-709, 712) 103 (OF-705) OU 1 (OF-712)	Inorganic (Cyanide)	335.3
		Metals	6020, 7470
		Pesticides and Aroclors	8081
		TPH	NWTPH-Gx
		Volatiles	8260, 8260B

Table C1
Analytical and Sampling History for Outfalls

Date	Site (Locations)	Analytes	Method
2007 (July)	101A (OF-716) 101 (OF-709, 712) 103 (OF-705)	Inorganic (Cyanide)	335.3
		Metals	6020, 7470
		Pesticides and Aroclors	8081
		Volatiles	8260
2008 (July)	101A (OF-716) 101 (OF-709, 712) 103 (OF-705)	Inorganic (Cyanide)	4500_CN_E
		Metals	6020, 7060, 7470A
		Pesticides and Aroclors	8081
		Volatiles	8260B
2009 (July)	101A (OF-716) 101 (OF-709, 712) 103 (OF-705)	Inorganic (Cyanide)	4500_CN_E
		Metals	6020, 7470A
		Pesticides and Aroclors	8081
		Volatiles	8260B
2010 (July)	101A (OF-716) 101 (OF-709, 712) 103 (OF-705)	Inorganic (Cyanide)	4500_CN_E
		Metals	6020, 7470A
		Pesticides and Aroclors	8081
		Volatiles	8260B
2011 (July)	101A (OF-716) 101 (OF-709, 712) 103 (OF-705)	Inorganic (Cyanide)	4500_CN_E
		Metals	6020, 7470A
		Pesticides and Aroclors	8081
		Volatiles	8260B

Table C2
Analytical and Sampling History for Seeps

Date	Site (Locations)	Analytes	Method
1991 (February)	101A (SEEP-01 & 02)	Metals	ILM-MET
		Ordance	ORD-GC/ECD
		Pesticides and Aroclors	OLM-P/A
		Semi-Volatiles	OLM-SV
		Volatiles	OLM-V
1991 (September)	101A (SEEP-01)	TPH	8015D
1992 (May)	103 (SEEP-03)	Inorganic (Cyanide)	ILM-INO
		Metals	ILM-MET
		Ordance	ORD-GC/ECD, ORD-HPLC
		Pesticides and Aroclors	OLM-P/A
		Semi-Volatiles	OLM-SV
		Volatiles	OLM-V
1993 (December)	103 (SEEP-4, OUT-15-715)	Volatiles	OLM-V-LOW
1996 (September, October)	101A (SP-715) 101 (SP-710, 711, 713) 103 (SP-701 to 704, SP-706 to 707, SP-717)	Metals	ILC-MET
		Ordance	8330, ORD-HPLC
		Pesticides and Aroclors	OLM-P/A-LOW
		Semi-Volatiles	OLM-SV-LOW
		TPH	418.1, WTPH-D, WTPH-G
		Volatiles	OLM-V-LOW
1997 (June)	101 (SEEP-R)	TPH	WTPH-HCID, WTPH-D, WTPH-G
		Volatiles	8020
1998	101A (SP-715) 101 (SP-710, 711, 713, SEEP-L & R) 103 (SP-701 to 704, SP-706 to 707, SP-717)	Inorganic	300.0, ILC-INO
		Metals	6000/7000, ILC-MET
		Ordance	8330, ORD-HPLC
		Pesticides and Aroclors	OLM-P/A-LOW
		Physical Characteristics	160.1, 2320B, 310.1
		Semi-Volatiles	OLM-SV-LOW
		TPH	WTPH-D, WTPH-G
		Volatiles	8020, 8260, OLM-V-LOW
1999 (November)	101 (SEEP-L & R)	Inorganic	300.0, 376.1
		Metals	6000/7000
		Physical Characteristics (Alkalinity)	310.1
		TPH	EPH, VPH
		Volatiles	Methane is only analyte
2001 (November)	101 (SEEP-R)	TPH	VPH
2002	101A (SP-715) 101 (SP-619, 710, 711, 713, SEEP-L & R) 103 (SP-707) OU 1 (SP-707, 710, 713, 715)	Inorganic	300.0, 335.3, 376.1
		Metals	6020, 7470
		Pesticides and Aroclors	8081
		Physical Characteristics (Alkalinity)	310.1
		TPH	418.1, VPH, WTPH-D, WTPH-G
		Volatiles	8020, 8260
2003	101A (SP-715) 101 (SP-619, 710, 713, SEEP-L & R) 103 (SP-703, 707)	Inorganic	300.0, 335.3, 376.1
		Metals	6020, 7470
		Pesticides and Aroclors	8081
		Physical Characteristics (Alkalinity)	310.1
		TPH	VPH, NWTPH-Dx, NWTPH-Gx
		Volatiles	8260
2004	101A (SP-715) 101 (SP-710, 711, 713) 103 (SP-703, 707)	Inorganic (Cyanide)	335.3
		Pesticides and Aroclors	6020, 7470
		Pesticides and Aroclors	8081
		TPH	NWTPH-Dx, NWTPH-Gx, WTPH-D, WTPH-G
		Volatiles	8260

Table C2
Analytical and Sampling History for Seeps

Date	Site (Locations)	Analytes	Method
2005 (July)	101A (SP-715) 101 (SP-710, 713) 103 (SP-703, 707)	Inorganic (Cyanide)	335.3
		Metals	6020, 7470
		Pesticides and Aroclors	8081
		TPH	NWTPH-Dx, NWTPH-Gx
		Volatiles	8260
2006 (August)	101A (SP-715) 101 (SP-710, 713) 103 (SP-703, 707)	Inorganic (Cyanide)	335.3
		Metals	6020, 7470
		Pesticides and Aroclors	8081
		TPH	NWTPH-Dx, NWTPH-Gx
		Volatiles	8260
2007 (July)	101A (SP-715) 101 (SP-710, 713) 103 (SP-703)	Inorganic (Cyanide)	335.3
		Metals	6020, 7470
		Pesticides and Aroclors	8081
		TPH	NWTPH-Dx, NWTPH-Gx
		Volatiles	8260
2008 (July, October)	101A (SP-715) 101 (SP-710, 713) 103 (SP-703, Seep Near Mound)	Inorganic	300, 353.2, 4500_CN_E
		Metals	6010, 6020, 7060, 7470A
		Ordance	8330
		Pesticides and Aroclors	8081
		Semi-Volatiles	6850, 8321
		TPH	NWTPH-Dx, NWTPH-Gx
		Volatiles	8260B
2009 (July)	101A (SP-715) 101 (SP-710, 713) 103 (SP-703)	Inorganic (Cyanide)	4500_CN_E
		Metals	6020, 7470A
		Pesticides and Aroclors	8081
		TPH	NWTPH-Dx, NWTPH-Gx
		Volatiles	8260B
2010 (July)	101A (SP-715) 101 (SP-710, 713) 103 (SP-703)	Inorganic (Cyanide)	4500_CN_E
		Metals	6020, 7470A
		Pesticides and Aroclors	8081
		TPH	NWTPH-Dx, NWTPH-Gx
		Volatiles	8260B
2011 (July)	101A (SP-715) 101 (SP-710, 713) 103 (SP-703)	Inorganic (Cyanide)	4500_CN_E
		Metals	6020, 7470A
		Pesticides and Aroclors	8081
		TPH	NWTPH-Dx, NWTPH-Gx
		Volatiles	8260B

Table C3
Analytical and Sampling History for Sediment

Sampling Effort	Date	Site (Locations)	Analytes	Method
NA	1990 (November)	103 (SED-1, 2, &3)	Metals	ILM-MET
			Pesticides and Aroclors	OLM-P/A
			Semi-Volatiles	OLM-SV
			Volatiles	OLM-V
Final Phase I RI (June 1994)	1991 (April, May, & December)	0-JPC (MS-29 through 37) 101 (MS-01 through 19) 103 (MS-20 through 28)	Inorganic (Cyanide)	ILM-INO
			Metals	ILM-MET
			Ordance	ORD-GC/ECD, ORD-HPLC
			Pesticides and Aroclors	OLM-P/A
			Physical Characteristics (TOC)	9060
			Semi-Volatiles	OLM-SV
Final Phase I RI (June 1994)	1991 (August)	101A (SED-4 & 5)	Metals	ILM-MET
			Ordance	ORD-GC/ECD, ORD-HPLC
			Physical Characteristics (TOC)	9060
			Semi-Volatiles	OLM-SV
			Volatiles	OLM-V
Final Phase 2 RI (1994)	1994 (July)	CARR-JPC (CRR02A, B, & C) HOLM-JPC (HM04, 05, & 07) OSTB-JPC (311, 315, 320-341)	Metals	6010
			Ordance	8330, ORD-HPLC
			Physical Characteristics (TOC)	5310
			Semi-Volatiles	8270
NA	1996 (September, October)	101A (SP-715) 101 (OF-709 & 712, SP-710, 711, & 713) 103 (LK-32, OF-705 &708, SP-701-704, SP-706 & 707, SP-717-719)	Metals	ILM-MET
			Ordance	8330, ORD-HPLC
			Pesticides and Aroclors	OLM-P/A
			Semi-Volatiles	OLM-SV
			TPH	418.1, WTPH-D, WTPH-G
			Volatiles	OLM-V
OU 2 Treatability Study (April 1998)	1997 (December)	CARR-JPC (CRR02A, B, & C) DYES-JPC (501-504)	Inorganic (Sulfide)	9030B
			Metals	6000/7000
			Physical Characteristics (TOC, Percent Fines)	PS-PSEP, TOC-AG#9
OU 2 Treatability Study (April 1998)	1997 (December)	OSTB-JPC (4-9, 326-327, 329-330, 332, 334, 337, 340-341, 400-413)	Inorganic (Sulfide)	350.1, 376.1, 9030B
			Metals	6000/7000
			Ordance	8330, ORD-HPLC
			Pesticides and Aroclors	8082
			Physical Characteristics (TOC, Percent Fines)	D422, PS-PSEP, TOC-AG#9
			Semi-Volatiles	8270
BERA	2009	OSTB-JPC (OU2-SS1 to 6, SS15 to 43)	Conventionals	TOC, Total Solids, Total Sulfides, Ammonia (Total as Nitrogen)
			Physical Characteristics	Sediment Grain Size
			Metals	6020, 7471 (Mercury)
			Tri-n-butyltin	TBT Method Krone et al.
			PAHs	8270C
			Semi-Volatiles (Phenols)	8270C
			PCBs	8082
			Pesticides	8081A
			Volatiles	BTEX
			TPH	WTPH-Dx, WTPH-Gx
			Munition Constituents	8330B, 353.3 (Nitrocellulose), 8270 GC/MS
BERA - Post-dredge pilot study OU 3M sampling event	2009	OSTB-JPC (OU2-SS7 to 14)	Metals	6020, 7471 (Mercury)
			Tri-n-butyltin	TBT Method Krone et al.
			PAHs	8270C
			Semivolatiles (Phenols)	8270C
			Pesticides	8081A
			PCBs	8082
			Volatiles	BTEX
			Munition Constituents	8330B, 353.3 (Nitrocellulose), 8270 GC/MS

Notes:
NA - not available

Table C4
Summary Statistics for Selected Chemicals

Chemical	Minimum Detected Concentration (ug/L)	Minimum Qualifier	Maximum Detected Concentration (ug/L)	Maximum Qualifier	Sample Date of Maximum Detected Concentration	Location of Maximum Detected Concentration	Detection Frequency	Range of Detection Limits (ug/L)	Reference Value[1] (ug/L)	Number of Detected Samples that Exceed Reference Value
Seep and Outfall (1991-2011)										
Copper	0.048		22.6		Sep-96	OF-709	146/237	0.06-6.3	4.8	19
Mercury	0.1	J	0.34		Nov-02	SP-711	8/234	0.02-0.61	--	--
Nickel	0.2	J	30.6	J	Nov-92	OUT-17	151/237	3.6-20	1.8	35
Silver	0.002	J	2.4	J	Sep-96	SP-717	27/238	0.002-10	--	--
Pre-ROD Seep and Outfall (1991-1999)										
TPH-D	2×10^7	J	2×10^7	J	Sep-91	SEEP-01	1/39	100-310	--	--
Groundwater (Selected Shoreline Wells) (1991-2009)										
Mercury	0.27		0.79		Aug-91	MW-07	71/79	0.1-0.2	--	--

Notes:

[1] Copper is compared to 4.8 ug/L the Ambient Water Quality Standard.
Nickel is compared to 1.8 ug/L, the background value listed in the RI.

-- No reference value previously identified

APPENDIX D

Figures from Phase II Site Investigation

Legend

- Radon Sample Locations
- Ambient Air Sample Locations
- Indoor Air Sample Locations
- Site
- Operable Site Unit Boundary
- Figure Extents

0 350 700

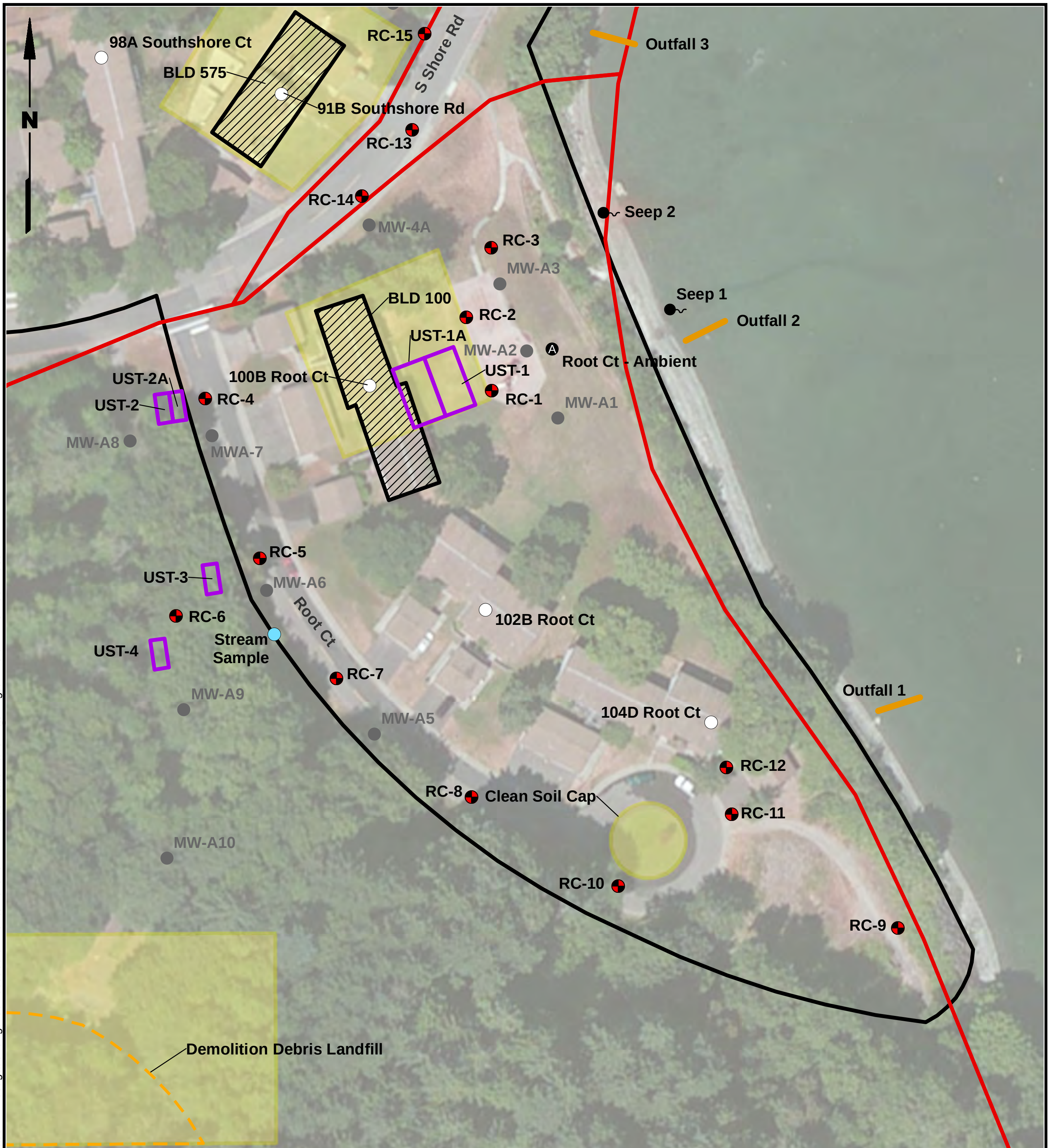
Scale in Feet

Data Source: ESRI World Imagery

Note
1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

LANDAU ASSOCIATES

Jackson Park Focused Phase II Investigation Bremerton, Washington	Site Plan - Indoor Air and Radon Sampling Locations	Figure 2B



G:\Projects\1255\002\020\021\Focused Phase II Investigation\Figure3RootCourt.mxd 9/11/2013 NAD 1983 StatePlane Washington North FIPS 4601 Feet

Legend

- Ambient Air Sample
- Indoor Air Sample
- Boring Location
- Former Monitoring Well
- Stream Sample
- Seep
- Outfall
- Site
- Operable Site Unit Boundary
- Former UST Location
- Approximate Area of Documented Current or Former Contamination
- Bunker/Building Linked to Contamination
- Land Use Control Area

Data Source: Esri World Imagery

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 100 200

Scale in Feet

Landau Associates

Jackson Park Focused Phase II Investigation Bremerton, Washington	**Root Court Area**	Figure 3

G:\Projects\1255\002\020\021\Focused Phase II Investigation\Figure4Building575.mxd 9/11/2013 NAD 1983 StatePlane Washington North FIPS 4601 Feet

Legend

- Indoor Air Sample
- Boring Location
- Former Monitoring Well
- Outfall
- Site
- Operable Site Unit Boundary
- Land Use Control Area
- Bunker/Building Linked to Contamination

0 50 100

Scale in Feet

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

LANDAU ASSOCIATES

Data Source: ESRI World Imagery.

Jackson Park Focused Phase II Investigation Bremerton, Washington	**Building 575 Area**	Figure 4

Y:\Projects\1255002\020\021\Focused Phase II Investigation\Figure5StreetwasteDisposall.mxd 8/15/2013 NAD 1983 StatePlane Washington North FIPS 4601 Feet

Legend

- Boring Location
- Site
- Operable Site Unit Boundary
- Approximate Area of Documented Current or Former Contamination

0 100 200

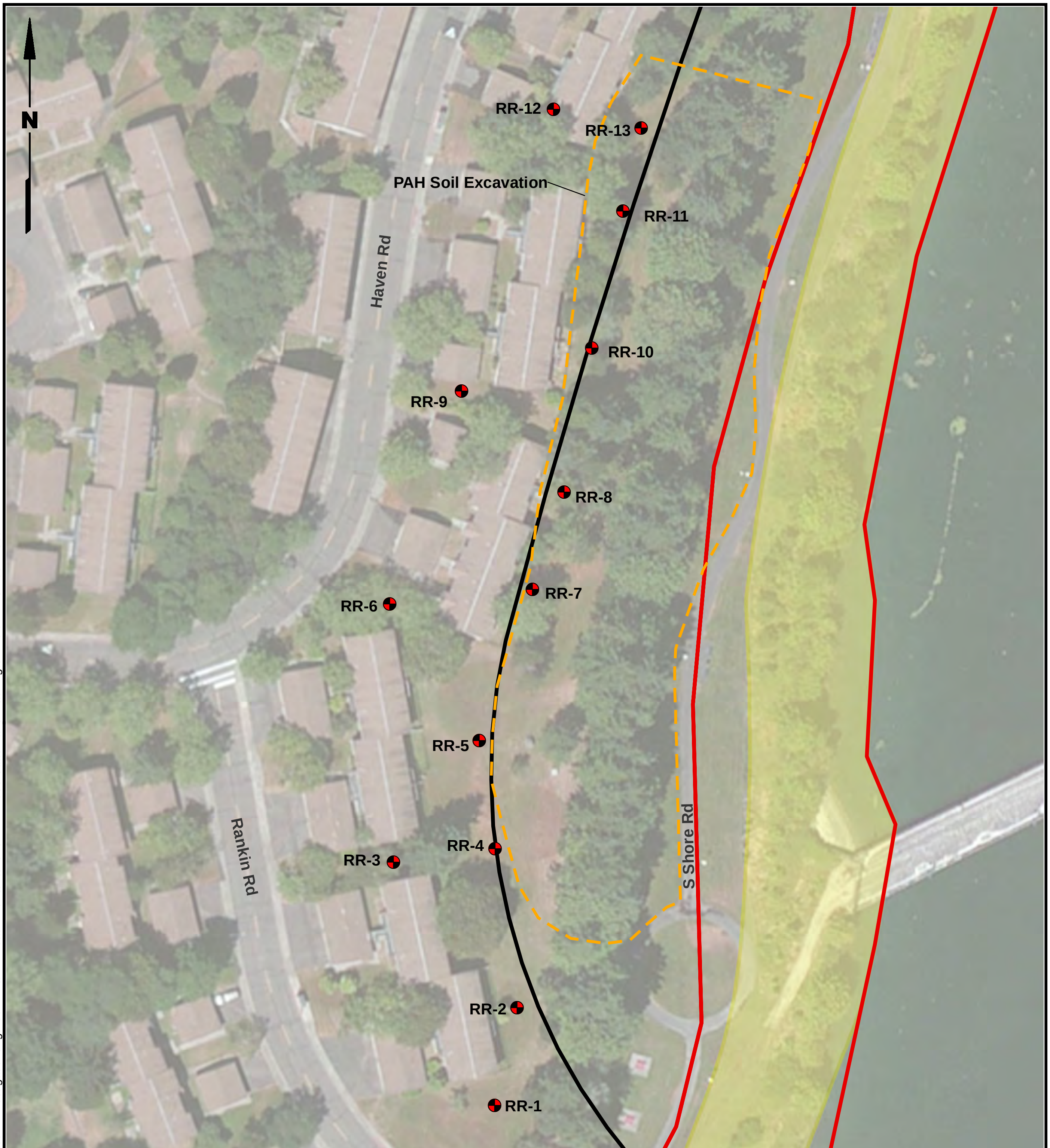
Scale in Feet

Note
1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Landau Associates

Data Source: ESRI World Imagery.

Jackson Park Focused Phase II Investigation Bremerton, Washington	**Street Waste Disposal Area**	Figure 5



Legend

- Boring Location
- Site
- Operable Site Unit Boundary
- Approximate Area of Documented Current or Former Contamination
- Land Use Control Area

Note
1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 100 200

Scale in Feet

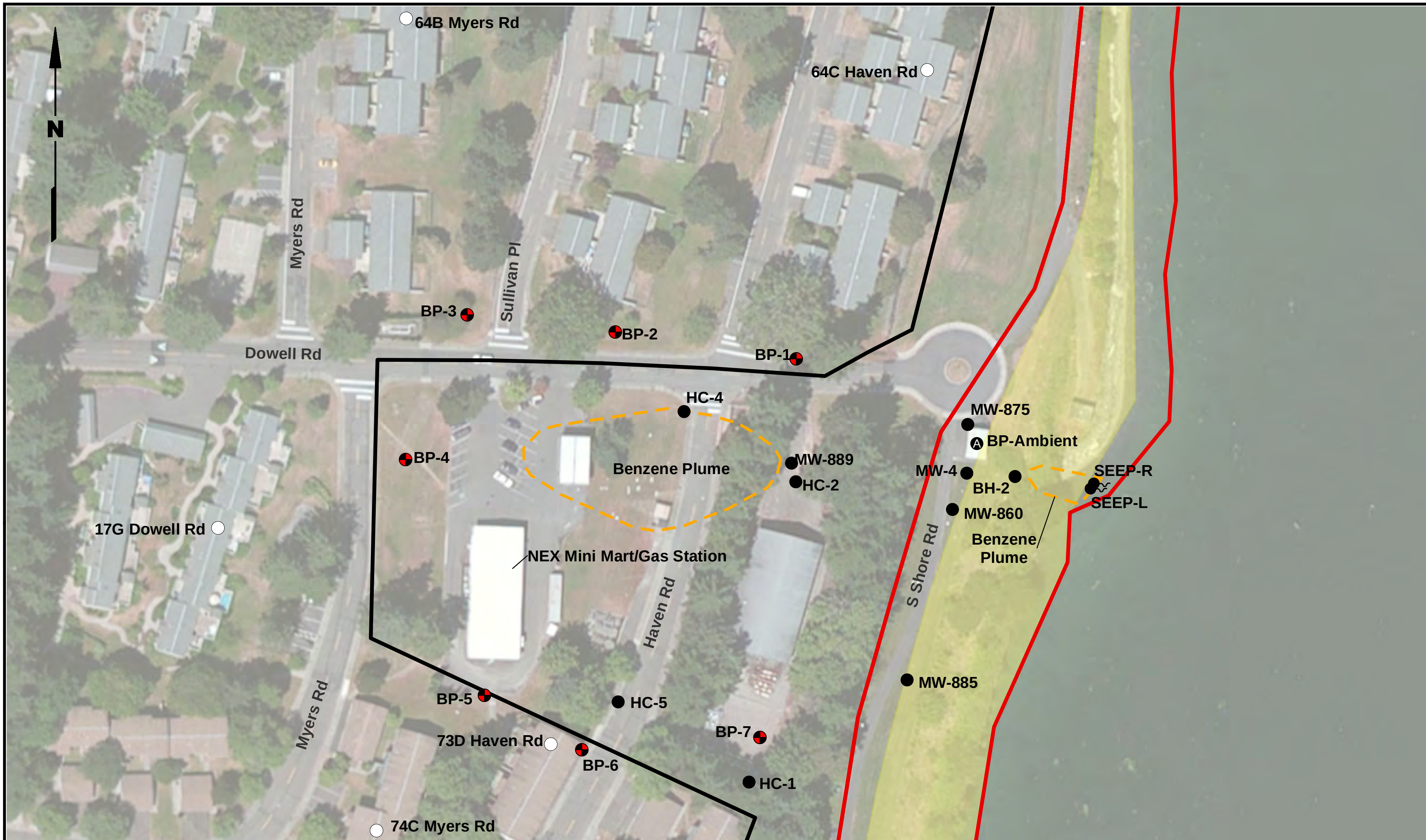
Data Source: Esri World Imagery

Y:\Projects\1255002\020\021\Focused Phase II Investigation\Figure6NERankinRoad.mxd 8/15/2013 NAD 1983 StatePlane Washington North FIPS 4601 Feet

Landau Associates

Jackson Park Focused Phase II Investigation Bremerton, Washington	**Area Northeast of Rankin Road**	Figure 6

G:\Projects\1255\002\020\021\Focused Phase II Investigation\Figure7BenzenePlume.mxd 9/12/2013 NAD 1983 StatePlane Washington North FIPS 4601 Feet



Legend

- Ambient Air Sample
- Indoor Air Sample
- Boring Location
- Monitoring Well
- Seep
- Site
- Operable Site Unit Boundary
- Approximate Area of Documented Current or Former Contamination
- Land Use Control Area

0 120 240

Scale in Feet

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

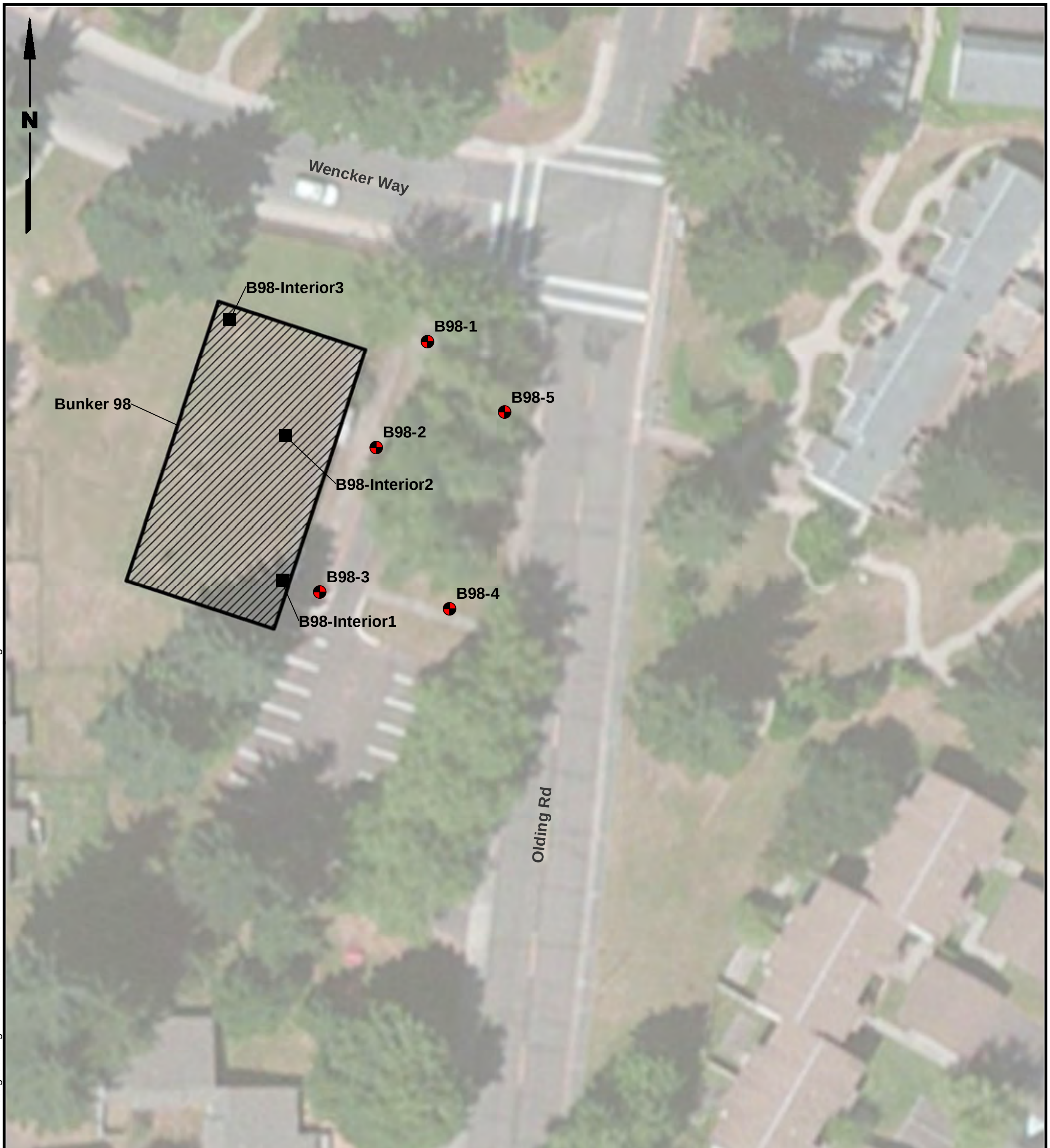
LANDAU ASSOCIATES

Data Source: ESRI World Imagery.

Jackson Park
Focused Phase II Investigation
Bremerton, Washington

Benzene Release Area

Figure 7



Y:\Projects\1255002\020\021\Focused Phase II Investigation\Figure8MunitionsBunker98.mxd 8/15/2013 NAD 1983 StatePlane Washington North FIPS 4601 Feet

Legend

- Boring Location
- Bunker Interior Surface Wipe Sample Location
- Bunker/Building Linked to Contamination

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 50 100

Scale in Feet

Data Source: Esri World Imagery

Landau Associates

Jackson Park Focused Phase II Investigation Bremerton, Washington	**Munitions Storage Bunker 98**	Figure 8

Legend

- Boring Location
- Bunker Interior Surface Wipe Sample Location
- Approximate Location of Bunker/Building Linked to Contamination

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 50 100

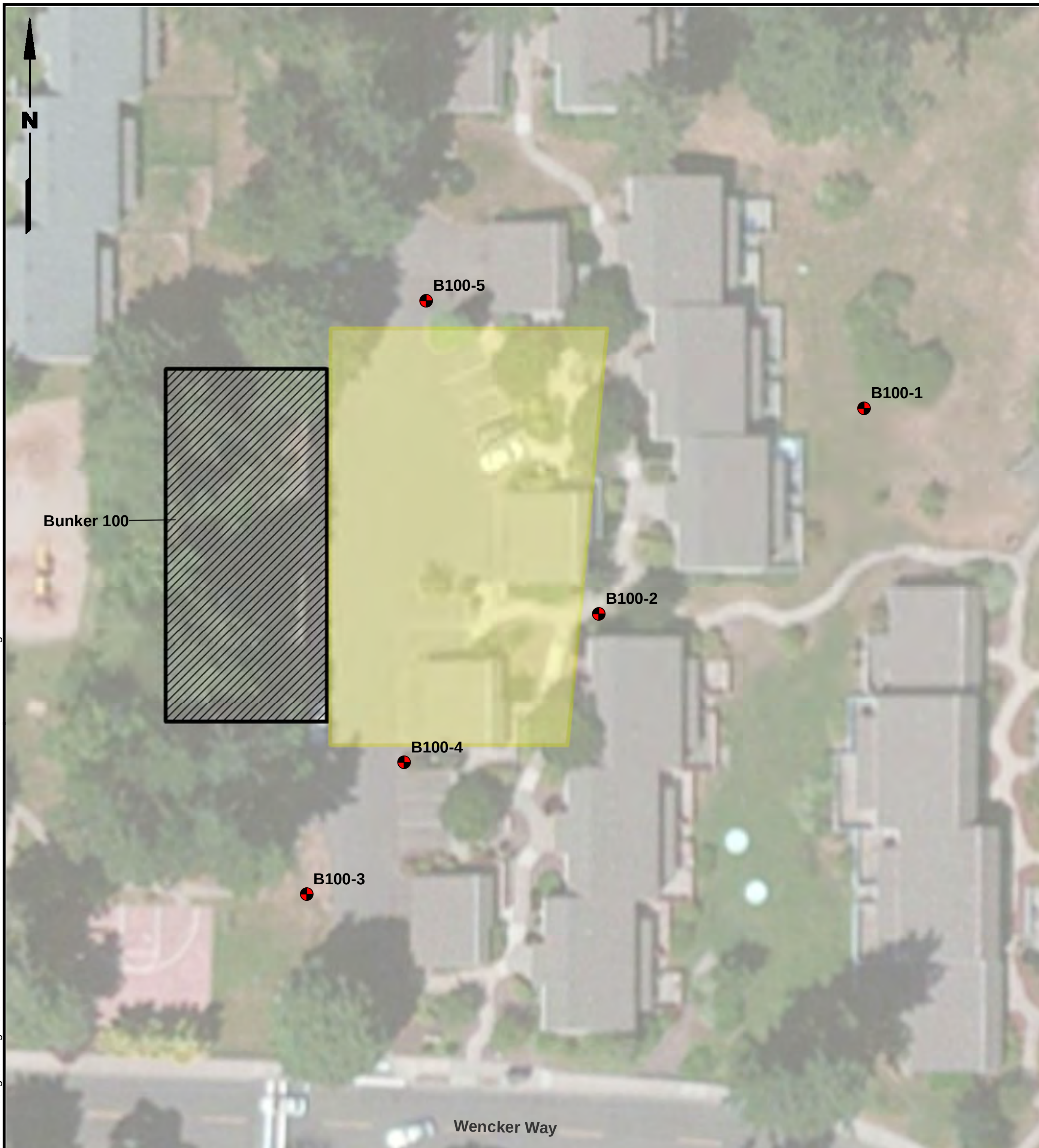
Scale in Feet

Data Source: Esri World Imagery

Y:\Projects\1255002\020\021\Focused Phase II Investigation\Figure9MunitionsBunker99.mxd 8/15/2013 NAD 1983 StatePlane Washington North FIPS 4601 Feet

LANDAU ASSOCIATES

Jackson Park Focused Phase II Investigation Bremerton, Washington	**Munitions Storage Bunker 99**	Figure 9



Legend

- Boring Location
- Bunker/Building Linked to Contamination
- Land Use Control Area

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 50 100

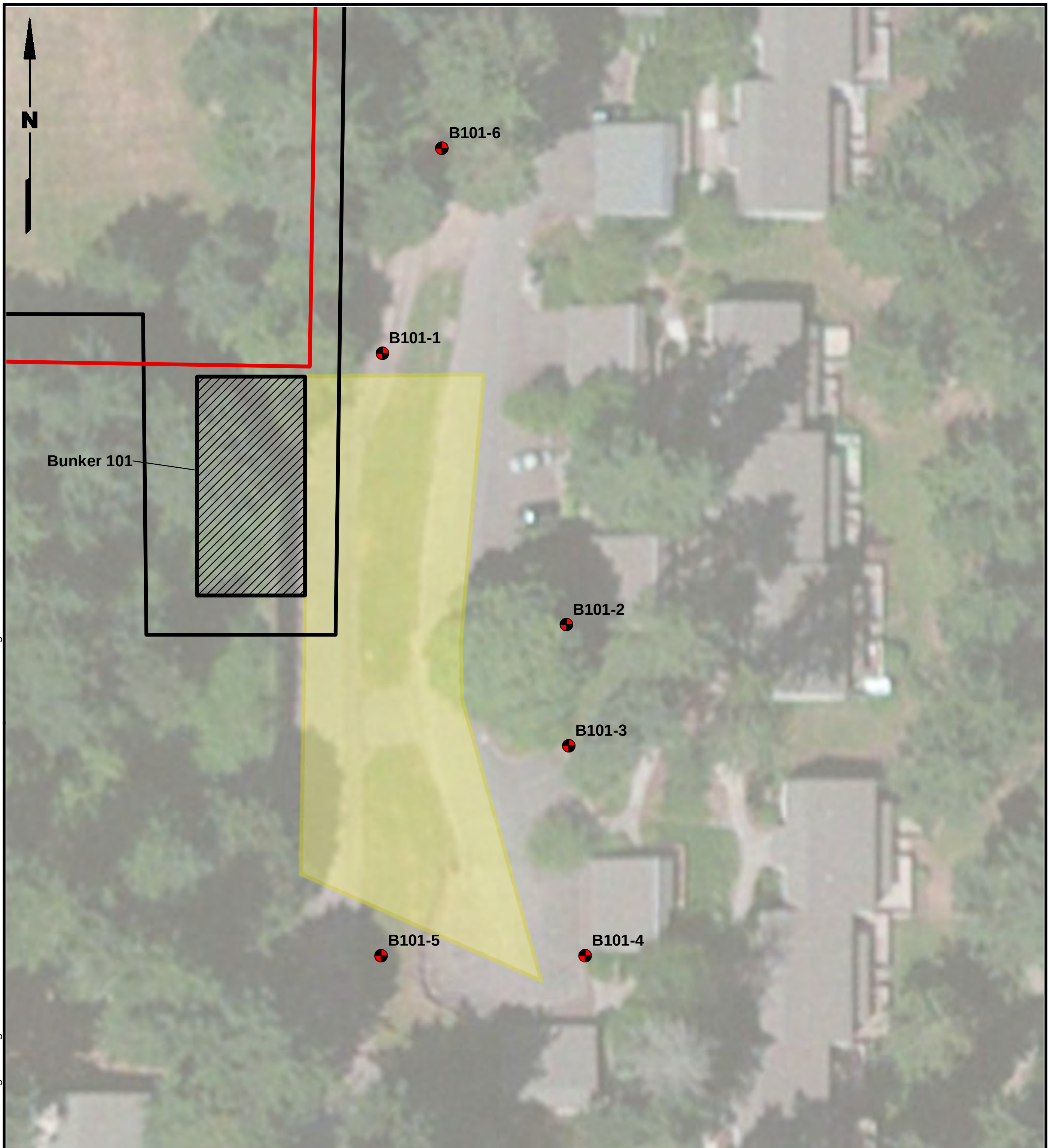
Scale in Feet

Data Source: Esri World Imagery

Y:\Projects\1255002\020\021\Focused Phase II Investigation\Figure10MunitionsBunker100.mxd 8/15/2013 NAD 1983 StatePlane Washington North FIPS 4601 Feet

LANDAU ASSOCIATES

Jackson Park Focused Phase II Investigation Bremerton, Washington	**Munitions Storage Bunker 100**	Figure 10



Y:\Projects\1255002\020\021\Focused Phase II Investigation\Figure11MunitionsBunker101.mxd 8/15/2013 NAD 1983 StatePlane Washington North FIPS 4601 Feet

Legend

- Boring Location
- Site
- Operable Site Unit Boundary
- Bunker/Building Linked to Contamination
- Land Use Control Area

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

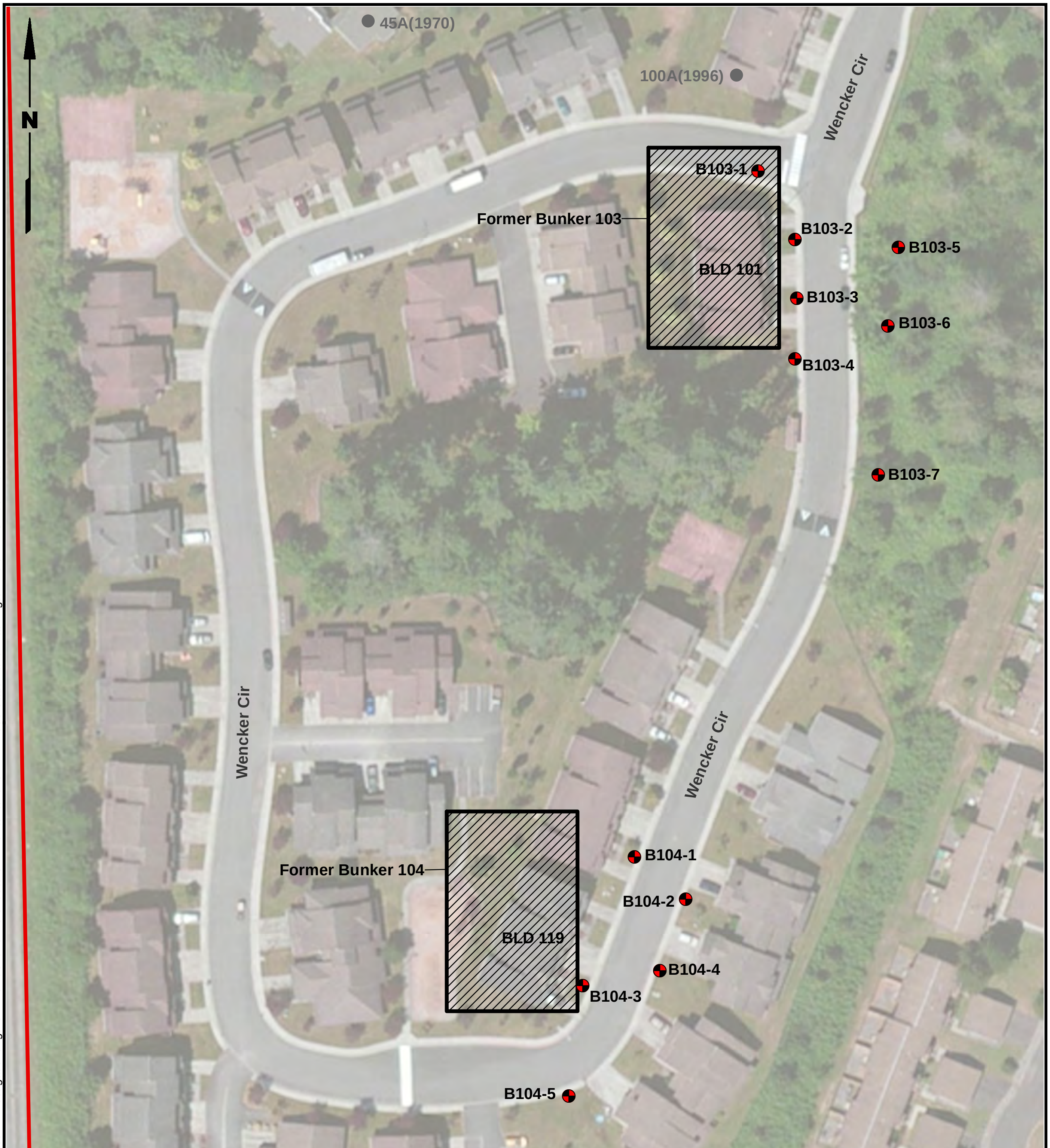
0 50 100

Scale in Feet

Data Source: Esri World Imagery

Landau Associates

Jackson Park Focused Phase II Investigation Bremerton, Washington	**Munitions Storage Bunker 101**	Figure 11



Legend

- Boring Location
- Radon Sample Location
- Operable Site Unit Boundary
- Approximate Location of Former Bunker/Building Linked to Contamination

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 100 200

Scale in Feet

Data Source: Esri World Imagery

Y:\Projects\1255002\020\021\Focused Phase II Investigation\Figure12MunitionsBunkers103&104.mxd 8/15/2013 NAD 1983 StatePlane Washington North FIPS 4601 Feet

LANDAU ASSOCIATES

Jackson Park Focused Phase II Investigation Bremerton, Washington	**Munitions Storage Bunkers 103 & 104**	Figure 12

G:\Projects\1255\002\020\021\Focused Phase II Investigation\Figure13DrumDisposalLandfill.mxd 9/12/2013 NAD 1983 StatePlane Washington North FIPS 4601 Feet

Legend

- Ambient Air Sample
- Indoor Air Sample
- Boring Location
- Site
- Operable Site Unit Boundary
- Approximate Area of Documented Current or Former Contamination

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 75 150

Scale in Feet

Data Source: Esri World Imagery

LANDAU ASSOCIATES

Jackson Park Focused Phase II Investigation Bremerton, Washington	**Drum Disposal Area**	Figure 13

Y:\Projects\1255002\020\021\Focused Phase II Investigation\Figure14InvestigationResultsSummary.mxd 8/15/2013 NAD 1983 StatePlane Washington North FIPS 4601 Feet

Notes
1. Contaminant concentrations represent only soil and groundwater sampled during the investigation. Other contaminants or different concentrations may be present anywhere on the Site, both inside and outside of the delineated area.
2. Contaminants listed in red were detected above the screening level. Contaminants listed in black were detected above the reporting limit and below the screening level.
3. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Legend
- Sampling Locations (Landau Associates 2013b)
- Site
- Operable Site Unit Boundary
- Land Use Control Area
- Contaminant Detected in Soil and/or Water Shallower than 15 feet, Below the Screening Level
- Contaminant Detected in Soil and/or Water Shallower than 15 feet, Above the Screening Level

Data Source: ESRI World Imagery

0 350 700
Scale in Feet

LANDAU ASSOCIATES

Jackson Park
Focused Phase II Investigation
Bremerton, Washington

Summary of Soil and Groundwater Investigation Results

Figure
14

TABLE 13
INDOOR AIR ANALYTICAL RESULTS
JACKSON PARK PHASE II INVESTIGATION
BREMERTON, WASHINGTON

	Screening Level	100B Root Ct-Kitchen P1303743-003 8/22/2013	102B Root Ct-Kitchen P1303743-002 8/22/2013	104D Root Ct-Kitchen P1303743-001 8/22/2013	Root Ct-Ambient P1303743-004 8/22/2013	89D South Shore Rd-Stairs P1303744-001 8/22/2013	91B South Shore Rd-Kitchen P1303744-010 8/22/2013	96B South Shore Ct-Kitchen P1303743-006 8/22/2013	98A South Shore Ct-Kitchen P1303743-005 8/22/2013	64C Haven Rd-Kitchen P1303744-003 8/22/2013	73D Haven Rd-Kitchen P1303743-007 8/22/2013	64B Meyers Rd-Kitchen P1303743-010 8/22/2013	74C Meyers Rd-Kitchen P1303743-008 8/22/2013
VOLATILES (μg/m^3)													
Method TO-15													
Propene	---	0.36 J1	0.54 J1	0.80	0.29 J1	2.4	7.7	0.44 J1	0.58 J1	1.1	0.44 J1	0.79	0.67 J1
Dichlorodifluoromethane (CFC 12)	91	2.2	2.2	2.5	2.1	1.9	2.1	2.1	2.1	2.1	2.2	2.2	2.1
Chloromethane	41	0.51	0.48	0.53	0.55	0.36	0.39	0.52	0.50	0.48	0.54	0.62	0.51
1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	---	0.65 U	0.70 U	0.66 U	0.80 U	0.78 U	0.67 U	0.71 U	0.73 U	0.74 U	0.72 U	0.65 U	0.74 U
Vinyl Chloride	0.28	0.13 U	0.14 U	0.13 U	0.16 U	0.16 U	0.13 U	0.14 U	0.15 U	0.15 U	0.14 U	0.13 U	0.15 U
1,3-Butadiene	0.083	0.26 U	0.28 U	0.26 U	0.32 U	0.31 U	0.27 U	0.28 U	0.29 U	0.30 U	0.29 U	0.26 U	0.29 U
Bromomethane	---	0.13 U	0.14 U	0.13 U	0.16 U	0.16 U	0.13 U	0.14 U	0.15 U	0.15 U	0.14 U	0.13 U	0.15 U
Chloroethane	---	0.13 U	0.14 U	0.13 U	0.16 U	0.16 U	0.13 U	0.14 U	0.15 U	0.15 U	0.14 U	0.13 U	0.15 U
Ethanol	---	6.8	9.3	38	6.4 J1	58	16	9.3	16	29	7.6	16	5.5 J1
Acetonitrile	---	0.65 U	0.70 U	0.66 U	0.80 U	0.78 U	0.67 U	0.71 U	0.73 U	0.74 U	0.72 U	0.65 U	0.74 U
Acrolein	0.0091	1.3 J1	1.2 J1	1.1 J1	0.37 J1	2.1 J1	1.3 J1	1.9 J1	1.9 J1	3.0	1.7 J1	1.7 J1	1.1 J1
Acetone	---	9.0	8.8	17	6.2 J1	16	12	9.8	11	22	9.1	18	7.3 J1
Trichlorofluoromethane	320	1.1	4.7	1.2	1.1	1.0	1.1	14	1.4	1.1	1.1	1.1	1.2
2-Propanol (Isopropyl Alcohol)	---	6.5 U	2.2 J1, J	2.0 J1, J	8.0 U	9.3 J	26	0.80 J1, J	7.3 U	7.4 U	7.2 U	6.5 U	0.99 J1, J
Acrylonitrile	---	0.65 U	0.70 U	0.66 U	0.80 U	0.78 U	0.67 U	0.71 U	0.73 U	0.74 U	0.72 U	0.65 U	0.74 U
1,1-Dichloroethene	91	0.13 U	0.14 U	0.13 U	0.16 U	0.16 U	0.13 U	0.14 U	0.15 U	0.15 U	0.14 U	0.13 U	0.15 U
Methylene Chloride	5.3	0.26 J1	0.26 J1	0.27 J1	0.26 J1	0.25 J1	0.25 J1	0.25 J1	0.25 J1	0.28 J1	0.29 J1	0.26 J1	0.25 J1
3-Chloro-1-propene (Allyl Chloride)	---	0.13 U	0.14 U	0.13 U	0.16 U	0.16 U	0.13 U	0.14 U	0.15 U	0.15 U	0.14 U	0.13 U	0.15 U
Trichlorotrifluoroethane	---	0.54	0.53	0.5	0.54	0.49	0.52	0.56	0.55	0.54	0.52	0.54	0.56
Carbon Disulfide	320	0.25 J1	0.20 J1	0.27 J1	8.0 U	7.8 U	6.7 U	7.1 U	0.85 J1	7.4 U	7.2 U	6.5 U	7.4 U
trans-1,2-Dichloroethene	27	0.13 U	0.14 U	0.13 U	0.16 U	0.16 U	0.13 U	0.14 U	0.15 U	0.15 U	0.14 U	0.13 U	0.15 U
1,1-Dichloroethane	---	0.13 U	0.14 U	0.13 U	0.16 U	0.16 U	0.13 U	0.14 U	0.15 U	0.15 U	0.14 U	0.13 U	0.15 U
Methyl tert-Butyl Ether	---	0.13 U	0.14 U	0.13 U	0.16 U	0.16 U	0.13 U	0.14 U	0.15 U	0.15 U	0.14 U	0.13 U	0.15 U
Vinyl Acetate	91	2.2 J1	0.88 J1	1.6 J1	8.0 U	1.2 J1	1.6 J1	2.4 J1	4.6 J1	2.5 J1	7.2 U	1.3 J1	7.4 U
2-Butanone (MEK)	2300	1.2 J1	1.1 J1	1.4 J1	0.60 J1	1.4 J1	1.0 J1	1.5 J1	2.0 J1	1.7 J1	1.0 J1	2.6 J1	0.81 J1
cis-1,2-Dichloroethene	---	0.13 U	0.14 U	0.13 U	0.16 U	0.16 U	0.13 U	0.14 U	0.15 U	0.15 U	0.14 U	0.13 U	0.15 U
Ethyl Acetate	---	7.5	8.6	22	9.1	9.9	8.7	11	29	7.3	8.4	9.9	5.0
n-Hexane	320	0.28 J1	0.24 J1	0.32 J1	0.26 J1	0.40 J1	0.29 J1	0.36 J1	0.33 J1	0.34 J1	0.32 J1	0.48 J1	2.2
Chloroform	0.11	0.20	0.14 U	0.22	0.16 U	0.86	0.38	0.15	0.45	0.57	0.13 J1	0.37	0.14 J1
Tetrahydrofuran (THF)	---	0.65 U	0.70 U	0.66 U	0.80 U	0.78 U	0.67 U	0.71 U	0.73 U	0.74 U	0.72 U	0.65 U	0.74 U
1,2-Dichloroethane	0.096	0.13 U	0.14 U	0.13 U	0.16 U	0.24	0.13 U	0.12 J1	0.15 U	0.15 J1	0.14 U	0.15	0.15 U
1,1,1-Trichloroethane	2300	0.13 U	0.14 U	0.13 U	0.16 U	0.16 U	0.13 U	0.14 U	0.15 U	0.15 U	0.14 U	0.13 U	0.15 U
Benzene	0.32	0.30	0.39	0.31	0.29	0.50	0.37	0.41	0.44	0.38	0.39	0.43	1.2
Carbon Tetrachloride	0.42	0.40	0.43	0.41	0.39	0.43	0.44	0.39	0.39	0.41	0.43	0.38	0.42
Cyclohexane	2700	1.3 U	1.4 U	1.3 U	1.6 U	1.6 U	1.3 U	1.4 U	1.5 U	1.5 U	1.4 U	1.3 U	0.54 J1
1,2-Dichloropropane	1.8	0.13 U	0.14 U	0.13 U	0.16 U	0.16 U	0.13 U	0.14 U	0.15 U	0.15 U	0.14 U	0.13 U	0.15 U
Bromodichloromethane	---	0.13 U	0.14 U	0.13 U	0.16 U	0.14 J1	0.13 U	0.14 U	0.15 U	0.15 U	0.14 U	0.13 U	0.15 U
Trichloroethene	0.37	0.13 U	0.14 U	0.13 U	0.16 U	0.16 U	0.13 U	0.14 U	0.15 U	0.15 U	0.14 U	0.13 U	0.15 U
1,4-Dioxane	---	0.65 U	0.70 U	0.66 U	0.80 U	0.78 U	0.67 U	0.71 U	0.73 U	0.74 U	0.72 U	0.65 U	0.74 U
Methyl Methacrylate	---	1.3 U	1.4 U	1.3 U	1.6 U	1.6 U	1.3 U	1.4 U	1.5 U	1.5 U	1.4 U	1.3 U	1.5 U
n-Heptane	---	0.65 U	0.70 U	0.66 U	0.80 U	0.78 U	0.67 U	0.71 U	0.73 U	0.33 J1	0.72 U	0.29 J1	1.0
cis-1,3-Dichloropropene	---	0.65 U	0.70 U	0.66 U	0.80 U	0.78 U	0.67 U	0.71 U	0.73 U	0.74 U	0.72 U	0.65 U	0.74 U
4-Methyl-2-pentanone	---	0.65 U	0.70 U	0.26 J1	0.80 U	0.78 U	0.67 U	0.71 U	0.73 U	0.74 U	0.90	0.65 U	0.74 U
trans-1,3-Dichloropropene	---	0.65 U	0.70 U	0.66 U	0.80 U	0.78 U	0.67 U	0.71 U	0.73 U	0.74 U	0.72 U	0.65 U	0.74 U
1,1,2-Trichloroethane	0.16	0.13 U	0.14 U	0.13 U	0.16 U	0.16 U	0.13 U	0.14 U	0.15 U	0.15 U	0.14 U	0.13 U	0.15 U
Toluene	2300	1.1	1.5	1.5	1.2	2.4	1.3	2.0	1.7	1.7	1.7	2.0	10
2-Hexanone	---	0.65 U	0.70 U	0.66 U	0.80 U	0.78 U	0.67 U	0.71 U	0.44 J1	0.32 J1	0.72 U	0.49 J1	0.74 U
Dibromochloromethane	---	0.13 U	0.14 U	0.13 U	0.16 U	0.16 U	0.13 U	0.14 U	0.15 U	0.15 U	0.14 U	0.13 U	0.15 U
1,2-Dibromoethane	---	0.13 U	0.14 U	0.13 U	0.16 U	0.16 U	0.13 U	0.14 U	0.15 U	0.15 U	0.14 U	0.13 U	0.15 U
n-Butyl Acetate	---	0.33 J1	0.54 J1	0.9	0.80 U	0.82	0.29 J1	0.71 U	0.46 J1	0.60 J1	0.57 J1	1.4	0.44 J1
n-Octane	---	0.65 U	0.70 U	0.66 U	0.80 U	0.30 J1	0.30 J1	0.21 J1	0.28 J1	0.23 J1	0.72 U	0.22 J1	0.30 J1
Tetrachloroethene	9.6	0.13 U	0.14 U	0.13 U	0.16 U	0.66	0.13 U	0.14 U	0.15 U	0.15 U	0.14 U	0.13 U	0.15 U
Chlorobenzene	23	0.13 U	0.14 U	0.13 U	0.16 U	0.16 U	0.13 U	0.14 U	0.15 U	0.15 U	0.14 U	0.13 U	0.15 U
Ethylbenzene	460	0.65 U	0.70 U	0.24 J1	0.80 U	0.35 J1	0.67 U	0.26 J1	0.31 J1	0.28 J1	0.21 J1	0.26 J1	0.95
m,p-Xylenes	46	0.68	0.53 J1	0.71	0.56 J1	1.2	0.58 J1	0.86	1.5	0.83	0.80	0.85	4.3
Bromoform	---	0.65 U	0.70 U	0.66 U	0.80 U	0.78 U	0.67 U	0.71 U	0.73 U	0.74 U	0.72 U	0.65 U	0.74 U
Styrene	460	0.65 U	0.70 U	0.32 J1	0.80 U	0.40 J1	0.67 U	0.35 J1	0.34 J1	0.60 J1	0.72 U	0.65 U	0.74 U
o-Xylene	46	0.24 J1	0.70 U	0.27 J1	0.80 U	0.55 J1	0.23 J1	0.36 J1	0.48 J1	0.37 J1	0.35 J1	0.30 J1	1.5
n-Nonane	---	0.65 U	0.70 U	0.66 U	0.80 U	0.28 J1	0.67 U	0.71 U	0.39 J1	0.74 U	0.72 U	0.65 U	0.74 U

TABLE 13
INDOOR AIR ANALYTICAL RESULTS
JACKSON PARK PHASE II INVESTIGATION
BREMERTON, WASHINGTON

	Screening Level	100B Root Ct-Kitchen P1303743-003 8/22/2013	102B Root Ct-Kitchen P1303743-002 8/22/2013	104D Root Ct-Kitchen P1303743-001 8/22/2013	Root Ct-Ambient P1303743-004 8/22/2013	89D South Shore Rd-Stairs P1303744-001 8/22/2013	91B South Shore Rd-Kitchen P1303744-010 8/22/2013	96B South Shore Ct-Kitchen P1303743-006 8/22/2013	98A South Shore Ct-Kitchen P1303743-005 8/22/2013	64C Haven Rd-Kitchen P1303744-003 8/22/2013	73D Haven Rd-Kitchen P1303743-007 8/22/2013	64B Meyers Rd-Kitchen P1303743-010 8/22/2013	74C Meyers Rd-Kitchen P1303743-008 8/22/2013
1,1,2,2-Tetrachloroethane	---	0.13 U	0.14 U	0.13 U	0.16 U	0.16 U	0.13 U	0.14 U	0.15 U	0.15 U	0.14 U	0.13 U	0.15 U
Cumene	---	0.65 U	0.70 U	0.66 U	0.80 U	0.78 U	0.67 U	0.71 U	0.73 U	0.74 U	0.72 U	0.65 U	0.74 U
alpha-Pinene	---	**0.56** J1	**0.64** J1	**0.72**	**0.71** J1	**0.95**	**0.74**	**0.82**	**0.95**	**3.3**	**0.83**	**1.3**	**1.0**
n-Propylbenzene	---	0.65 U	0.70 U	0.66 U	0.80 U	0.78 U	0.67 U	0.71 U	0.73 U	0.74 U	0.72 U	0.65 U	0.74 U
4-Ethyltoluene	---	0.65 U	0.70 U	0.66 U	0.80 U	0.78 U	0.67 U	0.71 U	0.73 U	0.74 U	0.72 U	0.65 U	0.74 U
1,3,5-Trimethylbenzene	---	0.65 U	0.70 U	0.66 U	0.80 U	0.78 U	0.67 U	0.71 U	0.73 U	0.74 U	0.72 U	0.65 U	**0.27** J1
1,2,4-Trimethylbenzene	3.2	0.65 U	0.70 U	**0.22** J1	0.80 U	**0.42** J1	**0.22** J1	**0.21** J1	**0.48** J1	**0.25** J1	0.72 U	**0.20** J1	**0.76**
Benzyl Chloride	---	0.65 U	0.70 U	0.66 U	0.80 U	0.78 U	0.67 U	0.71 U	0.73 U	0.74 U	0.72 U	0.65 U	0.74 U
1,3-Dichlorobenzene	---	0.13 U	0.14 U	0.13 U	0.16 U	0.16 U	0.13 U	0.14 U	0.15 U	0.15 U	0.14 U	0.13 U	0.15 U
1,4-Dichlorobenzene	370	0.13 U	0.14 U	**0.37**	0.16 U	0.16 U	0.13 U	0.14 U	0.15 U	0.15 U	0.14 U	**0.53**	0.15 U
1,2-Dichlorobenzene	91	0.13 U	0.14 U	0.13 U	0.16 U	0.16 U	0.13 U	0.14 U	0.15 U	0.15 U	0.14 U	0.13 U	0.15 U
d-Limonene	---	**0.23** J1	**0.33** J1	**0.61** J1	0.80 U	**1.3**	**0.27** J1	0.71 U	**0.26** J1	**2.9**	0.72 U	**0.29** J1	0.74 U
1,2-Dibromo-3-chloropropane	---	0.65 U	0.70 U	0.66 U	0.80 U	0.78 U	0.67 U	0.71 U	0.73 U	0.74 U	0.72 U	0.65 U	0.74 U
1,2,4-Trichlorobenzene	---	0.65 U	0.70 U	0.66 U	0.80 U	0.78 U	0.67 U	0.71 U	0.73 U	0.74 U	0.72 U	0.65 U	0.74 U
Naphthalene	1.4	0.65 U	0.70 U	**0.32** J1	0.80 U	**0.41** J1	0.67 U	0.71 U	**0.36** J1	**0.50** J1	0.72 U	0.65 U	0.74 U
Hexachlorobutadiene	---	0.65 U	0.70 U	0.66 U	0.80 U	0.78 U	0.67 U	0.71 U	0.73 U	0.74 U	0.72 U	0.65 U	0.74 U

TABLE 13
INDOOR AIR ANALYTICAL RESULTS
JACKSON PARK PHASE II INVESTIGATION
BREMERTON, WASHINGTON

	Screening Level	17G Dowell Rd-Kitchen P1303743-009 8/22/2013	20B Elwood Point Rd-Kitchen P1303744-005 8/22/2013	21D Elwood Point Rd-Kitchen P1303743-011 8/22/2013	22D Elwood Point Rd-Kitchen P1303744-004 8/22/2013	24C Elwood Point Rd-Kitchen P1303743-013 8/22/2013	26A Elwood Point Rd-Kitchen P1303744-008 8/22/2013	28A Elwood Point Rd-Kitchen P1303743-012 8/22/2013	49B Olding Rd-Kitchen P1303744-006 8/22/2013	51A Olding Rd-Kitchen P1303744-007 8/22/2013	52B Olding Rd-Kitchen P1303744-009 8/22/2013	Drum Disposal-Ambient P1303743-014 8/22/2013	Benzene Plume-Ambient P1303744-002 8/22/2013
VOLATILES (μg/m^3)													
Method TO-15													
Propene	---	**0.49** J1	**1.7**	**0.72**	**0.57** J1	**1.0**	**0.99**	**0.85**	0.75 U	**1.0**	**0.99**	**0.44** J1	**0.42** J1
Dichlorodifluoromethane (CFC 12)	91	**2.2**	**2.0**	**2.2**	**2.0**	**2.1**	**2.1**	**2.1**	**2.0**	**2.1**	**2.0**	**2.2**	**2.1**
Chloromethane	41	**0.69**	0.24 U	**0.68** J	0.26 U	**0.71** J	**0.60** J	**0.69** J	**0.41** J	**0.35**	**0.49**	**0.55**	**0.42**
1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	---	0.76 U	0.61 U	0.64 U	0.64 U	0.63 U	0.75 U	0.65 U	0.75 U	0.74 U	0.90 U	0.69 U	0.76 U
Vinyl Chloride	0.28	0.15 U	0.12 U	0.13 U	0.13 U	0.13 U	0.15 U	0.13 U	0.15 U	0.15 U	0.18 U	0.14 U	0.15 U
1,3-Butadiene	0.083	0.30 U	0.24 U	0.26 U	0.26 U	0.25 U	0.30 U	0.26 U	0.30 U	0.30 U	0.36 U	0.27 U	0.30 U
Bromomethane	---	0.15 U	0.12 U	0.13 U	0.13 U	0.13 U	0.15 U	0.13 U	0.15 U	0.15 U	0.18 U	0.14 U	0.15 U
Chloroethane	---	0.15 U	0.12 U	0.13 U	0.13 U	0.13 U	0.15 U	0.13 U	0.15 U	0.15 U	0.18 U	0.14 U	0.15 U
Ethanol	---	**12**	**30**	**11**	**7.8**	**9.6**	**14**	**28**	**19**	**13**	**9.2**	**7.0**	**7.6**
Acetonitrile	---	0.76 U	0.61 U	0.64 U	0.64 U	0.63 U	0.75 U	0.65 U	0.75 U	0.74 U	0.90 U	0.69 U	0.76 U
Acrolein	0.0091	**1.9** J1	**3.6**	**1.5** J1	**1.9** J1	**2.4** J1	**2.9** J1	**2.4** J1	**2.8** J1	**1.7** J1	**2.0** J1	**0.57** J1	**0.59** J1
Acetone	---	**12**	**22**	**14**	**12**	**15**	**15**	**15**	**15**	**12**	**14**	**7.4**	**7.2** J1
Trichlorofluoromethane	320	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**
2-Propanol (Isopropyl Alcohol)	---	7.6 U	**4.1** J1, J	**2.4** J1, J	6.4 U	**3.2** J1, J	7.5 U	**1.9** J1	7.5 U	7.4 U	9.0 U	**0.55** J1	7.6 U
Acrylonitrile	---	0.76 U	0.61 U	0.64 U	0.64 U	0.63 U	0.75 U	0.65 U	0.75 U	0.74 U	0.90 U	0.69 U	0.76 U
1,1-Dichloroethene	91	0.15 U	**0.14**	0.13 U	**0.13**	**0.13**	0.15 U	0.13 U	0.15 U	0.15 U	0.18 U	0.14 U	0.15 U
Methylene Chloride	5.3	**0.28** J1	**0.26** J1	**0.26** J1	**0.26** J1	**0.26** J1	**0.34** J1	**0.28** J1	**0.46** J1	**0.27** J1	**0.31** J1	**0.27** J1	**0.26** J1
3-Chloro-1-propene (Allyl Chloride)	---	0.15 U	0.12 U	0.13 U	0.13 U	0.13 U	0.15 U	0.13 U	0.15 U	0.15 U	0.18 U	0.14 U	0.15 U
Trichlorotrifluoroethane	---	**0.54**	**0.51**	**0.54**	**0.51**	**0.53**	**0.51**	**0.55**	**0.53**	**0.53**	**0.52**	**0.53**	**0.50**
Carbon Disulfide	320	7.6 U	6.1 U	6.4 U	6.4 U	**0.21** J1	7.5 U	**0.35** J1	7.5 U	7.4 U	9.0 U	6.9 U	**0.48** J1
trans-1,2-Dichloroethene	27	0.15 U	0.12 U	0.13 U	0.13 U	0.13 U	0.15 U	0.13 U	0.15 U	0.15 U	0.18 U	0.14 U	0.15 U
1,1-Dichloroethane	---	0.15 U	0.12 U	0.13 U	0.13 U	0.13 U	0.15 U	0.13 U	0.15 U	0.15 U	0.18 U	0.14 U	0.15 U
Methyl tert-Butyl Ether	---	0.15 U	0.12 U	0.13 U	0.13 U	0.13 U	0.15 U	0.13 U	0.15 U	0.15 U	0.18 U	0.14 U	0.15 U
Vinyl Acetate	91	**1.8** J1	**2.8** J1	**1.1** J1	**1.2** J1	**2.0** J1	7.5 U	6.5 U	7.5 U	7.4 U	9.0 U	**1.2** J1	7.6 U
2-Butanone (MEK)	2300	**1.2** J1	**1.5** J1	**0.95** J1	**1.0** J1	**1.6** J1	**1.8** J1	**1.6** J1	**1.7** J1	**1.1** J1	**1.5** J1	**0.94** J1	**0.76** J1
cis-1,2-Dichloroethene	---	0.15 U	0.12 U	0.13 U	0.13 U	0.13 U	0.15 U	0.13 U	0.15 U	0.15 U	0.18 U	0.14 U	0.15 U
Ethyl Acetate	---	**8.8**	**7.8**	**8.3**	**4.7**	**4.7**	**31**	**8.0**	**9.8**	**7.0**	**7.0**	**17**	**8.2**
n-Hexane	320	**0.48** J1	**0.87**	**0.33** J1	**1.2**	**0.89**	**2.0**	**4.0**	**0.72** J1	**0.41** J1	**0.47** J1	**0.38** J1	**0.33** J1
Chloroform	0.11	0.15 U	**0.29**	**0.16**	**0.44**	**0.24**	**0.53**	**0.23**	**0.45**	**0.20**	**0.17** J1	0.14 U	0.15 U
Tetrahydrofuran (THF)	---	0.76 U	0.61 U	0.64 U	0.64 U	**0.93**	**0.41** J1	0.65 U	**1.1**	0.74 U	0.90 U	0.69 U	0.76 U
1,2-Dichloroethane	0.096	0.15 U	0.12 U	0.13 U	0.13 U	0.13 U	0.15 U	0.13 U	0.15 U	0.15 U	0.18 U	0.14 U	0.15 U
1,1,1-Trichloroethane	2300	0.15 U	0.12 U	0.13 U	0.13 U	0.13 U	0.15 U	0.13 U	0.15 U	0.15 U	0.18 U	0.14 U	0.15 U
Benzene	0.32	**0.38**	**0.66**	**0.38**	**0.48**	**0.57**	**0.86**	**2.2**	**0.52**	**0.41**	**0.43**	**0.44**	**0.32**
Carbon Tetrachloride	0.42	**0.43**	**0.46**	**0.41**	**0.45**	**0.44**	**0.42**	**0.43**	**0.43**	**0.41**	**0.45**	**0.39**	**0.36**
Cyclohexane	2700	1.5 U	**0.36** J1	1.3 U	**0.34** J1	**0.38** J1	**0.75** J1	**2.7**	1.5 U	1.5 U	1.8 U	1.4 U	1.5 U
1,2-Dichloropropane	1.8	0.15 U	0.12 U	0.13 U	0.13 U	0.13 U	0.15 U	0.13 U	0.15 U	0.15 U	0.18 U	0.14 U	0.15 U
Bromodichloromethane	---	0.15 U	0.12 U	0.13 U	0.13 U	0.13 U	0.15 U	0.13 U	0.15 U	0.15 U	0.18 U	0.14 U	0.15 U
Trichloroethene	0.37	0.15 U	0.12 U	0.13 U	0.13 U	0.13 U	0.15 U	0.13 U	0.15 U	0.15 U	0.18 U	0.14 U	0.15 U
1,4-Dioxane	---	0.76 U	0.61 U	0.64 U	0.64 U	0.63 U	0.75 U	0.65 U	0.75 U	0.74 U	0.90 U	0.69 U	0.76 U
Methyl Methacrylate	---	1.5 U	1.2 U	1.3 U	1.3 U	1.3 U	1.5 U	1.3 U	1.5 U	1.5 U	1.8 U	1.4 U	1.5 U
n-Heptane	---	**0.30** J1	**0.48** J1	**0.20** J1	**0.60** J1	**0.54** J1	**1.1**	**3.1**	**0.35** J1	**0.24** J1	**0.33** J1	**0.20** J1	0.76 U
cis-1,3-Dichloropropene	---	0.76 U	0.61 U	0.64 U	0.64 U	0.63 U	0.75 U	0.65 U	0.75 U	0.74 U	0.90 U	0.69 U	0.76 U
4-Methyl-2-pentanone	---	0.76 U	**0.39** J1	0.64 U	0.64 U	0.63 U	0.75 U	0.65 U	**0.28** J1	0.74 U	0.90 U	0.69 U	**0.57** J1
trans-1,3-Dichloropropene	---	0.76 U	0.61 U	0.64 U	0.64 U	0.63 U	0.75 U	0.65 U	0.75 U	0.74 U	0.90 U	0.69 U	0.76 U
1,1,2-Trichloroethane	0.16	0.15 U	0.12 U	0.13 U	0.13 U	0.13 U	0.15 U	0.13 U	0.15 U	0.15 U	0.18 U	0.14 U	0.15 U
Toluene	2300	**1.6**	**3.8**	**1.4**	**2.4**	**4.0**	**6.3**	**26**	**2.4**	**1.9**	**1.6**	**2.3**	**1.5**
2-Hexanone	---	0.76 U	**0.27** J1	0.64 U	0.64 U	**0.39** J1	0.75 U	0.65 U	0.75 U	0.74 U	0.90 U	0.69 U	0.76 U
Dibromochloromethane	---	0.15 U	0.12 U	0.13 U	0.13 U	0.13 U	0.15 U	0.13 U	0.15 U	0.15 U	0.18 U	0.14 U	0.15 U
1,2-Dibromoethane	---	0.15 U	0.12 U	0.13 U	0.13 U	0.13 U	0.15 U	0.13 U	0.15 U	0.15 U	0.18 U	0.14 U	0.15 U
n-Butyl Acetate	---	**0.98**	**0.60** J1	**0.83**	**0.63** J1	**1.0**	**1.1**	**3.6**	**1.5**	0.74 U	**0.65** J1	0.69 U	0.76 U
n-Octane	---	0.76 U	**0.37** J1	**0.18** J1	**0.37** J1	**0.38** J1	**0.68** J1	**2.0**	**0.23** J1	0.74 U	**0.30** J1	**0.20** J1	0.76 U
Tetrachloroethene	9.6	0.15 U	0.12 U	0.13 U	0.13 U	0.13 U	0.15 U	0.13 U	0.15 U	0.15 U	0.18 U	0.14 U	0.15 U
Chlorobenzene	23	0.15 U	0.12 U	0.13 U	0.13 U	0.13 U	0.15 U	0.13 U	0.15 U	0.15 U	0.18 U	0.14 U	0.15 U
Ethylbenzene	460	0.76 U	**0.77**	**0.21** J1	**1.0**	**1.4**	**1.6**	**5.8**	**0.35** J1	**0.30** J1	**0.27** J1	**0.26** J1	0.76 U
m,p-Xylenes	46	**0.62** J1	**3.0**	**0.77**	**4.8**	**6.0**	**6.5**	**21**	**1.2**	**1.0**	**0.91**	**0.89**	**0.59** J1
Bromoform	---	0.76 U	0.61 U	0.64 U	0.64 U	0.63 U	0.75 U	0.65 U	0.75 U	0.74 U	0.90 U	0.69 U	0.76 U
Styrene	460	0.76 U	**1.1**	0.64 U	**0.38** J1	**2.0**	**2.2**	**2.6**	**0.27** J1	0.74 U	0.90 U	0.69 U	0.76 U
o-Xylene	46	0.76 U	**1.2**	**0.29** J1	**2.6**	**3.0**	**3.0**	**8.4**	**0.47** J1	**0.38** J1	**0.35** J1	**0.31** J1	0.76 U
n-Nonane	---	0.76 U	**0.30** J1	**0.27** J1	**0.65**	**0.53** J1	**0.52** J1	**1.4**	**0.38** J1	0.74 U	0.90 U	**0.21** J1	0.76 U

TABLE 13
INDOOR AIR ANALYTICAL RESULTS
JACKSON PARK PHASE II INVESTIGATION
BREMERTON, WASHINGTON

	Screening Level	17G Dowell Rd-Kitchen P1303743-009 8/22/2013	20B Elwood Point Rd-Kitchen P1303744-005 8/22/2013	21D Elwood Point Rd-Kitchen P1303743-011 8/22/2013	22D Elwood Point Rd-Kitchen P1303744-004 8/22/2013	24C Elwood Point Rd-Kitchen P1303743-013 8/22/2013	26A Elwood Point Rd-Kitchen P1303744-008 8/22/2013	28A Elwood Point Rd-Kitchen P1303743-012 8/22/2013	49B Olding Rd-Kitchen P1303744-006 8/22/2013	51A Olding Rd-Kitchen P1303744-007 8/22/2013	52B Olding Rd-Kitchen P1303744-009 8/22/2013	Drum Disposal-Ambient P1303743-014 8/22/2013	Benzene Plume-Ambient P1303744-002 8/22/2013
1,1,2,2-Tetrachloroethane	---	0.15 U	0.12 U	0.13 U	0.13 U	0.13 U	0.15 U	0.13 U	0.15 U	0.15 U	0.18 U	0.14 U	0.15 U
Cumene	---	0.76 U	0.61 U	0.64 U	0.64 U	0.63 U	0.75 U	**0.43** J1	0.75 U	0.74 U	0.90 U	0.69 U	0.76 U
alpha-Pinene	---	**1.2**	**2.3**	**1.5**	**2.1**	**2.3**	**2.8**	**2.2**	**2.3**	**1.4**	**1.9**	**1.3**	**0.84**
n-Propylbenzene	---	0.76 U	0.61 U	0.64 U	0.64 U	0.63 U	**0.28** J1	**1.3**	0.75 U	0.74 U	0.90 U	0.69 U	0.76 U
4-Ethyltoluene	---	0.76 U	**0.23** J1	0.64 U	0.64 U	**0.27** J1	**0.38** J1	**1.7**	0.75 U	0.74 U	0.90 U	0.69 U	0.76 U
1,3,5-Trimethylbenzene	---	0.76 U	**0.25** J1	0.64 U	**0.36** J1	**0.40** J1	**0.55** J1	**2.0**	0.75 U	0.74 U	0.90 U	0.69 U	0.76 U
1,2,4-Trimethylbenzene	3.2	0.76 U	**0.89**	**0.20** J1	**0.94**	**1.0**	**2.0**	$\boxed{\mathbf{6.2}}$	**0.34** J1	**0.35** J1	**0.31** J1	**0.38** J1	0.76 U
Benzyl Chloride	---	0.76 U	0.61 U	0.64 U	0.64 U	0.63 U	0.75 U	0.65 U	0.75 U	0.74 U	0.90 U	0.69 U	0.76 U
1,3-Dichlorobenzene	---	0.15 U	0.12 U	0.13 U	0.13 U	0.13 U	0.15 U	0.13 U	0.15 U	0.15 U	0.18 U	0.14 U	0.15 U
1,4-Dichlorobenzene	370	0.15 U	0.12 U	0.13 U	0.13 U	0.13 U	0.15 U	0.13 U	**3.1**	0.15 U	0.18 U	0.14 U	0.15 U
1,2-Dichlorobenzene	91	0.15 U	0.12 U	0.13 U	0.13 U	0.13 U	0.15 U	0.13 U	0.15 U	0.15 U	0.18 U	0.14 U	0.15 U
d-Limonene	---	**0.87**	**0.89**	**0.41** J1	**0.45** J1	**0.42** J1	**0.72** J1	**3.6**	**1.3**	**0.29** J1	**0.31** J1	**0.24** J1	0.76 U
1,2-Dibromo-3-chloropropane	---	0.76 U	0.61 U	0.64 U	0.64 U	0.63 U	0.75 U	0.65 U	0.75 U	0.74 U	0.90 U	0.69 U	0.76 U
1,2,4-Trichlorobenzene	---	0.76 U	0.61 U	0.64 U	0.64 U	0.63 U	0.75 U	0.65 U	0.75 U	0.74 U	0.90 U	0.69 U	0.76 U
Naphthalene	1.4	0.76 U	**0.39** J1	0.64 U	0.64 U	0.63 U	0.75 U	0.65 U	0.75 U	0.74 U	0.90 U	**0.31** J1	0.76 U
Hexachlorobutadiene	---	0.76 U	0.61 U	0.64 U	0.64 U	0.63 U	0.75 U	0.65 U	0.75 U	0.74 U	0.90 U	0.69 U	0.76 U

U = Indicates the compound was not detected at the reported concentration.
J = The analytical result is greater than the method detection limit, but less than the reporting limit.
J1 = Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
UJ = The analyte was not detected in the sample; the reported sample reporting limit is an estimate.
Bold = Detected compound.
Box = Exceedance of cleanup level.
--- = no screening level value available

APPENDIX E

Site Inspection Form

I. SITE INFORMATION	
Site name: *Jackson Park Housing Complex/Naval Hospital Bremerton*	**Date of inspection:** 7/22/2014
Location and Region: *Bremerton, WA, Region 10*	**EPA ID:** WA3170090044
Agency, office, or company leading the five-year review: *US Navy*	**Weather/temperature:** Cloudy, 60 F

Remedy Includes: (Check all that apply)

- ☒ Landfill cover/containment
- ☐ Access controls
- ☒ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☒ Other *Soil removal; shoreline stabilization; groundwater, seep, and shellfish monitoring; oxygen-releasing compound remediation*
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☐ Inspection team roster in body of report ☐ Site map in body of report

II. INTERVIEWS (Check all that apply)

1. **Navy Staff**

Contact: Ellen Brown, RPM for JPHC OU 2, NAVFAC NW

Problems; suggestions; ☒ Report attached: See Appendix F

Contact: Ray Kobeski, RPM, NAVFAC NW

Problems; suggestions; ☒ Report attached: See Appendix F

Contact: David Liu, Former RPM, NAVFAC NW

Problems; suggestions; ☒ Report attached: See Appendix F

Contact: Robert Mitchell, Environmental Manager, Naval Hospital Bremerton

Problems; suggestions; ☒ Report attached: See Appendix f

Contact: Leslie Yuenger, Public Affairs Officer, NAVFAC NW

Problems; suggestions; ☒ Report attached: See Appendix F

2. **Regulatory and Tribal authorities and response agencies**

Agency: Washington State Department of Ecology
Contact: Chris Maurer

Problems; suggestions; ☒ Report attached: See Appendix F

Agency: U.S. Environmental Protection Agency
Contact: Harry Craig

Problems; suggestions; ☐ Report attached:
Chose not to respond

Agency: Washington State Department of Natural Resources
Contact: Erika Shaffer

Problems; suggestions; ☒ Report attached: See Appendix F

Agency: Suquamish Tribe
Contact: Denice Taylor

Problems; suggestions; ☒ Report attached: See Appendix F

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3. **Members of the public**

Contact:

Problems; suggestions; ☐ Report attached:

4. **Other interviews** (optional): None.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Records**

☒ O&M manual	☒ Readily available	☒ Up to date	☐ N/A
☒ As-built drawings	☒ Readily available	☒ Up to date	☐ N/A
☒ Maintenance logs	☒ Readily available	☒ Up to date	☐ N/A

Remarks: Inspection and Maintenance Plan Last Updated August 2008

2. **Institutional Controls Inspection Records** ☒ Readily available ☒ Up to date
Remarks:

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house	☐ Contractor for State
☐ PRP in-house	☐ Contractor for PRP
☐ Federal Facility in-house	☒ Contractor for Federal Facility
☐ Other	

2. **O&M Cost Records**

☒ Readily available ☒ Up to date

☒ Funding mechanism/agreement in place

Original O&M cost estimate: OU 1 - $263,860 (not escalated from 2000), OU 3T JPHC - $52,706

Total annual cost for OU 1 by year for review period: *Annual average has been $455,410*

From FY 2010 To ____: *$243,086*
From FY 2011 To ____: *$380,408 (including a marine tissue sampling event)*
From FY 2012 To ____: *$532,612 (includes NEX Gas Station Leak Area ROD amendment)*
From FY 2013 To ____: *$1,120,945 (includes marine tissue work plan development and NEX Gas Station Leak Area design)*
From FY 2014 To ____: *$4,204,916 (including a marine tissue sampling event)*

Total annual cost for OU 3T JPHC for 2010 through 2014: *$125,881*

From FY 2010 To ____: *$0*
From FY 2011 To ____: *$0*
From FY 2012 To ____: *$0*
From FY 2013 To ____: *$0*
From FY 2014 To ____: *$125,881*

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: See narrative in 5-year review (Sections 4.1 and 4.2)

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable G N/A

A. Elwood Point (Site 103)

1. **Has non-residential land use been maintained?** ☒ Yes ☐ No
Remarks: ____

2. **Are the barriers over soil still in place?** ☒ Yes ☐ No
Remarks: ____

3. **Are the non-vegetative covers intact and is the vegetative cover maintained/healthy?**
☒ Yes ☐ No
Remarks: ____

4. **Any digging without dig permit?** ☐ Yes ☒ No
Remarks: ____

5. **Any activities that could interfere with remedy or monitoring?** ☐ Yes ☒ No
Remarks: ____

6. **Any disturbance to the sensitive archaeological area (outside IC area)?** ☐ Yes ☒ No
Remarks: ____

B. Upland Areas (Sites 110 and 101-A) (1: Bldg 100/Bldg 101; 2: Root Court Cul-de-Sac; 3: Root Court/S. Shore Fill Areas; 4: Construction Debris Landfill)

1. **Are asphalt covers being maintained in front of Buildings 100 and 101**?
☒ Yes ☐ No
Remarks: Cracks on the eastern edge of Area K (Building 100) and along the center of the road. In Area J (Building 101) there are small depressions along the east side in various places. There are also cracks around the perimeter of the entrance driveway.

2.	**Are soil and vegetative covers maintained/ healthy at the Root Court cul-de-sac?** ☒ Yes ☐ No Remarks: ______	
3.	**Any digging without dig permit in any of the upland areas?** ☐ Yes ☒ No Remarks: ______	
4.	**Are there any signs of erosion or exposed soils in the Root Court or Construction Landfill areas**? ☐ Yes ☒ No Remarks: ______	
5.	**Groundwater wells installed?** ☐ Yes ☒ No Remarks:	
C. Shoreline (Site 101 and shoreline areas of Site 103)		
1.	**Are the rock shelf areas and stairways being maintained**? ☒ Yes ☐ No Remarks:	
2.	**Is the seawall being maintained**? ☒ Yes ☐ No Remarks: In Area 101, there are cracks in the concrete seawall. Area 103 seawall is well maintained .	
3.	**Is the armor stone revetment and associated stairways being maintained**? ☒ Yes ☐ No Remarks:	
4.	**Is the storm drainage system (catch basin, berm, swale, French drain, riprap slash pads) functioning to prevent erosion of the beaches**? ☒ Yes ☐ No Remarks: ______	
5.	**Are shellfish harvesting restriction signs present**? ☒ Yes ☐ No Remarks:	
D. Institutional Controls (ICs)		
1.	**Implementation and enforcement** Site conditions imply ICs properly implemented ☒ Yes ☐ No Site conditions imply ICs being fully enforced ☒ Yes ☐ No Type of monitoring (*e.g.*, self-reporting, drive by): *self reporting* Frequency: *Quarterly* Responsible party NAVFAC NW Contact Ray Kobeski (Name) RPM (Title) 306.396.0597 (Phone no.) Reporting is up-to-date ☒ Yes ☐ No Specific requirements in decision documents have been met ☒ Yes ☐ No Violations have been reported ☐ Yes ☒ No Other problems or suggestions; ☐ Report attached:	
2.	**Adequacy** ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A Remarks: ______	

VI. REMEDY COMPONENTS

A. Areas of Soil Cover and Asphalt Paving (Sites 103, 110, and 101-A)

1. **Settlement** (Low spots) ☐ Location shown on site map ☒ Settlement not evident
   Areal extent_______________ Depth_____________
   Remarks: ____________________

2. **Cracks** ☒ Location shown on site map ☐ Cracking not evident
   Lengths___varies__ Widths_max ½"__ Depths__< ½"________
   Remarks:

3. **Erosion** ☐ Location shown on site map ☒ Erosion not evident
   Areal extent_______________ Depth_____________
   Remarks____________________

4. **Holes** ☐ Location shown on site map ☒ Holes not evident
   Areal extent_______________ Depth_____________
   Remarks: ____________________

5. **Vegetative Cover** ☒ Grass ☒ Cover properly established ☒ No signs of stress
   ☒ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks: _Some minor invasive species present (blackberry)____________________

6. **Wet Areas/Water Damage** ☒ Wet areas/water damage not evident
   ☐ Wet areas ☐ Location shown on site map Areal extent_______________
   ☐ Ponding ☐ Location shown on site map Areal extent_______________
   ☐ Seeps ☐ Location shown on site map Areal extent_______________
   ☐ Soft subgrade ☐ Location shown on site map Areal extent_______________
   Remarks: ____________________

B. Shoreline Stabilization

1. **Seawall & Revetment** ☐ Location shown on site map ☒ Erosion not evident
   Areal extent_______________ Depth_____________
   Remarks:

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
   ☒ Vegetation is healthy and preventing erosion
   Areal extent_______________ Type_____________
   Remarks:

3. **Beach Maintenance (pocket beach area)** ☐ Location shown on site map
   ☒ Erosion not evident
   Areal extent_______________ Depth_____________
   Remarks: ____________________

4. **Storm Drainage System** ☐ Location shown on site map ☒ Functioning ☐ N/A
   Remarks: ____________________

C. Groundwater, Seep, and Shellfish Monitoring

1. **Monitoring Wells**
   ☒ Properly secured/locked ☒ Functioning ☐ Routinely sampled ☒ Good condition
   ☒ All required wells located ☐ Needs Maintenance ☐ N/A
   Remarks: _Site wells were not routinely monitored during this 5-year review period._______________

2. **Monitoring**

Types of monitoring being conducted:

☐ Groundwater (Site 110) ☒ Seeps (shoreline areas) ☒ Shellfish

Frequency:

Remarks: See 5 year review report narrative

3. **Data Trends**

Describe results and trends: See 5 year review report narrative

E. Other Remedy Components

1. **Soil excavations** ☒ Completed ☐ Not Completed
2. **ORC injected into soils at Benzene Release Area** ☒ Completed ☐ Not Completed
3. **Elwood Point pilings removed** ☒ Completed ☐ Not Completed

VII. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

See narrative of five-year review.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

See narrative of five-year review.

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

See narrative of five-year review

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

See narrative of five-year review.

APPENDIX F

Interview Responses

INTERVIEW RECORD FOR THIRD FIVE-YEAR REVIEW
July 2009 through June 2014
Type 1 Interview – Navy Personnel
Jackson Park Housing Complex/Naval Hospital Bremerton
Bremerton, Washington

Individual Contacted:	Ellen Brown
Title:	RPM for JPHC OU 2
Organization:	NAVFAC NW
Telephone:	(360) 396-0070
E-mail:	ellen.brown1@navy.mil
Address:	NAVFAC NW 1101 Tautog Circle, Silverdale, WA 98315
Contact made by:	Nicole Rangel
Response type:	e-mail
Date:	September 3, 2014

Summary of Communication

If you are not familiar with the topic of a particular question, or have no information or opinion to offer, please indicate "none" after "response."

1. Please describe your degree of familiarity with the Jackson Park Housing Complex/Naval Hospital Bremerton, the Records of Decision (RODs) for OU 1 and OU 3T-JPHC, the OU 1 ROD amendment, the implementation of the remedies at these two OUs, and the monitoring and maintenance that has taken place since implementation of the remedies. Please also describe your involvement since July 2009.

   Response: I have not been involved in any of these OUs. I am the RPM for OU2 since Fall 2012.

2. What is your overall impression of the on-going effectiveness of the components of the OU 1 remedy? For reference, the remedy components included:

   - Covering of surface soils with concentrations above remedial goals in non-residential areas;
   - Excavation of surface soils in backyards where concentrations exceeded remedial goals;
   - Excavation of petroleum-impacted soils where concentrations were above remedial goals and the impacted soil was above the seasonal high-water table in the benzene release area;
   - Shoreline stabilization measures;

- Removal of old pilings at Elwood Point
- Long-term monitoring (groundwater, seeps, shellfish)
- Institutional controls/land use restrictions

Response: No opinion.

3. What is your overall impression of progress toward implementing the revised remedy in the benzene release area of OU 1? For reference, the remedy components included:

- Active treatment of source area subsurface soil and groundwater using electrical resistance heating with dual phase extraction
- Active treatment in the near-shore area using in situ chemical oxidation to treat contaminated groundwater migrating toward Ostrich Bay
- Long-term monitoring (groundwater and seeps)

Response: No opinion.

4. What is your overall impression of progress toward implementing the components of the OU 3T-JPHC remedy? For reference, the remedy components included:

- Investigation and removal of 100 percent of the detected subsurface metallic anomalies in the three upland grids where discarded military munitions were found during the remedial investigation
- Investigation and removal of 100 percent of the detected subsurface metallic anomalies in the intertidal zone between mean higher high water and mean lower low water
- Implementation of land use controls consisting of an education awareness program, an excavation and dig permitting program, discarded military munitions reporting and response procedures, and land use control monitoring and reporting

Response: No opinion.

5. Are you aware of any violations of the institutional controls requirements at any of the sites within OU 1 or at OU 3T-JPHC that could impact the protectiveness of this component of the remedies (e.g., unauthorized excavation, unauthorized use of groundwater)?

Response: No opinion.

6. To the best of your knowledge, are regular inspections of the institutional controls remedy components for OU 1 and OU 3T-JPHC being conducted and documented?

Response: No opinion.

7. To the best of your knowledge, has the on-going environmental monitoring performed at OU 1, since July 2009 been sufficiently thorough and frequent to meet the goals of the ROD? Have the monitoring data been timely and of acceptable quality?

   Response: No opinion.

8. Do you know of any significant operation and maintenance difficulties with the shoreline stabilization components of the OU 1 remedy that could have impacted the protectiveness of this component of the remedy?

   Response: No opinion.

9. Are you aware of any community concerns regarding implementation of the remedies at OU 1 and OU 3T-JPHC? If so, please give details.

   Response: No opinion.

10. Do you have any overall comments, concerns, or suggestions regarding the effectiveness of the remedies in protecting human health and the environment at Jackson Park Housing Complex?

    Response: *None. OU2 does not have a ROD yet, and I have no knowledge of the other sites.*

INTERVIEW RECORD FOR THIRD FIVE-YEAR REVIEW
July 2009 through June 2014
Type 1 Interview – Navy Personnel
Jackson Park Housing Complex/Naval Hospital Bremerton
Bremerton, Washington

Individual Contacted:	Ray Kobeski
Title:	RPM Environmental Restoration
Organization:	NAVFAC NW
Telephone:	(360) 396-0597
E-mail:	raymond.kobeski@navy.mil
Address:	NAVFAC NW 1101 Tautog Circle, Silverdale, WA 98315
Contact made by:	Nicole Rangel
Response type:	e-mail
Date:	August 20, 2014

Summary of Communication

If you are not familiar with the topic of a particular question, or have no information or opinion to offer, please indicate "none" after "response."

1. Please describe your degree of familiarity with the Jackson Park Housing Complex/Naval Hospital Bremerton, the Records of Decision (RODs) for OU 1 and OU 3T-JPHC, the OU 1 ROD amendment, the implementation of the remedies at these two OUs, and the monitoring and maintenance that has taken place since implementation of the remedies. Please also describe your involvement since July 2009.

   Response: I have a high degree of familiarity with Jackson Park Housing Complex/Naval Hospital. Since September of 2011 I have held the position as the Team Lead for OU1, OU2, OU3T JPHC, OU3T NHB and OU3M. The following is my work history for Jackson Park since July 2009:
   - RPM for OU3T NHB from August 2008 to March 2011.
   - Lead RPM for OU1, OU2, OU3T JPHC/NHB and OU3M since July 2011
   - RPM for OU3T JPHC and OU3M since July 2011
   - RPM for OU1 since July 2013.

   For OU3T, I am the project manager who implemented the remedies for OU3T including the Removal action for uplands, Removal action in the intertidal and implementation of Land Use Controls.

   For OU3M, I am currently the project manager for phase 3 remedial investigations that started October 2014.

For OU, I currently am the project manager for Long term chemical monitoring and maintaining land use controls for the Jackson Park housing Complex.

2. What is your overall impression of the on-going effectiveness of the components of the OU 1 remedy? For reference, the remedy components included:

- Covering of surface soils with concentrations above remedial goals in non-residential areas:

  Response: The on-going effectiveness of the components of the OU1 remedy for covering of surface soils with concentrations above remedial goals has been effective in the non-residential areas.

- Excavation of surface soils in backyards where concentrations exceeded remedial goals:

  Response: The excavation of surface soils in backyards where concentrations exceeded remedial goals has been effective.

- Excavation of petroleum-impacted soils where concentrations were above remedial goals and the impacted soil was above the seasonal high-water table in the benzene release area:

  Response: Amended Record of Decision and approved design of the electric resistive heating remedy will ensure petroleum impacted soils will be below remedial goals in the amended record of decision. This system is slated to be construction in the near future ~FY 15 contracted with work plans generated 30 days after award.

- Shoreline stabilization measures:

  Response: Shoreline stabilization measures are ongoing and effective.

- Removal of old pilings at Elwood Point:

  Response: All old piles have been removed and sampling has stopped for chemicals of concern which demonstrates the effectiveness.

- Long-term monitoring (groundwater, seeps, shellfish):

  Response for Groundwater: Once the Amended record of decision remedy is implemented groundwater monitoring in the benzene seep will commence to ensure the remedy is function as intended.

Response for Seeps and Outfalls: Currently eight out of ten possible locations are still sampled. Sixteen chemicals of concern are listed in Table 8-4 of OU1 Record of decision. Currently Cyanide is sampled at the remaining eight locations, 1,1-DCE, TCE, Vinyl Chloride and total (Arsenic, Beryllium, Mercury, and Thallium) and dissolved metals (Copper, Lead, Nickel, Silver, and Zinc) are included in the sample at Outfall 705 and Benzene and TPH are included in the sampled at Seep 710 and Benzene is included in the sample at Outfall 712. Benzene and TPH at outfall and seeps will be discontinued once sampling begins at the new 880 series wells required by the amended OU 1 Record of decision.

Response for Shellfish: It was agreed to conduct addition shellfish sampling for OU1 including a new ordnance sampling method. The shellfish sampling occurred after the this five year review period snap shot of time and will be included in the next five year review. Sample results as of November 20, 2014 have not been provided to the Navy.

- Institutional controls/land use restrictions:

  Response: Institutional control/land use restriction remains in place and are continuing to demonstrate the effectiveness as a remedy component.

3. What is your overall impression of progress toward implementing the revised remedy in the benzene release area of OU 1? For reference, the remedy components included:

- Active treatment of source area subsurface soil and groundwater using electrical resistance heating with dual phase extraction
- Active treatment in the near-shore area using in situ chemical oxidation to treat contaminated groundwater migrating toward Ostrich Bay
- Long-term monitoring (groundwater and seeps)

Response: The 100% design plans for the active treatment have been approved in Sept 2014. Currently the Federal Government is in continuing resolution which limits the available funds until a budget is passed by Congress and President. Currently this project is in FY 15 contract execution plan contingent on funding.

Currently the Draft final work plan for the Data Gap Investigation has been submitted to EPA Region 10. Since this plan is based on the approved 100% Design of September 2014 the Navy expects to be in the field January 2015 to start the field work. Currently the in situ chemical oxidation system has been contracted and will be constructed based on the results of the data gap investigation.

As discussed in section above long term monitoring is scheduled to continue until conditions in OU 1 record of decision are met for the remaining analytes being monitored.

4. What is your overall impression of progress toward implementing the components of the OU 3T-JPHC remedy? For reference, the remedy components included:

- Investigation and removal of 100 percent of the detected subsurface metallic anomalies in the three upland grids where discarded military munitions were found during the remedial investigation
- Investigation and removal of 100 percent of the detected subsurface metallic anomalies in the intertidal zone between mean higher high water and mean lower low water
- Implementation of land use controls consisting of an education awareness program, an excavation and dig permitting program, discarded military munitions reporting and response procedures, and land use control monitoring and reporting

Response: Currently the investigation and removal of 100 percent of the detected subsurface metallic anomalies in the three upland grids where discarded military munitions were found during the remedial investigation was completed in January 2013 and a Final Remedial Action Completion Plan was submitted in July 2013 to US EPA Region 10.

Investigation and removal of 100 percent of the detected subsurface metallic anomalies in the intertidal zone between mean higher high water and mean lower low water field work was completed in September 2014. Currently a draft Remedial Action Completion Plan is scheduled to be submitted to US EPA Region 10.

Implementation of land use controls consisting of an education awareness program, an excavation and dig permitting program, discarded military munitions reporting and response procedures, and land use control monitoring and reporting EPA Region 10 started with dispute resolution on the land use management plan in March 2013. The first report is currently being reviewed by US EPA the winter of 2014 after the completion of the Removal Action associated with the Intertidal. The land use restriction were in place prior to the record of decision but the dispute was on when they restriction can be removed.

5. Are you aware of any violations of the institutional controls requirements at any of the sites within OU 1 or at OU 3T-JPHC that could impact the protectiveness of this component of the remedies (e.g., unauthorized excavation, unauthorized use of groundwater)?

Response: No Violations have occurred for OU 1 or OU3T-JPHC that could impact the protectiveness of this component of the remedies.

6. To the best of your knowledge, are regular inspections of the institutional controls remedy components for OU 1 and OU 3T-JPHC being conducted and documented?

   Response: Yes regular inspection of institutional controls remedy components for OU1 and OU3T are being conducted and documented.

7. To the best of your knowledge, has the on-going environmental monitoring performed at OU 1, since July 2009 been sufficiently thorough and frequent to meet the goals of the ROD? Have the monitoring data been timely and of acceptable quality?

   Response: Yes to the best of my knowledge the on-going environmental monitoring performed at OU 1, since July 2009 has been sufficiently thorough and frequent to meet the goals of the ROD.

   Yes to the best of my knowledge the monitoring data been timely and of acceptable quality.

8. Do you know of any significant operation and maintenance difficulties with the shoreline stabilization components of the OU 1 remedy that could have impacted the protectiveness of this component of the remedy?

   Response: No significant operation and maintenance difficulties exist with the shoreline stabilization components of the OU 1 remedy that could have impacted the protectiveness of this component of the remedy.

9. Are you aware of any community concerns regarding implementation of the remedies at OU 1 and OU 3T-JPHC? If so, please give details.

   Response: No community concerns regarding implementation of the remedies at OU 1 and OU 3T-JPHC. The Suquamish Tribe has expressed concerns that the remedy is taking more time than they believe necessary and is preventing them from exercising their ability to shellfish harvest in Ostrich bay.

10. Do you have any overall comments, concerns, or suggestions regarding the effectiveness of the remedies in protecting human health and the environment at Jackson Park Housing Complex?

    Response: I have no overall concerns, or suggestions regarding the effectiveness of the remedies in protecting human health and the environment at Jackson Park Housing. The remedies need to be in place to ensure that human health and the environment remain protective including shellfish harvest restrictions for OU1 until cancer risk to Human health criteria are met for the remaining chemicals being monitored for OU1.

INTERVIEW RECORD FOR THIRD FIVE-YEAR REVIEW
July 2009 through June 2014
Type 1 Interview – Navy Personnel
Jackson Park Housing Complex/Naval Hospital Bremerton
Bremerton, Washington

Individual Contacted:	David Liu, P.E.
Title:	Remedial Project Manager
Organization:	NAVFAC NW
Telephone:	360-396-0944
E-mail:	david.liu2@navy.mil
Address:	1101 Tautog Circle, Silverdale, WA 98315

Contact made by:	Nicole Rangel, URS
Response type:	Written, by e-mail
Date:	June 16, 2014

Summary of Communication

You are not obligated to answer every question. If you are not familiar with the topic of a particular question, or have no information or opinion to offer, please indicate "none" after "response."

1. Please describe your degree of familiarity with the Jackson Park Housing Complex/Naval Hospital Bremerton, the Records of Decision (ROD) for OU 1, the implementation of the remedies at this OU, and the monitoring and maintenance that has taken place since implementation of the remedies. Please also describe your involvement since June 2009.

   Response: I have been the remedial project manager for OU 1 since July 2013. I am familiar with the RODs for OU 1, the implementation of the remedies, and the monitoring and maintenance that has taken place.

2. What is your overall impression of the on-going effectiveness of the components of the OU 1 remedy for the four sites that comprise OU 1? For reference, the remedy components included:

   - Covering of surface soils with concentrations above remedial goals in non-residential areas;
   - Excavation of surface soils in backyards where concentrations exceeded remedial goals;
   - Excavation of petroleum-impacted soils where concentrations were above remedial goals and the impacted soil was above the seasonal high-water table in the benzene release area;

- Shoreline stabilization measures;
- Removal of old pilings at Elwood Point
- Long-term monitoring (groundwater, seeps, shellfish)
- Institutional controls/ Land use restrictions

Response: All remedy components have been effective.

3. Are you aware of any violations of the institutional controls requirements at any of the sites within OU 1 that could impact the protectiveness of this component of the remedies (e.g., unauthorized excavation, unauthorized use of groundwater)?

   Response: I am not aware of any violations of the institutional controls requirements within OU 1.

4. To the best of your knowledge, are regular inspections of the institutional controls remedy components for OU 1 being conducted and documented?

   Response: Yes. The Navy conducts quarterly, semi-annual, and annual inspection of institutional controls remedy components in accordance with the OU 1 Inspection and Maintenance Plan. The inspections and maintenance are documented in quarterly reports and in the annual report.

5. To the best of your knowledge, has the on-going environmental monitoring performed at OU 1 since June 2009 been sufficiently thorough and frequent to meet the goals of the ROD? Have the monitoring data been timely and of acceptable quality?

   Response: With the exception of the marine tissue monitoring, the on-going environmental monitoring performed at OU 1 has been sufficiently thorough and frequent to meet the goals of the ROD. The monitoring was performed in accordance with approved work plans. Marine tissue monitoring is supposed to be performed every two years. The Navy missed the 2011 sampling round due to a lack of consensus on the analyte list with the stakeholders. The Navy worked with the stakeholders to reach consensus for sampling in 2014.

   With the exception of ordnance compounds in marine tissue, the data have been timely and of acceptable quality. New analytical methods developed for analysis of ordnance compounds in marine tissue for the OU 2 ecological risk assessment will be used at OU 1 to improve data quality.

6. Do you know of any significant operation and maintenance difficulties with the shoreline stabilization components of the OU 1 remedy that could have impacted the protectiveness of this component of the remedy?

Response: No. However, smaller rocks have a tendency to be moved to the beach by site visitors causing our contractor to have to spend extra time replacing the rocks.

7. What is your overall impression of progress to a revised remedy in the benzene release area?

   Response: The ROD amendment for the revised remedy was signed in September 2013. The remedial design has been accepted by EPA. Remedial action will begin in 2015.

8. Are you aware of any community concerns regarding implementation of the remedy at OU 1? If so, please give details.

   Response: No.

9. Do you have any overall comments, concerns, or suggestions regarding the effectiveness of the remedies in protecting human health and the environment at Jackson Park Housing Complex?

   Response: No.

INTERVIEW RECORD FOR THIRD FIVE-YEAR REVIEW
July 2009 through June 2014
Type 1 Interview – Navy Personnel
Jackson Park Housing Complex/Naval Hospital Bremerton
Bremerton, Washington

Individual Contacted:	Robert Mitchell
Title:	Environmental Manager
Organization:	Naval Hospital Bremerton
Telephone:	(360)475-4710
E-mail:	Robert.mitchell2@med.navy.mil
Address:	Code 09PWE Naval Hospital Bremerton 1 Boone Road Bremerton, WA 98312
Contact made by:	Nicole Rangel
Response type:	e-mail
Date:	September 3, 2014

Summary of Communication

If you are not familiar with the topic of a particular question, or have no information or opinion to offer, please indicate "none" after "response."

1. Please describe your degree of familiarity with the Jackson Park Housing Complex/Naval Hospital Bremerton, the Records of Decision (RODs) for OU 1 and OU 3T-JPHC, the OU 1 ROD amendment, the implementation of the remedies at these two OUs, and the monitoring and maintenance that has taken place since implementation of the remedies. Please also describe your involvement since July 2009.

   Response: No longer involved in this since CNIC land transfer. I do still received communication but no action items.

2. What is your overall impression of the on-going effectiveness of the components of the OU 1 remedy? For reference, the remedy components included:

   - Covering of surface soils with concentrations above remedial goals in non-residential areas;
   - Excavation of surface soils in backyards where concentrations exceeded remedial goals;
   - Excavation of petroleum-impacted soils where concentrations were above remedial goals and the impacted soil was above the seasonal high-water table in the benzene release area;
   - Shoreline stabilization measures;
   - Removal of old pilings at Elwood Point

- Long-term monitoring (groundwater, seeps, shellfish)
- Institutional controls/land use restrictions

Response: No longer involved in this since CNIC land transfer. I do still received communication but no action items.

3. What is your overall impression of progress toward implementing the revised remedy in the benzene release area of OU 1? For reference, the remedy components included:

- Active treatment of source area subsurface soil and groundwater using electrical resistance heating with dual phase extraction
- Active treatment in the near-shore area using in situ chemical oxidation to treat contaminated groundwater migrating toward Ostrich Bay
- Long-term monitoring (groundwater and seeps)

Response: No longer involved in this since CNIC land transfer. I do still received communication but no action items.

4. What is your overall impression of progress toward implementing the components of the OU 3T-JPHC remedy? For reference, the remedy components included:

- Investigation and removal of 100 percent of the detected subsurface metallic anomalies in the three upland grids where discarded military munitions were found during the remedial investigation
- Investigation and removal of 100 percent of the detected subsurface metallic anomalies in the intertidal zone between mean higher high water and mean lower low water
- Implementation of land use controls consisting of an education awareness program, an excavation and dig permitting program, discarded military munitions reporting and response procedures, and land use control monitoring and reporting

Response: No longer involved in this since CNIC land transfer. I do still received communication but no action items.

5. Are you aware of any violations of the institutional controls requirements at any of the sites within OU 1 or at OU 3T-JPHC that could impact the protectiveness of this component of the remedies (e.g., unauthorized excavation, unauthorized use of groundwater)?

Response: No longer involved in this since CNIC land transfer. I do still received communication but no action items.

6. To the best of your knowledge, are regular inspections of the institutional controls remedy components for OU 1 and OU 3T-JPHC being conducted and documented?

Response: No longer involved in this since CNIC land transfer. I do still received communication but no action items.

7. To the best of your knowledge, has the on-going environmental monitoring performed at OU 1, since July 2009 been sufficiently thorough and frequent to meet the goals of the ROD? Have the monitoring data been timely and of acceptable quality?

   Response: No longer involved in this since CNIC land transfer. I do still received communication but no action items.

8. Do you know of any significant operation and maintenance difficulties with the shoreline stabilization components of the OU 1 remedy that could have impacted the protectiveness of this component of the remedy?

   Response: No longer involved in this since CNIC land transfer. I do still received communication but no action items.

9. Are you aware of any community concerns regarding implementation of the remedies at OU 1 and OU 3T-JPHC? If so, please give details.

   Response: No longer involved in this since CNIC land transfer. I do still received communication but no action items.

10. Do you have any overall comments, concerns, or suggestions regarding the effectiveness of the remedies in protecting human health and the environment at Jackson Park Housing Complex?

    Response: No longer involved in this since CNIC land transfer. I do still received communication but no action items.

INTERVIEW RECORD FOR THIRD FIVE-YEAR REVIEW
July 2009 through June 2014
Type 1 Interview – Navy Personnel
Jackson Park Housing Complex/Naval Hospital Bremerton
Bremerton, Washington

Individual Contacted:	Leslie Yuenger
Title:	Public Affairs Officer
Organization:	NAVFAC NW
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E-mail:	leslie.yuenger@navy.mil
Address:	NAVFAC NW 1101 Tautog Circle, Room 203 Silverdale, WA 98315
Contact made by:	Nicole Rangel
Response type:	e-mail
Date:	September 3rd, 2014

Summary of Communication

If you are not familiar with the topic of a particular question, or have no information or opinion to offer, please indicate "none" after "response."

1. Please describe your degree of familiarity with the Jackson Park Housing Complex/Naval Hospital Bremerton, the Records of Decision (RODs) for OU 1 and OU 3T-JPHC, the OU 1 ROD amendment, the implementation of the remedies at these two OUs, and the monitoring and maintenance that has taken place since implementation of the remedies. Please also describe your involvement since July 2009.

   Response: I am extremely familiar with this remediation project as I have reviewed nearly all external communications regarding it.

2. What is your overall impression of the on-going effectiveness of the components of the OU 1 remedy? For reference, the remedy components included:

   - Covering of surface soils with concentrations above remedial goals in non-residential areas;
   - Excavation of surface soils in backyards where concentrations exceeded remedial goals;
   - Excavation of petroleum-impacted soils where concentrations were above remedial goals and the impacted soil was above the seasonal high-water table in the benzene release area;
   - Shoreline stabilization measures;
   - Removal of old pilings at Elwood Point

- Long-term monitoring (groundwater, seeps, shellfish)
- Institutional controls/land use restrictions

Response: My overall impression of the on-going effectiveness is one of high confidence. Using remediation and or institutional controls where appropriate goes a long way in reassuring our active duty members, their families, our local community, and the general public that the US Navy is serious when it comes to protecting them from harm.

3. What is your overall impression of progress toward implementing the revised remedy in the benzene release area of OU 1? For reference, the remedy components included:

- Active treatment of source area subsurface soil and groundwater using electrical resistance heating with dual phase extraction
- Active treatment in the near-shore area using in situ chemical oxidation to treat contaminated groundwater migrating toward Ostrich Bay
- Long-term monitoring (groundwater and seeps)

Response: Revising a treatment method to better control/remediate an area of continued concern is absolutely the right thing to do. It continues to demonstrate to our public that if one method fails to meet the requirement, we are more than willing to revise/regroup and *move forward again to keeping them safe from harm.*

4. What is your overall impression of progress toward implementing the components of the OU 3T-JPHC remedy? For reference, the remedy components included:

- Investigation and removal of 100 percent of the detected subsurface metallic anomalies in the three upland grids where discarded military munitions were found during the remedial investigation
- Investigation and removal of 100 percent of the detected subsurface metallic anomalies in the intertidal zone between mean higher high water and mean lower low water
- Implementation of land use controls consisting of an education awareness program, an excavation and dig permitting program, discarded military munitions reporting and response procedures, and land use control monitoring and reporting

Response: I'm very pleased with the progress in this location. While not a technical expert, 100% investigation and removal, as a parent I know that it was the right thing to do. As this site is within a housing area, kids and dogs can dig anywhere.

5. Are you aware of any violations of the institutional controls requirements at any of the sites within OU 1 or at OU 3T-JPHC that could impact the protectiveness of this component of the remedies (e.g., unauthorized excavation, unauthorized use of groundwater)?

   Response: No

6. To the best of your knowledge, are regular inspections of the institutional controls remedy components for OU 1 and OU 3T-JPHC being conducted and documented?

   Response: Yes. I receive updates as they occur, looking for opportunities to inform the public of our 'good-news' stories.

7. To the best of your knowledge, has the on-going environmental monitoring performed at OU 1, since July 2009 been sufficiently thorough and frequent to meet the goals of the ROD? Have the monitoring data been timely and of acceptable quality?

   Response: I believe so. Yes.

8. Do you know of any significant operation and maintenance difficulties with the shoreline stabilization components of the OU 1 remedy that could have impacted the protectiveness of this component of the remedy?

   Response: No.

9. Are you aware of any community concerns regarding implementation of the remedies at OU 1 and OU 3T-JPHC? If so, please give details.

   Response: None. I have only received one phone call from a concerned citizen who was looking for a copy of the 'we investigated your property and not found anything of significance.' It has been quite a while since the media has called for an update.

10. Do you have any overall comments, concerns, or suggestions regarding the effectiveness of the remedies in protecting human health and the environment at Jackson Park Housing Complex?

    Response: Now that the JPMHC is now included in the Public-Private Venture with Forest City, we must ensure that we are properly coordinating with them when information is to be released to the public.

INTERVIEW RECORD FOR THIRD FIVE-YEAR REVIEW
July 2009 through June 2014
Type 2 Interview – Regulatory Agency
Jackson Park Housing Complex/Naval Hospital Bremerton
Bremerton, Washington

Individual Contacted: Harry Craig
Title: Senior Remedial Project Manager
Organization: USEPA, Region 10
Telephone: (503)326-3689
E-mail: craig.harry@epa.gov
Address: Oregon Operations Office
805 SW Broadway, Suite 500
Portland, Oregon 97205

Contact made by: Nicole Rangel
Response type: e-mail
Date: September 3, 2014

Summary of Communication

If you are not familiar with the topic of a particular question, or have no information or opinion to offer, please indicate "none" after "response."

1. Please describe your degree of familiarity with the Jackson Park Housing Complex/Naval Hospital Bremerton, the Records of Decision (RODs) for OU 1 and OU 3T-JPHC, the OU 1 ROD amendment, the implementation of the remedies at these two OUs, and the monitoring and maintenance that has taken place since implementation of the remedies. Please also describe your involvement since July 2009.

   Response:

   I am EPA's Remedial Project Manager for all Operable Units at Jackson Park since 2003 under the Federal Facilities Agreement (FFA). I am familiar with the OU-1 ROD, OU-1 ROD Amendment, OU-3T-JPHC ROD, and OU-3T-NHB ROD.

2. What is your overall impression of the on-going effectiveness of the components of the OU 1 remedy? For reference, the remedy components included:

   - Covering of surface soils with concentrations above remedial goals in non-residential areas;
   - Excavation of surface soils in backyards where concentrations exceeded remedial goals;

- Excavation of petroleum-impacted soils where concentrations were above remedial goals and the impacted soil was above the seasonal high-water table in the benzene release area;
- Shoreline stabilization measures;
- Removal of old pilings at Elwood Point
- Long-term monitoring (groundwater, seeps, shellfish)
- Institutional controls/land use restrictions

Response:

The following issues have been generally effective as implemented - The 1st, 2nd, 4th, 5th, and 7th bullets.

3rd bullet - It is unclear what is being referred to in this bullet. The ROD Amendment for OU-1 has been signed, but Remedial Action start for in-situ thermal treatment of source area vadose zone soils and saturated groundwater has not started.

6th bullet – The shellfish sampling program has not been consistent with the OU-1 ROD, which required monitoring shellfish at two year intervals post-ROD. The last tissue sampling event was in 2009, and had data quality issues related to analysis of ordnance compounds, particularly dinitroluene isomers (2,4-DNT and 2,6-DNT).

Seep monitoring was generally ineffective as representative of groundwater in the Benzene Release Area, and was substituted by groundwater monitoring well point-of-compliance sampling in the OU-1 ROD Amendment.

3. What is your overall impression of progress toward implementing the revised remedy in the benzene release area of OU 1? For reference, the remedy components included:

- Active treatment of source area subsurface soil and groundwater using electrical resistance heating with dual phase extraction
- Active treatment in the near-shore area using in situ chemical oxidation to treat contaminated groundwater migrating toward Ostrich Bay
- Long-term monitoring (groundwater and seeps)

Response:

The OU-1 ROD Amendment has been signed, but the remedy components in the bullets above have not been implemented. There remain data gaps in site characterization to implement the full scale remedy at this site that are being addressed in the Data Gaps Investigation Report.

4. What is your overall impression of progress toward implementing the components of the OU 3T-JPHC remedy? For reference, the remedy components included:

   - Investigation and removal of 100 percent of the detected subsurface metallic anomalies in the three upland grids where discarded military munitions were found during the remedial investigation
   - Investigation and removal of 100 percent of the detected subsurface metallic anomalies in the intertidal zone between mean higher high water and mean lower low water
   - Implementation of land use controls consisting of an education awareness program, an excavation and dig permitting program, discarded military munitions reporting and response procedures, and land use control monitoring and reporting

   Response:

   Generally these three bullet items listed above have been implemented. The Remedial Action Closure Report for OU-3T-JPHC has not been completed.

5. Do you feel well informed about the OU 1 and OU 3T-JPHC remediation activities and progress at Jackson Park Housing Complex/Naval Hospital Bremerton? Please elaborate.

   Response:

   Yes

6. To the best of your knowledge, since July 2009, have there been any new scientific findings that relate to potential site risks and that might call into question the protectiveness of the OU 1 remedy or the OU 3T-JPHC remedy?

   Response:

   No – The OU-1 ROD Amendment included the use of the benzene Maximum Contaminant Level (MCL) as the basis for groundwater remediation criteria. The use of MCLs as ARARs for groundwater criteria is considered protective.

7. What is your overall impression of the on-going effectiveness of the institutional controls components of the OU 1 remedy and the OU 3T-JPHC remedy?

   Response:

   To date the IC components for OU-1 and OU-3T-JPHC appear to be effective. The FYR will need to evaluate the reasonable anticipated future land use (RAFLU) of substantial planned demolition and construction of housing under the new lease for the Navy's Public Private Venture (PPV).

8. Since July 2009, have there been any complaints, violations, or other incidents related to Jackson Park Housing Complex/Naval Hospital Bremerton 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 the best of my knowledge.

9. To the best of your knowledge, has the on-going program of environmental monitoring at Jackson Park Housing Complex/Naval Hospital Bremerton been sufficiently thorough and frequent to meet the goals of the OU 1 ROD and/or the OU 1 ROD amendment?

   Response:

   No – Tissue sampling under the OU-1 ROD has not met frequency requirements or laboratory data quality objectives.

10. Are you aware of any community concerns regarding implementation of the OU 1 remedy or the OU 3T-JPHC remedy at Jackson Park Housing Complex/Naval Hospital Bremerton? If so, please give details.

    Response:

    The Suquamish Tribe has expressed concerns regarding the on-going groundwater discharge from the Benzene Release Area into Ostrich Bay, which is a Tribal Usual & Accustomed (U&A) gathering area.

11. Do you have any other comments, concerns, or suggestions regarding the effectiveness of the OU 1 or the OU 3T-JPHC cleanup measures implemented so far in protecting human health and the environment at Jackson Park Housing Complex/Naval Hospital Bremerton?

    Response:

    The significant planned redevelopment of the Jackson Park Housing Complex by the Navy's PPV housing contractor (the four-year, $65 million plan entails demolishing 268 units, building 26 new ones, renovating 353 and keeping 245 intact for a total of 624 homes) may present challenges in the future to ensure that the UXO Construction Support Land Use Control (LUC) component of the OU-3T-JPHC remedy are implemented.

The revised groundwater remedy in the OU-1 ROD Amendment will need to be evaluated for effectiveness. If the remedy does not meet groundwater MCL criteria for benzene after 2 years of operation, a contingency remedy will be triggered under the OU-1 ROD Amendment.

INTERVIEW RECORD FOR THIRD FIVE-YEAR REVIEW
July 2009 through June 2014
Type 2 Interview – Regulatory Agency
Jackson Park Housing Complex/Naval Hospital Bremerton
Bremerton, Washington

Individual Contacted:	Chris Maurer
Title:	Toxics Cleanup Program
Organization:	Washington Department of Ecology
Telephone:	(360)407-7223
E-mail:	cmau461@ecy.wa.gov
Address:	300 Desmond Drive SE Lacey, WA 98503
Contact made by:	Nicole Rangel
Response type:	e-mail
Date:	September 3, 2014

Summary of Communication

If you are not familiar with the topic of a particular question, or have no information or opinion to offer, please indicate "none" after "response."

12. Please describe your degree of familiarity with the Jackson Park Housing Complex/Naval Hospital Bremerton, the Records of Decision (RODs) for OU 1 and OU 3T-JPHC, the OU 1 ROD amendment, the implementation of the remedies at these two OUs, and the monitoring and maintenance that has taken place since implementation of the remedies. Please also describe your involvement since July 2009.

    Response: I was the Ecology project manager for the site in the late 1990s and early 2000s. I have not worked on the site since 2007.

13. What is your overall impression of the on-going effectiveness of the components of the OU 1 remedy? For reference, the remedy components included:

    - Covering of surface soils with concentrations above remedial goals in non-residential areas;
    - Excavation of surface soils in backyards where concentrations exceeded remedial goals;
    - Excavation of petroleum-impacted soils where concentrations were above remedial goals and the impacted soil was above the seasonal high-water table in the benzene release area;
    - Shoreline stabilization measures;
    - Removal of old pilings at Elwood Point

- Long-term monitoring (groundwater, seeps, shellfish)
- Institutional controls/land use restrictions

Response: None

14. What is your overall impression of progress toward implementing the revised remedy in the benzene release area of OU 1? For reference, the remedy components included:

- Active treatment of source area subsurface soil and groundwater using electrical resistance heating with dual phase extraction
- Active treatment in the near-shore area using in situ chemical oxidation to treat contaminated groundwater migrating toward Ostrich Bay
- Long-term monitoring (groundwater and seeps)

Response: None

15. What is your overall impression of progress toward implementing the components of the OU 3T-JPHC remedy? For reference, the remedy components included:

- Investigation and removal of 100 percent of the detected subsurface metallic anomalies in the three upland grids where discarded military munitions were found during the remedial investigation
- Investigation and removal of 100 percent of the detected subsurface metallic anomalies in the intertidal zone between mean higher high water and mean lower low water
- Implementation of land use controls consisting of an education awareness program, an excavation and dig permitting program, discarded military munitions reporting and response procedures, and land use control monitoring and reporting

Response: None

16. Do you feel well informed about the OU 1 and OU 3T-JPHC remediation activities and progress at Jackson Park Housing Complex/Naval Hospital Bremerton? Please elaborate.

Response: None

17. To the best of your knowledge, since July 2009, have there been any new scientific findings that relate to potential site risks and that might call into question the protectiveness of the OU 1 remedy or the OU 3T-JPHC remedy?

Response: None

18. What is your overall impression of the on-going effectiveness of the institutional controls components of the OU 1 remedy and the OU 3T-JPHC remedy?

    Response: None

19. Since July 2009, have there been any complaints, violations, or other incidents related to Jackson Park Housing Complex/Naval Hospital Bremerton installation restoration issues that required a response by your office? If so, please provide details of the events and results of the responses.

    Response: None

20. To the best of your knowledge, has the on-going program of environmental monitoring at Jackson Park Housing Complex/Naval Hospital Bremerton been sufficiently thorough and frequent to meet the goals of the OU 1 ROD and/or the OU 1 ROD amendment?

    Response: None

21. Are you aware of any community concerns regarding implementation of the OU 1 remedy or the OU 3T-JPHC remedy at Jackson Park Housing Complex/Naval Hospital Bremerton? If so, please give details.

    Response: None

22. Do you have any other comments, concerns, or suggestions regarding the effectiveness of the OU 1 or the OU 3T-JPHC cleanup measures implemented so far in protecting human health and the environment at Jackson Park Housing Complex/Naval Hospital Bremerton?

    Response: None

INTERVIEW RECORD FOR THIRD FIVE-YEAR REVIEW
July 2009 through June 2014
Type 2 Interview – Regulatory Agency
Jackson Park Housing Complex/Naval Hospital Bremerton
Bremerton, Washington

Individual Contacted:	Erika Shaffer
Title:	Supervisor
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Telephone:	(360)902-1086
E-mail:	erika.shaffer@dnr.wa.gov
Address:	Sediment Quality Unit 111 Washington St SE PO Box 47027 Olympia, WA 98504-7027
Contact made by:	Nicole Rangel
Response type:	e-mail
Date:	September 3, 2014

Summary of Communication

If you are not familiar with the topic of a particular question, or have no information or opinion to offer, please indicate "none" after "response."

1. Please describe your degree of familiarity with the Jackson Park Housing Complex/Naval Hospital Bremerton, the Records of Decision (RODs) for OU 1 and OU 3T-JPHC, the OU 1 ROD amendment, the implementation of the remedies at these two OUs, and the monitoring and maintenance that has taken place since implementation of the remedies. Please also describe your involvement since July 2009.

   Response: I have been managing the site for DNR, a stakeholder in the cleanup, since the beginning of 2014. My primary interaction with these two OUs has been review of the tissue sampling and regular updates on project progress, primarily associated with OU3T as well as the LTM tissue sampling for OU1

2. What is your overall impression of the on-going effectiveness of the components of the OU 1 remedy? For reference, the remedy components included:

   - Covering of surface soils with concentrations above remedial goals in non-residential areas;
   - Excavation of surface soils in backyards where concentrations exceeded remedial goals;

- Excavation of petroleum-impacted soils where concentrations were above remedial goals and the impacted soil was above the seasonal high-water table in the benzene release area;
- Shoreline stabilization measures;
- Removal of old pilings at Elwood Point
- Long-term monitoring (groundwater, seeps, shellfish)
- Institutional controls/land use restrictions

Response: Not familiar with most of these activities. Shellfish tissue monitoring results are still in progress. Uncertain as to overall effectiveness; shellfish tissue results will be key to evaluating effectiveness in restoring unrestricted use.

3. What is your overall impression of progress toward implementing the revised remedy in the benzene release area of OU 1? For reference, the remedy components included:

- Active treatment of source area subsurface soil and groundwater using electrical resistance heating with dual phase extraction
- Active treatment in the near-shore area using in situ chemical oxidation to treat contaminated groundwater migrating toward Ostrich Bay
- Long-term monitoring (groundwater and seeps)

Response: Not as familiar with these remedies. I understand that there is a revised remedy that has been finalized and look forward to seeing how the implementation progresses.

4. What is your overall impression of progress toward implementing the components of the OU 3T-JPHC remedy? For reference, the remedy components included:

- Investigation and removal of 100 percent of the detected subsurface metallic anomalies in the three upland grids where discarded military munitions were found during the remedial investigation
- Investigation and removal of 100 percent of the detected subsurface metallic anomalies in the intertidal zone between mean higher high water and mean lower low water
- Implementation of land use controls consisting of an education awareness program, an excavation and dig permitting program, discarded military munitions reporting and response procedures, and land use control monitoring and reporting

Response: It is my impression that positive progress is being made in these areas in a timely fashion.

5. Do you feel well informed about the OU 1 and OU 3T-JPHC remediation activities and progress at Jackson Park Housing Complex/Naval Hospital Bremerton? Please elaborate.

   Response: OU3T-yes, regular update meetings have been useful. OU1-I have not been as heavily involved in this OU1 since coming on to the project in early 2014

6. To the best of your knowledge, since July 2009, have there been any new scientific findings that relate to potential site risks and that might call into question the protectiveness of the OU 1 remedy or the OU 3T-JPHC remedy?

   Response: Not to my knowledge

7. What is your overall impression of the on-going effectiveness of the institutional controls components of the OU 1 remedy and the OU 3T-JPHC remedy?

   Response: Though institutional controls are currently in place to protect human health, DNR supports remedy decisions that will allow unrestricted use of aquatic lands in the future.

8. Since July 2009, have there been any complaints, violations, or other incidents related to Jackson Park Housing Complex/Naval Hospital Bremerton 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

9. To the best of your knowledge, has the on-going program of environmental monitoring at Jackson Park Housing Complex/Naval Hospital Bremerton been sufficiently thorough and frequent to meet the goals of the OU 1 ROD and/or the OU 1 ROD amendment?

   Response: To my knowledge, yes, with the exception of shellfish tissue monitoring, which has had some delays.

10. Are you aware of any community concerns regarding implementation of the OU 1 remedy or the OU 3T-JPHC remedy at Jackson Park Housing Complex/Naval Hospital Bremerton? If so, please give details.

    Response: Not to my knowledge

11. Do you have any other comments, concerns, or suggestions regarding the effectiveness of the OU 1 or the OU 3T-JPHC cleanup measures implemented so far in protecting human health and the environment at Jackson Park Housing Complex/Naval Hospital Bremerton?

Response: N/A. DNR will submit further comments upon review of the drafter 3rd 5 Year Review.

INTERVIEW RECORD FOR THIRD FIVE-YEAR REVIEW
July 2009 through June 2014
Type 3 Interview – Tribal Stakeholder
Jackson Park Housing Complex/Naval Hospital Bremerton
Bremerton, Washington

Individual Contacted: Denice Taylor
Title: Environmental Scientist
Organization: Suquamish Tribe
Telephone: (360)394-8449
E-mail: dtaylor@suquamish.nsn.us
Address: PO Box 498
18490 Suquamish Way
Suquamish, WA 98392
Contact made by: Nicole Rangel
Response type: e-mail
Date: October 13, 2014

Summary of Communication

If you are not familiar with the topic of a particular question, or have no information or opinion to offer, please indicate "none" after "response."

1. Please describe your degree of familiarity with the Jackson Park Housing Complex/Naval Hospital Bremerton, the Records of Decision (RODs) for OU 1 and OU 3T-JPHC, the OU 1 ROD amendment, the implementation of the remedies at these two OUs, and the monitoring and maintenance that has taken place since implementation of the remedies. Please also describe your involvement since July 2009.

   Response:

   I have been the Suquamish Tribe's project manager for the JPHC sites since October 2002. I am familiar with the RODs for both OU 1 and OU 3T, the OU 1 ROD amendment, the implementation of the remedies and the monitoring and maintenance that has taken place since the implementation of the remedies.

2. What is your overall impression of the on-going effectiveness of the components of the OU 1 remedy? For reference, the remedy components included:

   - Covering of surface soils with concentrations above remedial goals in non-residential areas;
   - Excavation of surface soils in backyards where concentrations exceeded remedial goals;

- Excavation of petroleum-impacted soils where concentrations were above remedial goals and the impacted soil was above the seasonal high-water table in the benzene release area;
- Shoreline stabilization measures;
- Removal of old pilings at Elwood Point
- Long-term monitoring (groundwater, seeps, shellfish)
- Institutional controls/land use restrictions

Response:

The OU 1 remedial actions that have been implemented and are functioning as intended by the ROD include the covering and excavation of contaminated soils, shoreline stabilization measures, and the removal of pilings. Other remedy components, including the excavation of petroleum-impacted soils in the benzene release area, long-term monitoring and institutional controls/land use restrictions have either not been effective in addressing contamination or in achieving the Tribe's long-term goal of unrestricted use, including shellfish harvest. The continued restriction on harvest is not considered to be protective of treaty-reserved rights or resources.

The OU 1 RAO of reducing risks from subsistence-level ingestion to less than 1×10^{-5} excess carcinogenic risk, or less than a noncarcinogenic hazard index of 1 has not been achieved. The Navy has failed to address the ROD requirement to implement a shellfish sampling program that adequately addresses potential health risks to tribal members or evaluates the need to continue shellfish harvest restrictions.

3. What is your overall impression of progress toward implementing the revised remedy in the benzene release area of OU 1? For reference, the remedy components included:

- Active treatment of source area subsurface soil and groundwater using electrical resistance heating with dual phase extraction
- Active treatment in the near-shore area using in situ chemical oxidation to treat contaminated groundwater migrating toward Ostrich Bay
- Long-term monitoring (groundwater and seeps)

Response:

This action is long overdue. Prior to the First Five Year Review in 2005, the Navy was aware that the Oxygen Releasing Compound (ORC) remedy implemented for the Benzene Release Area was not effective in achieving compliance levels. The Navy was also aware that the groundwater monitoring network was inadequate to determine the extent of contamination present at the site. While the Navy has taken steps to further delineate the *groundwater regime at the site and to remove free product, the continuous plume of contamination from the NEX gas station to Ostrich Bay remains an uncontrolled source of chemical contamination.*

The Navy recently signed a ROD amendment to address the ongoing contamination. The design of the revised remedy has been finalized and the Navy is currently developing a plan to investigate known data gaps prior to implementation. The Tribe will assess the effectiveness of the remedy once it has been implemented and monitored.

4. What is your overall impression of progress toward implementing the components of the OU 3T-JPHC remedy? For reference, the remedy components included:

   - Investigation and removal of 100 percent of the detected subsurface metallic anomalies in the three upland grids where discarded military munitions were found during the remedial investigation
   - Investigation and removal of 100 percent of the detected subsurface metallic anomalies in the intertidal zone between mean higher high water and mean lower low water
   - Implementation of land use controls consisting of an education awareness program, an excavation and dig permitting program, discarded military munitions reporting and response procedures, and land use control monitoring and reporting

   Response:

   The Navy has implemented the OU 3T remedial action of investigating and removing metallic anomalies in the 3 upland grids and in the majority of the intertidal zone as intended by the ROD. The Tribe believes, however, that if technical questions regarding the no find rate in the northern intertidal grids had been addressed in a timely manner, the process would have been more efficient and would have resulted in less overall disturbance of intertidal habitats.

5. Do you feel well informed about the OU 1 and OU 3T-JPHC remediation activities and progress at Jackson Park Housing Complex/Naval Hospital Bremerton? Please elaborate.

   Response:

   In general, I am well informed about the OU 1 and OU 3T remedial activities and actively participate on both project teams. However, because the Tribe is not a signatory to the FFA for the sites, when there is a dispute action between the Navy and EPA, the Tribe is not party to the discussions and cannot meaningfully participate in site management decisions reached through the dispute process.

6. What effects have on-going OU 1 and OU 3T-JPHC remedy implementation had on the Tribe and the surrounding community?

   Response:

   This area is a significant natural and cultural resource for the Suquamish Tribe, whose contact and connection to the area predates European contact and the Navy's occupation. The site is within the exclusive usual and accustomed fishing area (U&A) of the Suquamish Tribe. By treaty, the Tribe has reserved fishing access rights and rights to harvest natural resources. The presence of contamination in this area detrimentally impacts these reserved rights and diminishes the Tribe's ability to safely gather and consume fish and shellfish.

7. Are you aware of any Tribal or other community concerns regarding the Tribal archaeological site at Elwood Point? If so, please give details.

   Response:

   The Navy is required to consult with the Suquamish Tribe when implementing any federal undertakings which may impact cultural resources, including the Elwood Point area. The Tribe participates in these consultations on a case-by-case basis and will recommend actions to protect and avoid impacts to cultural resources.

8. Are you aware of any Tribal or other community concerns regarding the restrictions on shellfish harvesting? If so, please give details.

   Response:

   See responses to Questions 1 and 6.

9. Are you aware of any other Tribal or other community concerns regarding implementation of the OU 1 remedy or the OU 3T-JPHC remedy? If so, please give details.

   Response:

   See preceding responses.

   The Tribe believes that the ultimate objective for the site is unrestricted use of Ostrich Bay, including intertidal areas and shellfish resources. Monitoring of marine tissues is necessary to evaluate site-related risks and will be used by WA DOH and the Tribe to determine the need for shellfish harvest restrictions.

   The Navy's current long-term monitoring approach does not adequately address the OU 1 RAO of reducing risks from subsistence-level ingestion to less than 1×10^{-5} excess carcinogenic risk, or less than a noncarcinogenic hazard index of 1. The Tribe has repeatedly requested that the long-term monitoring approach be revised to expand analytical parameters for tissue data and to address the question of continuing the shellfish harvest restriction.

   Based on project team agreements that this Five Year Review would re-evaluate long-term monitoring objectives, as well as data gaps and the potential need to expand sample analyses; that the 2014 data would be used to assess risks to subsistence harvesters based on Suquamish exposure scenarios and EPA regional guidance; and that the Tribe would be actively involved in the development and review of the risk assessment, the Tribe agreed that the analyte list for the 2014 tissue sampling would consist of speciated arsenic and ordnance compounds. The Navy collected and analyzed tissue samples in 2014 based on these agreements.

   However, in the initial meeting regarding this Five Year Review, the Navy announced that the 2014 data will not be included in the report. The Tribe does not believe this decision is consistent with DoD policy regarding consultation nor does it honor the good faith agreements reached by the project team.

This is the third Five Year Review since the completion of the OU 1 remedial action. After 15 years, the Tribe does not believe that the Navy has adequate data to determine if there is a need to continue shellfish harvest restrictions, or to evaluate the long-term protectiveness of the implemented remedies.

10. Do you have any other comments, concerns, or suggestions regarding the effectiveness of the cleanup measures implemented so far in protecting human health and the environment at Jackson Park Housing Complex/Naval Hospital Bremerton?

    Response:

    See preceding responses.

    The Tribe expects to submit additional comments when the Navy completes the draft report for review.

APPENDIX G

Agency Comments and Responses to Comments

Rodenhizer, Debbie

From: Kobeski, Raymond A CIV NAVFAC NW, OP3E31 <raymond.kobeski@navy.mil>
Sent: Thursday, April 16, 2015 3:36 PM
To: Craig, Harry
Cc: Denice Taylor; Erika. shaffer (Erika.shaffer@dnr.wa.gov); Rodenhizer, Debbie; Rohrer, Bill; Ginn, Dina R CIV NAVFAC NW, EV3; Wicklein, Mark A CIV NAVFAC NW, OP3E31
Subject: RE: EPA Extension on Review of draft Jackson Park 3rd Five Year Review
Signed By: raymond.kobeski@navy.mil

Thank you, T

The Navy will try to address your concerns at the draft final if time allows. A copy of this email will be included in the comment section of the five year review for the administrative record. . EPA could either concur or not concur with the final five year review. The Navy is asking EPA to understand the Navy as Lead Agency will be going for signature to meet the Legal driver of August 2015.

Raymond A. Kobeski
Remedial Project Manager Environmental Restoration
1101 Tautog Circle
Silverdale, Washington
98315-1101

Office: 360-396-0597
DSN: 744-0597
Fax: 360-396-0857

-----Original Message-----
From: Craig, Harry [mailto:Craig.Harry@epa.gov]
Sent: Thursday, April 16, 2015 2:17 PM
To: Kobeski, Raymond A CIV NAVFAC NW, OP3E31
Cc: Denice Taylor; Erika. shaffer (Erika.shaffer@dnr.wa.gov); Rodenhizer, Debbie; Rohrer, Bill; Ginn, Dina R CIV NAVFAC NW, EV3; Wicklein, Mark A CIV NAVFAC NW, OP3E31
Subject: RE: EPA Extension on Review of draft Jackson Park 3rd Five Year Review

Ray,

The Five Year Review is not identified as either a Primary or Secondary Document under the FFA. Section 5.7.1 of the FFA applies to review of draft documents, which EPA can provide you notification of the 20 day extension prior to the end of the original 30 day review, which we have done.

EPA is not asking for nor is required to get the Navy's concurrence on the 20 day extension. EPA's comments will be submitted to you by May 8th as I have indicated in my e-mail.

Regards,

Harry

-----Original Message-----

From: Kobeski, Raymond A CIV NAVFAC NW, OP3E31 [mailto:raymond.kobeski@navy.mil]
Sent: Wednesday, April 15, 2015 9:37 AM
To: Craig, Harry
Cc: Denice Taylor; Erika. shaffer (Erika.shaffer@dnr.wa.gov); Rodenhizer, Debbie; Rohrer, Bill; Ginn, Dina R CIV NAVFAC NW, EV3; Wicklein, Mark A CIV NAVFAC NW, OP3E31
Subject: RE: EPA Extension on Review of draft Jackson Park 3rd Five Year Review

Harry,
The Navy at this time cannot grant an extension on this secondary document. The Navy as lead agency has a Legal Driver for August 2015. Granting this extension will delay the Navy by 20 days with a final in September 21. Please provide comments as soon as possible

v/r
Raymond A. Kobeski
Remedial Project Manager Environmental Restoration
1101 Tautog Circle
Silverdale, Washington
98315-1101

Office: 360-396-0597
DSN: 744-0597
Fax: 360-396-0857

-----Original Message-----
From: Craig, Harry [mailto:Craig.Harry@epa.gov]
Sent: Tuesday, April 14, 2015 5:52 PM
To: Kobeski, Raymond A CIV NAVFAC NW, OP3E31
Cc: Denice Taylor; Erika. shaffer (Erika.shaffer@dnr.wa.gov)
Subject: EPA Extension on Review of draft Jackson Park 3rd Five Year Review

Ray,

This is to notify you that EPA will be taking a 20 day extension for review of the 3rd draft Jackson Park Five Year Review. We received the draft FYR on March 19th, so EPA will provide comments to the Navy by May 8th.

The draft FYR references the Landau Associates Inc. Phase I (May 2014) and Phase II (Sept 2013) Environmental Site Assess Reports, but the full reports are not included in the Appendix A disk. Please provide EPA a copy of the full Phase I and II Landau reports so that we can review them as background data for the FYR review.

Regards,

Harry

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND NORTHWEST
1101 TAUTOG CIRCLE
SILVERDALE, WASHINGTON 98315-1101

5090/JPHC
05ER/All OU SF 5.1
EV31RK/SER 480
01 Jun 2015

Mr. Harry Craig
U.S. EPA Region 10
Oregon Operations Office
805 SW Broadway, Suite 500
Portland, Oregon 97205

SUBJECT: REPSONSE TO EPA'S COMMENTS ON THE DRAFT THIRD FIVE YEAR REVIEW JACKSON PARK HOUSING COMPLEX, BREMERTON, WA

Dear Mr. Craig:

Thank you for reviewing the draft Third Five Year Review Document, Jackson Park Housing Complex, Bremerton, WA Report. Unfortunately the Navy is unable to conduct a meeting with the Tribe, EPA, and WA DNR on the comment responses. This change of schedule is directly related to receiving comments by The Tribe, EPA, and WA DNR outside the comment period. The Navy will include this letter with responses in the draft final document. The Navy was able to address EPA's concerns this time but may not in the future for comments received outside the comment period.

If you have any questions or concerns please contact me at (360) 396-0597 or raymond.kobeski@navy.mil.

Sincerely,

Raymond A Kobeski, PE
Remedial Project Manager

Enclosures: 1. Comment Responses to US. EPA's Comments on the Draft Third Five year review for JPHC Bremerton, WA

CC: Dennis Taylor, The Suquamish Tribe
Erika Shaffer, WA State DNR

RE: Comment Responses to US. EPA's Comments on the Draft Third Five year review for JPHC Bremerton, WA

I. GENERAL COMMENTS

1. EPA has completed review of the draft 3rd Five Year Review to assess protectiveness of the existing remedies for OU-1, OU-3T-JPHC, and OU-3T-NHB. EPA has concluded that *protectiveness is deferred* for OU-1 due to the outstanding issues identified below based on the OU-1 ROD and OU-1 ROD Amendment, and that the *remedy is protective* for OU-3T-JPHC and OU-3T-NHB.

   Navy Response: See response to General Comment Nos. 2, 3, 4, and 5.

2. The OU-1 ROD Amendment updated the groundwater remedy for the NEX Gas Station (i.e. Benzene Release Area) to utilize in-situ chemical oxidation (ISCO) using ozone for groundwater treatment, and the benzene RAO was revised downward to 5 ug/L to be protective of both groundwater use and discharge of groundwater to surface water. Since ISCO using ozone was not tested at pilot scale during the FFS stage, and the performance of this technology was not demonstrated under site-specific conditions, EPA required the inclusion of a Pump and Treat Contingency Remedy in the OU-1 ROD Amendment, with a two year operational period to establish the performance of ISCO to meet OU-1 ROD Amendment RAOs for groundwater. To date, this groundwater system has not been installed or assessed for operational performance to meet groundwater RAOs, therefore *protectiveness is deferred* for this site until this two year operational period is assessed.

   Navy Response: Neither EPA nor Navy guidance on conducting 5-year reviews specify the exact nature of the data to be considered. The guidance only states that relevant data should be considered. The lead agency is responsible for determining what is relevant to the issue of protectiveness and for determining if the data is technically sound and reliable.

   The draft 5-year review already concludes that protectiveness is deferred for all of OU 1 because additional data are needed to assess potential risks to human health based on new information (see response to General Comment No. 5). The protectiveness determination deferral is not because of the status of the NEX Gas Station amended remedy. In accordance with OSWER 9200.2-111, protectiveness determinations are made for each OU, not for individual sites within an OU (e.g., the NEX Gas Station). If the NEX Gas Station were a separate OU, then a protectiveness determination of "will be protective" would be most appropriate given that implementation of the remedy is ongoing and the remedy is anticipated to be protective upon completion regardless of whether the contingency remedy is required.

3. The Draft FYR includes data from the Landau Environmental Site Assessment (ESA) Phase I and II Reports. None of the Sampling and Analysis Plans/Quality Assurance Project Plans (SAP/QAPP) for the Landau ESA Reports were submitted by the Navy for

EPA review and approval or review by the Suquamish Tribe. It is unclear how the data quality objectives (if any) of the Landau ESA Reports are consistent with the OU-1 ROD or OU-1 ROD Amendment.

Navy Response: As stated in Section 6.4.3, the Landau reports were prepared in 2013, at the request of Forest City for approximately 200 acres of property at JPHC in advance of the public-private venture agreement between Forest City and the Navy. As required by OU 1 ROD, EPA was notified and commented on the land lease documentation. Forest City intends to construct new buildings and maintain and/or renovate existing buildings and related community facilities. The purpose of these investigations was to identify known and potential areas of contamination that may pose a potential liability to a potential lessee or purchaser. These reports were not prepared for use in the CERCLA process; therefore, an EPA-approved QAPP was not completed. These reports were used solely to identify potential issues at JPHC with the understanding that additional data collection and analysis would be required to confirm any potential issues. Therefore, additional sampling and analysis is recommended in Table 8-1. All sampling and analysis recommended in this 5-year review would be performed in accordance Navy and EPA procedural requirements.

4. The Landau ESA Reports identified groundwater, surface water seep, and subsurface soils contamination above screening levels identified by the contractor. Does the Navy intend to do further characterization of these sites or conduct a Supplemental Risk Assessment for OU-1 to assess human health risks from these releases? If so, all SAPs/QAPPs for further investigation and all Risk Assessment procedures need to be reviewed and approved by EPA for the Jackson Park NPL site.

   Navy Response: Table 8-1 includes recommendations to perform further sampling and analysis and risk evaluation (See Recommendations 1, 2, 5, and 7).

5. The evaluation human health risks from ingestion of seafood in Ostrich Bay as required by the OU-1 ROD are not included in this draft FYR. Fifteen years after the OU-1 ROD was completed, this ROD requirement has still not been met with adequate tissue sampling data to assess risks. The OU-1 ROD requires this to be completed at 2 or 5 year intervals, which has not been met. The tissue sampling conducted in August 2014 for speciated arsenic and ordnance should be included in this FYR to assess risks as required by the schedule in the OU-1 ROD. *Protectiveness is deferred* until the OU-1 human health risk assessment is completed based on tissue data of known and documented quality.

   Navy Response: Thank you EPA for agreeing with the lead agency's (Navy's) determination that additional information is required to determine if the remedy was protective between August 2009 and July 2014. However, this determination is unrelated to the delay of the 2014 marine tissue monitoring and HHRA to after this 5-year review period (the basis of this determination is included in the next paragraph). Harvest restrictions are protective of human health regardless of the results of the HHRA. The purpose of the marine tissue monitoring and the HHRA

is to determine whether the harvest restrictions can be removed or whether they must be continued to protect human health. Once the HHRA demonstrates that harvest restrictions may be removed, a remedial action completion report would be prepared following EPA guidance to document the completion of marine tissue monitoring and the removal of the harvest restrictions, which are integral to current remedy protectiveness.

As stated on page 9-1 of the draft 5-year review for JPHC/NHB: "A protectiveness determination for the remedy at OU 1 cannot be made until further information is obtained through the following actions:

- **Performing mercury sampling at seeps/outfalls at Site 101-A**
- **Investigating the extent of shallow soil exceeding ROD remediation goals and evaluating whether contamination in shallow soil identified during the Phase II Site Investigation could pose unacceptable risks to human health**
- **Performing indoor air, subslab vapor intrusion, and crawl space sampling at the NEX Gas Station Leak Area and comparing results to screening levels to evaluate whether there are unacceptable risks to human health"**

The Navy predicted that these actions together with a 5-year addendum will take until March 2017 to complete.

During the Stakeholder Kickoff Meeting on September 17, 2015, the Navy announced that it was conducting the third 5-year review for JPHC/NHB for the period August 2009 to July 2014. The Navy has a legal obligation to complete the 5-year review by August 2015 including data from the 5-year review period (August 2009 to July 2014). The marine tissue monitoring occurred in August 2014, which was after the 5-year review period (August 2009 to July 2014). The marine tissue monitoring was delayed specifically because of the inability to achieve consensus with the stakeholders on the Project-Specific Sampling and Analysis Operable Unit 1 Long-Term Monitoring of Marine Tissue. Because of this delay, completion of the data gaps analysis and the HHRA was also delayed. However, work is continuing on the long-term monitoring report and the HHRA, which are scheduled to be delivered by May 15, 2015. As stated on page 4-4 of the 5-year review, the Navy will include the marine tissue monitoring data and the HHRA in the 5-year review addendum scheduled for submittal in March 2017.

The last marine tissue sampling event occurred in May 2009. Therefore, the August 2014 sampling event is approximately 5 years and 3 months after that previous sampling event. If delays had not been experienced, the data could have been included in this 5-year review. Regardless of whether sampling was performed in accordance with the stated schedule, human health is currently protected through harvest restrictions.

II. SPECIFIC COMMENTS

1. Page 3-4, Section 3.3 Operable Unit 3, 1st paragraph, "A CSM has not been developed for OU 3M." – This statement appears to be inconsistent with the 3 RI Workplans (Phase I, II, and III) that have already been completed, and form the basis for sampling design and investigation for OU-3M.

   Navy Response: The document will be revised to indicate that a preliminary CSM was developed in the phase I and phase II work plans. The phase III work plan was finalized in October 2014, which is outside this 5-year review period. The purpose of the phase III investigation is to refine the CSM and define the OU 3M site boundaries. Because the CSM presented in the phase I and II work plans may be modified based on the results of the phase III investigation work, the CSM was not included in the 5-year review.

2. Page 6-15, 2nd bullet – EPA does not concur with the suggested screening level, RDX was detected in groundwater, therefore the appropriate screening level would be for groundwater, not surface water. The MTCA Method B criteria is 0.8 ug/L and the EPA RSL is 0.61 ug/L for RDX in groundwater. See General Comment No. 4.

   Navy Response: In accordance with the OU 1 ROD, groundwater remediation goals at Sites 101, 101-A, and 103 are based on surface water ARARs (see Section 8.2.1, Section 8.2.3, and Table 8-4 of the OU 1 ROD). Therefore, the values presented in Table 3-7 of the BERA report for OU 2 (U.S. Navy 2011c), which are based on freshwater and marine surface water criteria for munitions compounds, are the appropriate screening level for Site 101-A, where RDX was detected in groundwater during the Phase II SI sampling. The lowest and therefore most conservative criterion presented in the BERA for RDX was 186 µg/L. Therefore, this is the screening criterion used in 5-year review.

3. Page 7-3, Seep and Outfall Monitoring – The OU-1 ROD Amendment revised the benzene RAO to 5 ug/L, therefore seep sample results should be compared to this criteria. See General Comment No. 2.

   Navy Response: Additional text will be added to the Seep and Outfall Monitoring Section clarifying that the OU-1 ROD Amendment revised the benzene remediation goal to 5 ug/L for the NEX Gas Station Leak Area at the conditional point of compliance (the 880 series wells), based on the potential future use of the groundwater aquifer at <u>Site 110</u> as drinking water. The remediation goals for the seeps/outfalls are unchanged by the ROD Amendment. As stated on page 4-6 of the OU 1ROD Amendment, "Because several years will be required for the remedial actions to achieve this goal for groundwater throughout the site, a "conditional point of compliance" (WAC 173-340-720[8][c]) is also established at the "880 series wells"." Furthermore, the ROD amendment states that "The combination of active treatment at the source area, active treatment at the near-shore area, and flushing between these areas is expected to achieve the cleanup levels in groundwater at the standard point of compliance in approximately 12 years."

4. Page 7-6 and 7-7, Benzene – The new benzene groundwater and discharge to surface water criteria in the OU-1 ROD Amendment is 5 ug/L, see General Comment No. 2.

   Navy Response: The analysis provided here is appropriate for Sites 101, 101-A, and 103, because the OU-1 ROD Amendment is only applicable to the drinking water aquifer point of compliance at the NEX Gas Station Leak Area.

5. Page 7-11, 1st full bullet – TPH criteria for soil and groundwater were established in the OU-1 ROD Amendment.

   Navy Response: RGs were not established in the OU 1 ROD or OU 1 ROD Amendment for TPH-creosote, TPH-oil, and TPH-diesel, which are the TPH contaminants of concern in the referenced text. The OU 1 ROD, which is applicable to Site 101-A, only established an RG for TPH-gasoline. Note that the TPH-gasoline RG in the OU 1 ROD Amendment only applies to the NEX Gas Station Leak Area. The referenced text will be clarified.

6. Page 7-13, Section 7.4.1 – The remedy for the NEX Gas Station has not been implemented yet, see General Comment No. 2.

   Navy Response: The specific text does not claim that the remedy has been implemented. It states "Yes, the revised remedy for the NEX Gas Station Leak Area selected in the OU 1 ROD Amendment No. 1 is expected to function as designed once it is implemented." See response to EPA General Comment #2

7. Page 7-15, Section 7.4.4 - The remedy for the NEX Gas Station has not been implemented yet, see General Comment No. 2.

   Navy Response: See response to EPA Specific Comment #6 and EPA General Comment #2.

8. Page 7-24. Table 7-4 - The new benzene groundwater and discharge to surface water criteria in the OU-1 ROD is 5 ug/L, see General Comment No. 2.

   Navy Response: The analysis provided here is appropriate for Sites 101, 101-A, and 103, because the OU-1 ROD Amendment is only applicable to the drinking water aquifer point of compliance at the NEX Gas Station Leak Area.

9. Appendix C – Stakeholder Meeting #1 Handout – This 2012 meeting handout does not constitute an approved workplan by EPA or the Suquamish Tribe. EPA provided comments to the Navy after 2012 with numerous concerns regarding this "weight-of-evidence" proposal by the Navy's contractor. This appendix shall be removed from the draft FYR, as it is unrelated to any approved administrative or legal CERCLA decision document for this site. If any document should be cited, it should be the final Project Specific Sampling and Analysis Plan, OU 1 Long-Term Monitoring of Marine Tissue, dated 18 July 2014. Data quality and completeness remain the primary objectives for the

OU-1 human health risk assessment for ingestion of seafood, see General Comment No. 5.

Navy Response: The 5-year review does not claim that this information is a work plan. The purpose of the 5-year review is to summarize activities that have occurred during this 5-year review period, and the development of the preliminary data gaps analysis occurred during this period. Furthermore, the purpose of including this information in the 5-year review was to provide a formal means to obtain written comments from the regulators and the Tribe on the preliminary data gaps analysis for the administrative record. The Navy invites the regulatory agencies and the Tribe to resubmit comments on this preliminary data gaps analysis, and requests that they provide clarification on <u>specifically</u> how this data gaps analysis did not address previously identified issues.

The 2012 meeting handout will not be deleted from the report, but additional clarifying information will be included to indicate that the project team did not reach consensus on adding to the OU 1 analyte list based on this preliminary data gaps analysis, and the regulatory agencies and the Tribe did not agree with the Navy's conclusions presented in these meeting materials. Text will also be added explaining that even though consensus was not obtained, the 2014 sampling would proceed in accordance with the EPA-approved SAP and the ROD as modified by the last 5-year review and marine tissue would be analyzed for speciated arsenic and ordnance compounds, and analysis of ordnance compounds would use improved analytical methods. A reference to the EPA-approved Final Project-Specific SAP, Operable Unit 1 Long-Term Monitoring of Marine Tissue, Jackson Park Housing Complex/Naval Hospital Bremerton, Bremerton, Washington has already been included in the 5-year review.

CORRESPONDENCE RECORD NOTE
Subject or SSIC/ID Information:

Indicate Distribution Method: IN HOUSE _X_ CONTRACTOR_____

Location of attachments/ enclosures: emailed

Mail original letter to (address):

Mr. Harry Craig
U.S. EPA Region 10
Oregon Operations Office
805 SW Broadway, Suite 500
Portland, Oregon 97205

Mail copy of letter to as indicated on letter (address):

Ms. Denice Taylor
The Suquamish Tribe
PO Box 498
Suquamish, WA 98392-0498

Erika
PO Box 47000
1111 Washington Street SE
Olympia, WA 98504-7000

PDF and e-mail copy of letter to (include email address):

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DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND NORTHWEST
1101 TAUTOG CIRCLE
SILVERDALE, WASHINGTON 98315-1101

5090/JPHC
05ER/All OU SF 5.1
EV31RK/SER 479
01 Jun 2015

Ms. Erika Shaffer
PO Box 47000
1111 Washington Street SE
Olympia, WA 98504-7000

SUBJECT: REPSONSE TO WA DNR'S COMMENTS ON THE DRAFT THIRD FIVE YEAR REVIEW JACKSON PARK HOUSING COMPLEX, BREMERTON, WA

Dear Ms. Shaffer:

Thank you for reviewing the draft Third Five Year Review Document, Jackson Park Housing Complex, Bremerton, WA Report. Unfortunately the Navy is unable to conduct a meeting with the Tribe, EPA, and WA DNR on the comment responses. This change of schedule is directly related to receiving comments by The Tribe, EPA, and WA DNR outside the comment period. The Navy will include this letter with responses in the draft final document. The Navy was able to address WA DNR's concerns this time but may not in the future for comments received outside the comment period.

If you have any questions or concerns please contact me at (360) 396-0597 or raymond.kobeski@navy.mil.

Sincerely,

Raymond A Kobeski, PE
Remedial Project Manager

Enclosures: 1. Comment Responses to WA DNR's Comments on the Draft Third Five year review for JPHC Bremerton, WA

CC: Harry Craig, US EPA Region 10
Dennis Taylor, The Suquamish Tribe

RE: Comment Responses to WA DNR's Comments on the Draft
Third Five year review for JPHC Bremerton, WA

The Washington State Department of Natural Resources (DNR) would like to thank you for the opportunity to comment on the Draft Third Five Year Review.

DNR's comments are based on principles of stewardship and proprietary management derived from our legislative defined goals to protect State-Owned Aquatic Lands (SOAL) and preserve them for the public's benefit. We appreciate your consideration of these and any future comments related to the site.

DNR concurs with the conclusion that the remedy for OU1 cannot be determined to be protective of current and future uses at this time. In particular, DNR is concerned by the long term monitoring of marine tissue chemistry and evaluation of human health risks. DNR believes that the data to date is insufficient to fully evaluate human health risks. Once the 2014 monitoring event data is available, it should be incorporated into an evaluation of human health risk, including a data gaps analysis and potential re-evaluation of long term monitoring plans.

<u>Navy Response:</u> Thank you for agreeing with the Navy's determination that additional information is required to determine if the remedy was protective between August 2009 and July 2014. However, this determination is unrelated to the delay of the 2014 marine tissue monitoring and HHRA to after this 5-year review period (the basis of this determination is included in the next paragraph). Harvest restrictions are protective of human health regardless of the results of the HHRA. The purpose of the marine tissue monitoring and the HHRA is to determine whether the harvest restrictions can be removed or whether they must be continued to protect human health. Once the HHRA demonstrates that harvest restrictions may be removed, a remedial action completion report would be prepared following EPA guidance to document the completion of marine tissue monitoring and the removal of the harvest restrictions, which are integral to current remedy protectiveness.

As stated on page 9-1 of the draft 5-year review for JPHC/NHB: "A protectiveness determination for the remedy at OU 1 cannot be made until further information is obtained through the following actions:

1. **Performing mercury sampling at seeps/outfalls at Site 101-A**
2. **Investigating the extent of shallow soil exceeding ROD remediation goals and evaluating whether contamination in shallow soil identified during the Phase II Site Investigation could pose unacceptable risks to human health**
3. **Performing indoor air, subslab vapor intrusion, and crawl space sampling at the NEX Gas Station Leak Area and comparing results to screening levels to evaluate whether there are unacceptable risks to human health"**

The Navy predicted that these actions together with a 5-year addendum will take until March 2017 to complete.
During the Stakeholder Kickoff Meeting on September 17, 2015, the Navy announced that it was conducting the third 5-year review for JPHC/NHB for the period August 2009 to

July 2014. The Navy has a legal obligation to complete the 5-year review by August 2015 including data from the 5-year review period (August 2009 to July 2014). The marine tissue monitoring occurred in August 2014, which was after the 5-year review period (August 2009 to July 2014). The marine tissue monitoring was delayed specifically because of the inability to achieve consensus with the stakeholders on the Project-Specific Sampling and Analysis Operable Unit 1 Long-Term Monitoring of Marine Tissue. Because of this delay, completion of the data gaps analysis and the HHRA was also delayed. However, work is continuing on the long-term monitoring report and the HHRA, which are scheduled to be delivered by May 15, 2015. As stated on page 4-4 of the 5-year review, the Navy will include the marine tissue monitoring data and the HHRA in the 5-year review addendum scheduled for submittal in March 2017.

DNR would also like to reiterate its support for the ultimate objective of unrestricted use in Ostrich Bay. As the manager and steward of SOAL, DNR believes that cleanup to levels allowing unrestricted use is most consistent with the preservation of SOAL for the people of Washington State.

Navy Response: **The Navy understands that the ultimate objective for the site is unrestricted use of Ostrich Bay, and shares that objective with the stakeholders. However, as long as the risk assessment shows potential risks to subsistence, commercial, ceremonial, and recreational harvesters, given the limitations of the analytical methods available for ordnance compounds in marine tissue, above 1 x 10-5 excess cancer risk or a noncarcinogenic hazard index of 1 using Suquamish exposure scenarios and EPA regional guidance, harvest restrictions must remain in place for all harvesters.**

CORRESPONDENCE RECORD NOTE

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05ER/All OU SF 5.1
EV31RK/SER 15-478
01 Jun 2015

Ms. Denice Taylor
The Suquamish Tribe
PO Box 498
Suquamish, WA 98392-0498

SUBJECT: REPSONSE TO THE SUQUAMISH TRIBES COMMENTS ON THE DRAFT THIRD FIVE YEAR REVIEW JACKSON PARK HOUSING COMPLEX, BREMERTON, WA

Dear Ms. Taylor:

Thank you for reviewing the draft Third Five Year Review Document, Jackson Park Housing Complex, Bremerton, WA Report. Unfortunately the Navy is unable to conduct a meeting with the Tribe, EPA, and WA DNR on the comment responses. This change of schedule is directly related to receiving comments by The Tribe, EPA, and WA DNR outside the comment period. The Navy will include this letter with responses in the draft final document. The Navy was able to address The Tribe concerns this time but may not in the future for comments received outside the comment period.

If you have any questions or concerns please contact me at (360) 396-0597 or raymond.kobeski@navy.mil.

Sincerely,

Raymond A Kobeski, PE
Remedial Project Manager

Enclosures: 1. Comment Responses to The Suquamish Tribe's Comments on the Draft Third Five year review for JPHC Bremerton, WA

CC: Harry Craig, US EPA Region 10
Erika Shaffer, WA State DNR

RE: Comment Responses to The Suquamish Tribe's Comments on the Draft Third Five year review for JPHC Bremerton, WA

OU 1 Protectiveness Determination and Recommendations

The Tribe agrees with the Navy's conclusion that the remedy for OU 1 cannot be determined to be protective of current and future uses at this time. The issues identified in the draft FYR and listed on Table 7-10 indicate that all sources, contaminants of concern and potential risks have not been adequately addressed by previous remedial actions or existing land use controls and monitoring strategies.

Navy Response: Thank you for agreeing with the Navy's determination that additional information is required to determine if the remedy was protective between August 2009 and July 2014. See responses to EPA General Comment Nos. 3, 4, and 5.

Forest City Site Investigation Data

The Navy introduced a considerable amount of data from the Forest City site investigations that was not previously reviewed or discussed by the project team. The data call into question assumptions and conclusions regarding groundwater contaminant migration to surface water, analytical detection levels, and the nature and extent of soil contamination. In addition to the follow up actions proposed by the Navy, the Tribe recommends that the actions be systematically coordinated as a review of the CSM and a re-evaluation of long-term monitoring objectives for the upland portion of the JPHC site.

Navy Response: To address the issues identified based on the results of the Phase II SI, the following recommendations were included in Table 8-1 of the JPHC/NHB Third 5-Year Review:

- **Prior to each seep sampling event, determine the best available cyanide PQL and compare to the cyanide RG (1 µg/L). Ensure that the laboratory uses the best analytical method for achieving the current cyanide PQL (5 µg/L in 2015 using EPA Method 335.4) and that monitoring results are compared to the best available PQL at the time of monitoring.**
- **Restart mercury monitoring at Site 101-A (OF-716 and SP-715).**
- **Control excavation and construction in the Root Court area (see Figure 8-1) with deep soil contamination (TPH and cPAHs) above ROD RGs and/or focused Phase II SI screening criteria (if no ROD RG is established) and incorporate the areas into the LUC Management Plan.**
- **Evaluate whether contamination in shallow soil (arsenic, lead, cPAHs, and explosives) identified during the focused Phase II SI in the vicinity of NE Rankin**

Road and the bunkers could pose unacceptable risks to human health.

- **Investigate the extent of shallow soil exceeding the ROD RGs in the vicinity of NE Rankin Road and the bunkers and incorporate areas exceeding RGs into the LUC Management Plan.**

The results of these sampling activities will be carefully reviewed, and the CSM and the long-term monitoring program will be updated, if needed.

Marine Tissue Monitoring

The Tribe has continuing concerns related to the long-term monitoring of marine tissues and the assessment of potential impacts via tribal harvest of fish and shellfish. Fifteen years after the ROD was signed, the OU 1 RAO of reducing risks from subsistence-level ingestion to less than 1 x 10-5 excess cancer risk, or less than a noncarcinogenic hazard index of 1, has not been achieved. Furthermore, the Tribe does not consider the restriction on harvest to be protective of treaty-reserved rights and resources in the long-term. The findings of the draft 5YR support the Tribe's position that the Navy has failed to address the ROD requirement to implement a shellfish sampling program that will adequately address potential health risks to tribal members and evaluate the need to continue shellfish harvest restrictions.

Navy Response: **The Navy understands that the Tribe has continuing concerns regarding the long-term monitoring of marine tissue and the risks associated with subsistence-level ingestion, and has attempted to work with the Tribe and EPA to address these concerns over this 5-year review period. Specifically:**

- **The 2010 HHRA concluded that ROD goals had likely been met, but an additional round of monitoring was recommended in large part to satisfy the EPA's concern regarding the analytical method used to quantify ordnance concentrations in tissue.**
- **A draft SAP for long-term monitoring of marine tissue in Ostrich Bay in support of the HHRA was submitted for EPA and Tribe review in May 2011. The Navy's intent with this draft SAP was to perform a long-term monitoring event equivalent to the event performed in 2009, but using the updated analytical methods for ordnance.**
- **A scoping meeting between the Navy, the EPA, and the Tribe was held in August 2011. At this meeting, EPA and the Tribe asked the Navy to review the OU 2 BERA sampling data to assess whether the long-term monitoring for OU 1 and HHRA analyte list were sufficiently comprehensive (i.e., are we missing anything from OU 1?). A follow up meeting was planned.**
- **The Navy prepared meeting materials that included a brief assessment of the OU 2 BERA data against risk-based screening levels for the meeting in November 2011.**
- **During the November 2011 meeting, EPA and the Tribe indicated that the meeting materials did not provide the desired level of detail to fully comprehend the assumptions used to derive the Suquamish risk-based screening values and the screening process used to determine whether inclusion of additional analytes was warranted. The Navy agreed to add a HHRA Work Plan, which would include the derivation of the analyte list, as an appendix to a revised LTM SAP. The group agreed that additional meetings would be required to refine the scope of the HHRA Work Plan.**
- **The Navy subsequently provided more detailed meeting materials for review as part of the development of the HHRA Work Plan and analyte list. However, EPA and Tribe found concerns with the approach proposed by the Navy. As a result of**

personnel changes and contracting actions, discussion of those concerns and work on the HHRA Work Plan was delayed until 2014.

Marine Tissue Monitoring (cont'd)

- **On January 16, 2014, a stakeholder scoping meeting was held that discussed continued progress of the SAP and HHRA Work Plan. The stakeholders agreed to execute the marine monitoring as outlined in the 2011 Draft SAP, which included sampling of clam and crab and analysis of speciated arsenic and ordnance compounds. The Navy agreed to include an evaluation of the available marine data in Ostrich Bay, including the OU 2 BERA data, to identify potential data gaps relating to human exposures to seafood (i.e., analyte list, species consumed, sampling locations) from OU 1 site-related chemicals as part of the HHRA.**
- **During the January 16, 2014 scoping meeting, the Navy, EPA, and Tribe discussed and finalized the risk assessment approach that would be included in the work plan.**
- **The SAP, which included the HHRA Work Plan, was reviewed and approved by the EPA and the document was finalized on July 18, 2014.**
- **Sampling was conducted in August 2014, outside of the 3rd 5-year data review window. Thus, these data and the conclusions and recommendations from the HHRA and data gaps analysis were not included in the 3rd 5-year review. The Navy relayed this to the stakeholders during the stakeholder kickoff meeting for the third 5-year review.**

The Navy will use the conclusions of the HHRA and data gaps analysis to determine whether modifications to the sampling program are warranted. If so, those modifications will be developed in collaboration with the stakeholders. Thus, the Navy believes that project activities have been conducted as anticipated and consistent with prior documented agreements between the stakeholders and the lead agency (Navy).

As follow up actions related to monitoring, the Navy has recommended that the results of the 2014 marine tissue monitoring be evaluated and an HHRA completed to resolve whether ordnance compounds and arsenic are present in marine tissues at levels that indicate unacceptable site-related risks. An analysis will also be completed to determine if potential data gaps in the human health marine tissue analyte list could impact the assessment of risks. The text in Section 7 states that these actions are already underway, with reports to be completed by October 2015; Table 8-1 indicates milestone dates of December 31, 2015.

Navy Response: **The draft marine tissue long-term monitoring report and the draft HHRA, including a data gaps analysis, are scheduled to be delivered to the regulatory agencies and the Tribe by May 15, 2015 for review and comment and are not part of this 5-year review. These reports have been completed in accordance with the Final Project-Specific SAP, Operable Unit 1 Long-Term Monitoring of Marine Tissue, Jackson Park Housing Complex/Naval Hospital Bremerton, Bremerton, Washington dated July 2014 and the HHRA Work Plan, which is included as Appendix A of the Final Project-Specific SAP. The SAP and HHRA Work Plan were completed in collaboration with the stakeholders and were reviewed and approved by EPA as described in the Navy response above. Because consensus could not be reached between the Navy, the regulators, and**

the Tribe on adding to the OU 1 analyte list for the long-term monitoring of marine tissue, it was agreed that the 2014 sampling will be performed in accordance with the ROD as modified by the last 5-year review. Therefore, marine tissue will be analyzed for speciated arsenic and ordnance compounds, and analysis of ordnance compounds will use improved analytical methods. A reference to the HHRA Work Plan will be added to the 5-year review since this work was conducted during this 5-year review period.

Marine Tissue Monitoring (cont'd)

The Navy has referred to and included within this FYR a June 2012 proposal to the project team for the development of an analyte list for human health shellfish risk assessment as the basis for the proposed data gaps analysis. This proposal was one aspect of a significant project team effort that occurred prior to Mr. Kobeski's assignment as the current OU 1 RPM. What the Navy has not included in this FYR are comments from both the Tribe and EPA stating that the proposed approach did not address previously identified issues. The project team did not reach consensus regarding the proposed approach and did not agree with the Navy's conclusion that none of the chemicals detected in the 2009 BERA other than ordnance compounds should be included in the OU 1marine monitoring.

Navy Response: A summary of the preliminary data gaps analysis performed by the Navy was provided in the 5-year review. This preliminary analysis was documented in the Stakeholder Meeting #1 handout e-mailed to the stakeholders on June 18, 2012 (see Navy's response to EPA Specific Comment No. 9) . The handout was also included in Appendix C of the 5-year review. The purpose of including this information in the 5-year review was to provide a formal means to obtain written comments from the regulators and the Tribe on the preliminary data gaps analysis for the administrative record. The Navy invites the regulatory agencies and the Tribe to resubmit comments on this preliminary data gaps analysis, and requests that they provide clarification on specifically how this data gaps analysis did not address previously identified issues. Text will be included to indicate that the project team did not reach consensus on adding to the OU 1 analyte list based on this preliminary data gaps analysis, and the regulatory agencies and the Tribe did not agree with the Navy's conclusions presented in these meeting materials. Text will also be added explaining that even though consensus was not obtained, the 2014 sampling would proceed in accordance with the ROD as modified by the last 5-year review, and marine tissue would be analyzed for speciated arsenic and ordnance compounds, and analysis of ordnance compounds would use improved analytical methods.

Although consensus was not reached on how or if the marine tissue monitoring strategy should be revised, the project team did agree that there was value in collecting data in 2014, specifically for inclusion in this FYR. The project team agreed that the analyte list for the 2014 tissue sampling would consist of speciated arsenic and ordnance compounds, with the caveats that the FYR would re-evaluate long-term monitoring objectives, as well as data gaps and the potential need to expand the analyte list. The project team also agreed that the 2014 data would be used to assess risks to subsistence harvesters based on Suquamish exposure scenarios and EPA regional guidance. The Tribe has made it clear to the Navy that it expects to be actively involved in the development and review of human health risk assessment, including the development of the scope of work, as well as tribal exposure scenarios and parameters.

Marine Tissue Monitoring (cont'd)

Navy Response: **During the Stakeholder Kickoff Meeting on September 17, 2015, the Navy announced that it was conducting the third 5-year review for JPHC/NHB for the period August 2009 to July 2014. The Navy has a legal obligation to complete the 5-year review by August 2015 including data from the 5-year review period (August 2009 to July 2014). The marine tissue monitoring occurred in August 2014, which was after the 5-year review period (August 2009 to July 2014). As stated on page 4-4 of the 5-year review, the Navy will include the marine tissue monitoring data and the HHRA in the 5-year review addendum scheduled for submittal in March 2017.**

The marine tissue monitoring was delayed specifically because of the inability to achieve consensus with the stakeholders on the Project-Specific SAP, Operable Unit 1 Long-Term Monitoring of Marine Tissue. Because of this delay, completion of the data gaps analysis and the HHRA was also delayed. However, work is continuing on the long-term monitoring report and the HHRA, which are scheduled to be delivered to the stakeholders by May 15, 2015. The 2014 data is being used to assess risks to subsistence, commercial, recreational, and ceremonial harvesters based on Suquamish exposure scenarios and EPA regional guidance in accordance with the EPA-approved HHRA Work Plan. In addition, the regulators and the Tribe have been involved in the development and review of the HHRA Work Plan, as described above, and they will have another opportunity to provide input on the marine tissue long-term monitoring report and the HHRA, including the data gaps analysis, during the review of the draft reports.

Harvest restrictions are protective of human health regardless of the results of the HHRA. The purpose of the marine tissue monitoring and the HHRA is to determine whether the harvest restrictions can be removed or whether they must be continued to protect human health. Once the HHRA demonstrates that harvest restrictions may be removed, a remedial action completion report would be prepared following EPA guidance to document the completion of marine tissue monitoring and the removal of the harvest restrictions, which are integral to current remedy protectiveness.

The Navy should not assume that the conclusions based on the June 2012 proposal are a sound basis for the proposed data gaps analysis. The June 2012 analytical proposal should be deleted from the text and appendix C of the FYR. The July 2014 Final Project-Specific Sampling and Analysis Plan for the OU 1 Long-Term Monitoring of Marine Tissue is an appropriate reference that adequately documents project team expectations and agreements prior to the 2014 sampling.

Navy Response: **The Navy understands that the regulatory agencies and the Tribe do not agree with the preliminary data gaps analysis. However, the purpose of the 5-year review is to summarize activities that have occurred during this 5-year review period, and the development of the preliminary data gaps analysis occurred during this period.**

As clarified above, another purpose of including this information in the 5-year review was to provide a formal means to obtain written comments from the regulators and the Tribe on the preliminary data gaps analysis for the administrative record. Therefore, this information will not be deleted from the report, but additional clarifying information will be included as described above. A reference to the EPA-approved Final Project-Specific SAP, Operable Unit 1 Long-Term Monitoring of Marine Tissue, Jackson Park Housing Complex/Naval Hospital Bremerton, Bremerton, Washington has already been included in the 5-year review.

Marine Tissue Monitoring (cont'd)

The Tribe believes that the ultimate objective for the site is unrestricted use of Ostrich Bay, including intertidal areas and shellfish resources. It is the Navy's responsibility to address site-related concerns that contribute to access and harvest restrictions. Based on previous communications with the WA DOH, which have been shared with the project team including the previous Navy RPMs, it will be necessary to evaluate risks related to contaminants associated with the site (ordnance, metals and some organics) in order to determine if there is a continued need for harvest restrictions. To this end, the Tribe has repeatedly requested that the long-term monitoring approach be revised to expand analytical parameters for tissue data. The Tribe emphasizes the need to focus on achieving the long-term objective of unrestricted use.

Navy Response:

The Navy agrees that the risks should only be related to contaminants associated with the site, and an analysis of whether contaminants are site-related was performed as part of the preliminary data gaps analysis and as part of the data gaps analysis currently being performed.

The Navy understands that the ultimate objective for the site is unrestricted use of Ostrich Bay, and shares that objective with the stakeholders. However, as long as the risk assessment shows potential risks to subsistence, commercial, recreational, and ceremonial harvesters, given the limitations of the analytical methods available for ordnance compounds in marine tissue, above 1 x 10-5 excess cancer risk or a noncarcinogenic hazard index of 1 using Suquamish exposure scenarios and EPA regional guidance, harvest restrictions must remain in place for all harvesters.

The Tribe recommends that a process for re-evaluating long-term monitoring objectives, including addressing questions raised by the Forest City site assessment data, evaluating the need for continued harvest restrictions and achieving unrestricted site use, be included in the FYR. It may be useful to consider some type of optimization process that would review the upland CSM and harmonize long- term monitoring efforts across operable units to the extent possible. This process should be a collaborative effort between the Navy, the Tribe, EPA and DNR.

<u>Navy Response:</u> These recommendations are already included in Recommendations 1-5 and 7-9 on Table 8-1 of the 5-year review. The results of these recommended activities will be carefully reviewed, and the CSM and the long-term monitoring program will be updated, if needed. Please also see the response to the consultation paragraph below.

<u>NEX Gas Station Leak Area</u>

With regard to the NEX Gas Station Leak Area, as stated in the FYR, the original remedy did not achieve ROD-specified cleanup objectives and a new remedy has been chosen. However, because the amended remedy has not yet been implemented, this component cannot be said to be protective. The continued release of contaminated groundwater to Ostrich Bay should be identified in Section 7 as an issue to be addressed; completion of the data gaps investigation and implementation of the amended remedy should be added as action items with milestone dates in Section 8.

<u>NEX Gas Station Leak Area (cont'd)</u>

<u>Navy Response:</u> As stated in Section 9.1, "A protectiveness determination for the remedy at OU 1 (including the NEX Gas Station Leak Area) cannot be made at this time until further information is obtained..." Therefore, the 5-year review does not state that the remedy is protective.

The 5-Year Review does include the following statement in Section 7.4.1: "Yes, the revised remedy for the NEX Gas Station Leak Area selected in the OU 1 ROD Amendment No. 1 is expected to function as designed once it is implemented." The migration of contaminated groundwater to Ostrich Bay will be addressed through the implementation of the amended remedy. Therefore, this issue has already been addressed by the signing of the ROD Amendment, and it should not be identified as an issue.

Completion of the data gaps analysis is included as Recommendation 8 in Table 8-1.

<u>Consultation</u>

By deciding not to include the 2014 marine tissue data in the FYR, and by not engaging with the project team in the re-evaluation of long-term monitoring objectives as part of this FYR, the Navy has not honored the good faith agreements of the project team. Given that there have been no follow up project team meetings and, as of the date of this letter, the Tribe has not been provided with the 2014 data, the Tribe also questions the Navy's intent to meaningfully consult with the Tribe, consistent with DoD policy and regional instruction, if the human health risk assessment and data gaps analysis efforts are already underway and will be completed in either October or December of 2015.

The Tribe again requests that the Navy consult with tribal staff, as well as EPA, regarding the human health risk assessment and data gaps analysis prior to issuing draft or final work plans or reports. If consultation at the staff level is not effective (i.e. meaningful, timely, cooperative and collaborative), this issue may be elevated for resolution. It should be noted that similar requests for consultation have been made in the two previous FYRs.

<u>Navy Response:</u> Please see previous responses regarding the reason why the 2014 marine tissue data and the HHRA, including the data gaps analysis, was not included in this 5-year review.

Also, see the previous response regarding how the Tribe has been, and will continue to be, involved in the development of the HHRA, including the data gaps analysis.

The Navy has gone above and beyond what the Tribe and the Navy leadership have agreed to in the Suquamish Cooperative Agreement dated April 2014. The following explains how the Navy met that agreement:

Consultation (Cont'd)

As part of technical planning and review, the Navy has provided documents and data over the 5-year review period and the 5-year review document for The Tribe to:

(a)Review, comment, and make recommendations on documents and data pertaining to pre-remedial, remedial, time critical removal actions, and other Installation Restoration response actions for Department of Defense facilities listed in Attachment A. For the work listed in 2b-f, 3, and 5, the Tribe will work primarily on issues associated with the protection of Tribal Treaty rights, Tribal trust resources, and archaeological resources of religious or cultural importance to the Tribe.
(b)Submit written comments on Installation Restoration documents as deliverables under this Cooperative Agreement.
(c)Participate in technical review committees, work groups, and other relevant activities for Department of Defense facilities identified in Attachment A.
(d)The Tribe designated project manager to participate in planning and review of all documents pertaining to activities under paragraph (a) and (b).
(e)Help identify applicable or relevant and appropriate requirements for remediation activities occurring within areas identified in Attachment A.
(f)Can afford opportunities to participate in DoD's response actions at installations identified in Attachment A, and agreements between DoD and the Tribe

OU 3T and OU NHB Protectiveness Determination

The Tribe agrees with the Navy's conclusions that the remedial action for OU 3T has been implemented as intended by the ROD, and that the remedies for both OU 3T and OU NHB are expected to be protective of human health and the environment once the LUC plans are in place.

Navy Response: **Thank you.**

CORRESPONDENCE RECORD NOTE
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July 27, 2015

RESPONSES TO EPA COMMENTS ON THE DRAFT FINAL THIRD FIVE-YEAR REVIEW, JACKSON PARK HOUSING COMPLEX/NAVAL HOSPITAL BREMERTON, DATED 16 JUNE 2015

I. GENERAL COMMENTS

1. EPA has completed review on the draft final Third Five Year Review (FYR) for the Jackson Park Housing Complex/Naval Hospital Bremerton NPL site. Based on the Executive Summary Table, EPA concurs with the Protective Determinations for each of the identified Operable Units with completed Records of Decisions.

   Navy Response: Thank you.

2. Based on the Five Year Review Summary Form, EPA concurs that additional evaluation will be needed for the OU-1 Marine Tissue Monitoring to assess human health risks, which will be completed as an addendum to the current 2015 FYR.

   Navy Response: Thank you.

II. SPECIFIC COMMENTS

1. Page 6-12, Conclusion – EPA does not concur with the Navy's conclusions regarding non-ordnance and non-arsenic related CoCs for marine tissue samples in Ostrich Bay. No background levels have been established for metals, PAHs, PCBs, and SVOCs in tissue samples in Ostrich Bay. This issue will need to be addressed as noted in General Comment No. 2.

   Navy Response: As stated in the second sentence of the referenced paragraph, the Navy already acknowledges that EPA does not agree with the Navy's conclusions. Therefore, Recommendation No. 8 of the 5-year review (page 8-6) states: "Complete the marine tissue data gaps analysis and finalize the analyte list for potential future rounds of marine tissue monitoring." However, it should be noted that some background levels for metals are available. Appendix D of the 1996 HHRA conducted a literature review of background metal concentrations in clams in Puget Sound for arsenic, cadmium, chromium, copper, mercury, lead, and zinc. No significant difference was found between site clam concentrations and background concentrations.

2. Page 6-15, 3rd bullet – RDX detected in groundwater needs be assessed for human health risks in groundwater based on human health criteria such as MTCA Method B of 0.8 ug/L and EPA Regional Screening Level (RSL) of 0.61 ug/L. The cited Talmage et al. (1999) criteria of 186 ug/L is for freshwater chronic ecological risks, not human health risk. It addition, it is a freshwater criteria, not marine waters criteria.

Navy Response: The standards cited by EPA are based on the ingestion of tap water. In section 8.2.1, the ROD for OU 1 states that: "Drinking water is not considered the highest beneficial use for groundwater at Sites 101, 101-A, and 103 under Washington State regulations. Therefore, no human health risks were defined for groundwater ingestion in the HHRA because groundwater was not considered as a potential source of drinking water." Furthermore, as stated in the response to EPA Specific Comment No. 2 on the draft 5-year review: "In accordance with the OU 1 ROD, groundwater remediation goals at Sites 101, 101-A, and 103 are based on surface water ARARs (see Section 8.2.1, Section 8.2.3, and Table 8-4 of the OU 1 ROD). Therefore, the values presented in Table 3-7 of the BERA report for OU 2 (U.S. Navy 2011c), which are based on freshwater and marine surface water criteria for munitions compounds, are the appropriate screening level for Site 101-A, where RDX was detected in groundwater during the Phase II SI sampling. The lowest and therefore most conservative criterion presented in the BERA for RDX was 186 µg/L. Therefore, this is the screening criterion used in 5-year review."

As stated in the last sentence of the paragraph above, the freshwater criteria are lower than the marine criteria. According to the BERA the marine criteria (FAV/NOEC and FCV/LOEC) in Table 3-7 are listed as 11,900 and 23,700 µg/L, respectively. These are two orders of magnitude higher than the freshwater criteria. Therefore, the conclusions of the 5-year review are valid.

3. Page 7-8, Section 7.1.3 – RDX as well as cyanide was detected in groundwater at Site 101-A. See also Specific Comment No. 2.

   Navy Response: The detection of cyanide is acknowledged in the first bullet of the referenced section. Furthermore, the 5-year review included the following recommendation in Table 8-1: "Prior to each seep sampling event, determine the best available cyanide PQL and compare to the cyanide RG (1 µg/L). Ensure that the laboratory uses the best analytical method for achieving the current cyanide PQL (5 µg/L in 2015 using EPA Method 335.4) and that monitoring results are compared to the best available PQL at the time of monitoring."

   See response to EPA Specific Comment No. 2 regarding the RDX detection at Site 101-A. Because the detected concentration of RDX in groundwater at Site 101-A does not exceed either marine or freshwater criteria, the detection of RDX does not call into question the protectiveness of the remedy. Therefore, it is not discussed in Section 7.1.3.

4. Page 7-22, Table 7-3 – Add RDX to groundwater, including MTCA Method B criteria and EPA RSL levels. See Specific Comment No. 2.

   Navy Response: The purpose of Section 7.1.2, where Table 7-3 is called out, is to answer Question B of the 5-year review process. Question B asks "Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?" In answering Question B, any change to ARARs used to establish RGs in the **ROD** and any change to risk assessment assumptions (exposure and toxicity) are reviewed to evaluate the protectiveness of the remedy. No RG was established in the OU 1 ROD for RDX in groundwater. Without an ESD or ROD Amendment, it is not appropriate to include RDX on Table 7-3. Furthermore, as discussed in the response to Specific Comment No. 2, the detected concentration of RDX is four orders of magnitude lower than the marine criteria, which forms the basis for the groundwater ROD RGs for Site 101-A. Therefore, the detected concentration of RDX does not call into question the protectiveness of the remedy.

Draft Final Third 5-Year Review
JPHC/NHB
Responses to Suquamish Comments

Consultation

In the comments on the draft FYR, the Tribe noted that there have been ongoing challenges at the project team level in working collaboratively and achieving meaningful participation in the decision-making process. In some instances, as with the OU 1 tissue sampling, the project team has not yet been able to reach consensus (i.e. the overall monitoring objectives and the analyte list) and it has affected project schedules and deliverable dates. While this has been an unfortunate outcome, the Tribe continues to believe that the good faith process of consultation must be honored.

In the Navy's response to the Tribe's comment on consultation, the Navy listed various ways the Tribe has been and will continue to be involved in site management decisions, and referenced the 2014 Cooperative Agreement regarding reimbursable tribal activities. While it is agreed that tribal staff has been and will continue to be actively involved in the JPHC project teams, consultation is a broader concept than the list of CA activities. Again, the Navy's own regional instruction on tribal consultation and the DoD's American Indian and Alaskan Native Policy both emphasize that consultation and the practice of meaningful participation provide for communication, coordination, cooperation and collaboration in determining and evaluating impacts on traditional and cultural lifeways, natural resources, and treaty and other federal reserved rights.

The Tribe is again stressing the need for collaboration and good communication as the cornerstone of an effective consultation process. In particular, the project team needs to continue to work toward consensus on the review and re-evaluation of the overall objectives of the JPHC OU 1 long-term monitoring plan, including the analyte list for future sampling efforts.

<u>Navy Response:</u> The Navy agrees.

JPHC OU 1 2014 Tissue Data/HHRA and 5YR Addendum

The Tribe submitted comments to the Navy on the draft 2014 tissue data report and the draft HHRA, including the data gap analysis, on June 22, 2015. Additional discussion with the project team will be necessary before these documents are finalized.

The Tribe recommends that the addendum to this FYR include the findings of the 2014 tissue sampling and any conclusions and recommendations from the HHRA. This would be in keeping with project team expectations that the 2014 data and HHRA would be included in this FYR, but would not delay the completion of the FYR or impact the Navy's legal obligation to meet its deadline. As the Navy has already recommended an addendum to address questions raised by the Forest City SI data, this would constitute an expanded effort rather than a new effort.

<u>Navy Response:</u> As discussed in the response to EPA general comment no. 5 and the responses to the Suquamish Tribe comments (see top of page 8 of the responses to comments on the draft 5-year review report), the Navy already proposed to include the findings of the 2014 tissue sampling and any conclusion and recommendations from the HHRA in the 5-year review addendum (see page 4-4 of the draft final 5-year review).

JPHC OU 1 CSM and LTM Review

The Tribe commented that, in addition to the follow up actions already proposed regarding questions raised by the Forest City SI data, the project team should be review the JPHC OU 1 CSM and re-evaluate the long-term monitoring objectives.

The Navy's response states "… the CSM and the long-term monitoring program will be updated, if needed." Revise sections 7 and 8 of the FYR to identify the need to review and revise the CSM and LTM and include a recommendation and milestone date for completion of the review and re-evaluation. The Tribe feels strongly that this should be a collaborative decision-making process. The proposed milestone date should allow enough time to accommodate that process.

<u>Navy Response:</u> The Phase II SI was performed by Forest City as part of their due diligence inquiries related to the public-private venture agreement ground lease. The Phase II SI was not performed for the Navy, nor was it performed under an EPA-approved SAP/QAPP. As recommended in the draft final 5-year review, the Navy will be verifying the Phase II SI sampling results (see recommendation nos. 1, 2, 5, and 7 on page 8-5 of the draft final 5-year review) by performing additional sampling under an EPA-approved SAP/QAPP. Depending on the results of this additional sampling, review and revision of the CSM and the long-term monitoring objectives may or may not be required. Therefore, until sampling results obtained under an EPA-approved SAP/QAPP are available, recommending review and revision of the CSM and the long-term monitoring objectives is premature.

MEETING NOTES
JPHC/NHB 3rd 5-YEAR REVIEW
COMMENT RESPONSE MEETING

MEETING DATE: August 05, 2015
MEETING TIME: 11:00 am – 12:30 pm

LOCATION: Century Square Building
1501 Fourth Avenue, Seattle, WA
13th Floor Coho Conference Room

Teleconference
Call In Number: 1-866-203-6896
Code: 1588214

PURPOSE: Meeting to discuss comment responses for the 3rd 5-Year Review. The Navy will provide written responses to stakeholder comments either in advance of the meeting or on the date of the meeting.

ATTENDEES:

Name	Organization
Ray Kobeski	NAVFAC NW
Denice Taylor	Suquamish Tribe
Erika Shaffer	DNR
Debbie Rodenhizer	AECOM
Nicole Rangel	AECOM
Jill Johnston	AECOM, Facilitator

Discussion Highlights:

Meeting recording started, attendance noted.

The Navy started with some clarifications on changes at the Navy. Ray has been replaced as OU1 RPM with Phil Nenninger, with the exception of the Jackson Park 5-Year Review. Ray is the team lead for Jackson Park; this includes technical direction of RPMs that are part of the Jackson Park team to ensure consistency and to ensure they are following Navy policy. Navy policy doesn't allow addition of analytical chemicals that are not specifically tied to a site and the upland is the source area.

Ray's earlier vision for the 5-Year Review. The Navy has a report that says more information is needed to ensure the remedy is protective. The vision is to confirm that this is a problem or confirm that there is not a problem based on samples that were taken for environmental liability purposes for a lease as part of a Phase II investigation performed for a different client by a different consultant. Protectiveness determination will be made based on additional data obtained by the NAVY through the CERCLA process.

Recommendation is to go with clean hands/dirty hands mercury sampling to get actual levels, confirm RDX, PAHs and arsenic that was found. As a temporary solution until CERCLA sampling with DQOs, the Navy is looking at the groundwater use restriction LUC and extending the boundaries of the current LUCs to cover those areas until the confirmation samples are analyzed. Until the 5-Year Review is done, which has reportedly been signed by the CO, but Ray doesn't have it back yet, he can't go to HQ to say more funding is needed. The idea is to get sampling done through the CERCLA process which would involve stakeholder input on the work plan, on the analytes, and move forward with making a protectiveness determination by March of 2017. The next phase, because an addendum is being done, tissue sampling round will be included in the addendum as indicated on page 4-4 of the draft final. Those projects will be with Phil Nenninger. It will be brought up as a separate project. Navy management knows that the sampling results need to be in hand 6-8 months prior to March 2017 to complete 5-Year Review and make a protectiveness determination.

Currently, the Navy agrees with EPA's comment on the draft report that the Phase II completed by another consultant for another client didn't follow the DQO process and therefore the Navy has to confirm those samples. Stakeholder input in the DQO process is needed in order to apply them to the 5-Year Review process and LTM process. General comment number 3 from EPA in Appendix G of the draft is where that EPA comment can be found. Navy legal provided input on whether or not this data can be included as it needs to be relevant and pertinent. The Navy had no input on the Phase II data, the Navy wants to confirm under CERCLA and then make recommendations on data that was collected through the CERCLA process. This would include stakeholder input/team collaboration.

One recommendation made to Phil is the use of multi-increment sampling for PAH and arsenic detection areas. Also which zone/aquifer – perched or the deeper one that is the same as the benzene release area? This all needs to be included in the work plans.

AECOM asked if people had a chance to look over the responses to comments. The Tribe responded that they were prepared to discuss Tribe comments, but not comfortable going over EPA comments.

The Navy stated that EPA and the Navy are required to say "no" out loud or in writing, otherwise it is interpreted as a "yes". The Navy is working with EPA to get any additional details on comments.

The team is not going to address EPA comments today, as EPA is not present. It is the Navy's understanding that since EPA did not require the meeting to change therefore they are comfortable with the responses to there comments.

The Tribe did not have the report handy during the meeting, but wants to make sure it is clear that tissue sampling will be included. It was very clear in the report that the Phase II data would be confirmed, but was not clear that the risk assessment data would also be included in the addendum process. The Tribe wants to double-check and make sure it is clear. The Tribe was mostly looking at Table 8 and noted that the comment response did reference where it was stated, but the Tribe wants to ensure it is clear.

The Navy asked if the Tribe wanted it added to ES-1. AECOM wanted to clarify that there is no issue with protectiveness related to this, that is why it doesn't show up in tables 7-16 or 8-1 or 8-2.

The Tribe stated that there is a disconnect between what data was included in the 5-Year Review, because newer data is available that could go into the addendum.

The Navy responded that they are not reviewing human health risk assessment or marine tissue sample results; they are reviewing whether or not it is protective of human health and the environment.

The Tribe stated that it does have to do with protectiveness.

The Navy stated that it doesn't have to do with protectiveness; it has to do with removing restrictions. As long as the LUC is in place, the remedy is protective. The HHRA is related to exit criteria for the remedy (removing LUCs).

From the Tribe's perspective, a harvest restriction is not considered a long-term remedy; it's something for the short term until the problem is taken care of.

The Navy responded that this is not what is written in the ROD. The Navy left waste in place and the remedy includes monitoring and use restrictions. Mercury was never removed, but now is being found in an outfall, the Navy doesn't know if this is site-related or coming from somewhere else. In June, the Navy HQ had to be told whether OU1 was in perpetuity or had a 30-year life and as the OU1 RPM, had to say in perpetuity. The Navy is looking at the remedy to see if additional items are needed, if RDX is detected, depending on the levels, the Navy will have to do some sort of action. The protectiveness is the restriction, and it needs to be maintained. The Navy needs the new data to know if ongoing monitoring is needed or if additional actions are needed.

The Tribe understands this, and it is the perfect reason to include tissue sampling data in the addendum as this is a risk level still above what is in the ROD, and with analytical uncertainty.

The Navy responded that they are going to include tissue data in the addendum.

AECOM stated that there is a bit of a nuance here. Table 8-1 in the document lists follow-up actions that affect protectiveness; there is a current and future column. The recommendations regarding marine tissue are 8 and 9 and they have no current protectiveness issue. The addendum comes in where there is a current protectiveness issue. The addendum is needed where there is something that could affect *current* protectiveness. If you don't know about current protectiveness, that's where the addendum is needed. We know that we're protective for marine tissue.

The Tribe stated that they believe we can do an addendum that addresses marine tissue as well.

The Navy stated that they will do that, they have agreed to include marine tissue data. However, the current protectiveness isn't affected.

The Navy stated that the marine tissue and HHRA are used as exit criteria and is used to determine whether or not addendum is required. Addendum is only required because of Phase II work.

The Tribe stated that now that the other information, that wasn't included in 5-Year Review is available and could be included in the addendum.

The Navy stated that yes, it will be included, as identified on page 4-4. There is guidance on how to write protectiveness statements. Following this guidance, marine tissue data won't show up in Section 9 or Table 8. However, it is included in other places in the 5-Year Review.

The Tribe will go back and check on the last Keyport protectiveness statements, it was a similar issue and they think it's in there. Tribe also will go back to ensure it is in the document.

Clarification was requested on what the need is related to the marine tissue data as it will be included in the addendum.

The Tribe stated that if it doesn't show up in Table 8, which is the concern. It needs to be clear. If it's only on page 4-4, and not showing up elsewhere, the Tribe thinks it needs to be there.

AECOM stated that table 8 doesn't talk about the addendum.

Remedy protectiveness is about whether or not restrictions in place are valid. The data or lack of data doesn't affect the remedy protectiveness.

The Tribe wants the data brought into the addendum.

The Navy stated that it will be in the addendum.

Tribe wants to be sure this happens and there is accountability for making it happen and Tribe believes it needs to be included in the table. This will be in the Tribe's response to response to comments.

The Navy stated that people are not allowed to touch shellfish currently, this covers protectiveness.

Tribe's focus is on long-term protectiveness.

The Navy stated that a lot of the comments received on the draft and draft final have concentrated on adding analytes back in after previous 5-Year Reviews removed them. The Navy will look at results of confirmation samples and see if they are tied to the site to have a means of justifying bringing them back. Chemicals need to be tied to the site. Long-term goal is unrestricted use of the bay for all to enjoy.

The third comment was discussed. The Tribe thinks their comment is valid, and response says it's premature. The Tribe doesn't think it's premature, but it can be included as an objective in the QAPP.

The Navy feels that it belongs in the QAPP. A lot of the chemicals that stakeholders want to look at were ruled out in the original RI and the last two 5-Year Reviews.

The Tribe stated that the reason the question came up is from OU2 samples. Information related to Jackson Park should be considered to see how it relates overall, not limiting by OUs which were administratively separated.

The Navy stated that their decision has been that many of the chemicals were found in the sediments but were not tied back to the uplands.

The Tribe indicated their concern was with tissue data and comparison to eco screening levels and HH screening levels.

The Navy stated that the OU1 RI tied chemicals to the uplands, and ruled out some chemicals as not being site related.

The Tribe stated that the OU1 RI didn't have the extensive tissue data set.

The Navy stated that OU1 RI ruled out a number of the chemicals.

The Tribe is wondering why they Navy doesn't want to look at the data. The Navy responded that data from the tissue samples wasn't tied to the site at the time. The chemical was not part of the uplands. Sediment and tissue data may not be tied to the site. OU2 only covers OU2 and perhaps didn't do enough lab sampling to tie to the site. OU2 is for ecological risk from the site. The bay is not the site. The uplands are the site.

The Tribe stated that this is an administrative divide.

AECOM stated that this is a highly developed area, chemicals in the bay could come from a number of sources. Just because it's in the bay, doesn't mean the Navy put it there.

Tribe agrees that you look at what is and what isn't site related and Tribe doesn't feel that what does come from the site is not fully answered yet.

Both the Navy and Tribe appear to be stating that there is not enough data to confirm what is or isn't site related. More data will be collected and decisions can be made from there.

The Navy stated that most likely data will come back to say restrictions are valid and needed. Addendum will likely agree that restrictions are needed.

For the 5-Year Review Addendum, the ROD requires them to look at 4 uses for shellfish, 2 tribal related, and 2 for commercial and recreational. Long-term goal is to remove restrictions. Right now only looking at tribal and saying that's valid for commercial and recreational. That is not right.

The Tribe has the power and responsibility to set their own management practices. The Navy doesn't have anything to do with this. Navy agrees, it's outside CERCLA and Navy jurisdiction. The Navy has to also consider restrictions to DNR and residential.

The Tribe stated that DOH establishes harvest restrictions, not the Navy. The Navy stated that they have sent DOH notice that restrictions should remain in place. DOH makes the decision on whether or not to release it. The Tribe requested information about who the Navy corresponded with at DOH. The Navy's information came straight from OU1 ROD, listed the analytes the Navy is currently responsible for, and let DOH know that the Navy hasn't met goals yet. DOH will also get the risk assessment when it goes final.

No one had additional comments/issues.

Action Items:

The Tribe will review the draft final 5-Year Review to see if it is clear that marine tissue data will be included in the addendum and will send comments on comment responses.

The Navy will send the Tribe the names of the people contacted at DOH.

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THE SUQUAMISH TRIBE
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August 24, 2015

Ray Kobeski
Naval Facilities Engineering Command, NW
1101 Tautog Circle
Silverdale, WA 98315-1101

RE: Navy's Response to Comments and 8/5/2015 Comment Resolution Mtg.
Suquamish Tribe Comments
Draft-Final Third Five Year Review for JPHC/NHB

Mr. Kobeski:

The purpose of this letter is to clarify where the Tribe disagrees with the Navy's written and/or verbal response to tribal comments on the draft-final Third Five Year Review (5YR) for the JPHC/NHB site. It is expected that this letter will be included in the final 5YR.

<u>JPHC OU 1 2014 Tissue Data /HHRA and 5YR Addendum</u>

The Navy has agreed to include the 2014 tissue data and any conclusions and recommendations from the HHRA in the 5YR addendum, but has stated that inclusion of the tissue data and HHRA findings has nothing to do with determining protectiveness.

Given that the tissue data and HHRA findings are used to determine potential risk levels and to evaluate the continued need for harvest restrictions, the Tribe disagrees with the Navy's statements that this data and information are not related to evaluating protectiveness at the site. The Tribe understands that current exposure is controlled through a shellfish harvest restriction. Long-term (future) protectiveness, however, will be determined based on tissue data and risk assessment. Note that Table 8-1 of the draft final 5YR already indicates that the follow up action related to the tissue data and HHRA findings affect future protectiveness.

The Tribe continues to recommend that the text of the 5YR be revised to further clarify that the results of the 2014 tissue sampling and the findings of the HHRA will be included in the addendum and will be considered in the protectiveness determination for the remedy at OU 1.

JPHC OU 1 CSM and LTM Review

The Tribe has repeatedly recommended that, in addition to the follow up actions already proposed regarding the Forest City SI data, the project team should review the JPCH OU 1 CSM and re-evaluate the long-term monitoring objectives for the site. The Tribe has also suggested that an optimization process might be beneficial.

The Navy has responded that it believes review of the CSM and the long-term monitoring objectives is premature until after the additional sampling results are obtained.

The Tribe feels strongly that the project would benefit from a more pro-active, integrated and collaborative planning process regarding long-term monitoring, including tissue monitoring, for the site. The Tribe again recommends that the review and revision of the CSM and long-term monitoring objectives be added as a follow up action, with a milestone date, to this 5YR. The Tribe also notes that review of the CSM and establishment of monitoring objectives will be part of the UFP QAPP process for collection of additional monitoring data whether or not the Navy agrees to make the suggested revisions to the 5YR.

JPHC Analytical Parameters for HHRA

In reference to the project team's desire to evaluate OU 2 tissue data for human health risks, the Navy stated during the 8/5/2015 comment resolution meeting that stakeholders were trying to look at COCs that were "ruled out" in the original RI, and that OU 1 monitoring was only related to the JPHC uplands, not to the bay. The Navy's position is that there is no basis for adding any additional analytes to the long-term tissue monitoring.

The Tribe disagrees with the Navy's position. Tissue monitoring and human health risk assessment were included as part of OU 1 and are used to assess risks via exposure pathways that are related to both the upland and marine environments. The Tribe believes that achieving the overall goals for the site depend on an integrated and holistic approach for monitoring and management rather than on maintaining administrative divides between the operable units. It is for this reason that the Tribe feels it is imperative to re-evaluate the CSM and long-term monitoring objectives for the JPHC site.

The Tribe also notes that the project team has not yet met to resolve comments on the draft 2014 HHRA, including the Navy's data gaps evaluation for tissue sampling analytical parameters

Please contact me if you would like to discuss these issues further. I feel that further discussions should include EPA and DNR, if they choose to participate.

Sincerely,

Denice Taylor

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cc: Harry Craig, EPA
Erika Shaffer, WA DNR