Final

February 6, 2018

Third Five-Year Review for Petroleum Sites, 2012-2017

Naval Air Station Whidbey Island

Oak Harbor, Washington

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

Contract No. N44255-14-D-9013; Delivery Order No. 0022

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FINAL
THIRD FIVE-YEAR REVIEW FOR PETROLEUM SITES, 2012-2017
NAVAL AIR STATION WHIDBEY ISLAND
OAK HARBOR, WASHINGTON

Prepared by
Battelle
Columbus, Ohio

Prepared for
Naval Facilities Engineering Command Northwest
Silverdale, Washington

U.S. Navy Contract No. N44255-14-D-9013
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DOCUMENT IDENTIFICATION

Document Title:	Final Third Five-Year Review for Petroleum Sites, 2012-2017
Site Name/Location:	Naval Air Station Whidbey Island, Oak Harbor, Washington
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Report Coverage:	This report presents the results of the third five-year review (FYR; from July 2012 through January 2017) performed for Fuel Farms 1, 2, 3, and 4 and Building 357 at Naval Air Station (NAS) Whidbey Island, Oak Harbor, Washington. This FYR report was prepared by Battelle for Naval Facilities Engineering Command Northwest under Contract No. N44255-14-D-9013, Delivery Order No. 0022.
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EXECUTIVE SUMMARY

This report presents the results of the third five-year review (FYR) performed for the five petroleum sites located at Naval Air Station (NAS) Whidbey Island, Oak Harbor, Washington. It summarizes all the remedial activity data over the past five years (i.e., July 2012 through January 2017) for Fuel Farms 1, 2, 3, and 4 and Building 357. This FYR report was developed in accordance with the *Navy Toolkit for Preparing Five-Year Reviews* (Naval Facilities Engineering Command [NAVFAC], 2013c).

Fuel Farms 1, 2, 3, and 4 and Building 357 are regulated under the Model Toxics Control Act (MTCA) with oversight from the Washington State Department of Ecology, the lead regulatory agency. As the lead agency for the environmental cleanup, the Navy initiated this third FYR for the petroleum sites because contaminant concentrations remaining in soil and groundwater at these sites exceeded the MTCA Method A cleanup levels (CULs) selected when the decision documents were finalized and do not permit unlimited use and unrestricted exposure. The triggering action for this review was the completion date of the second FYR (i.e., September 18, 2012). There are no new data to present in this FYR for Building 357. Groundwater sampling was most recently conducted at Building 357 in August 2007 and contaminant concentrations exceeded CULs. An additional sampling event is needed to determine if current concentrations of dissolved-phase components indicate no further action (NFA) is appropriate.

The purpose of the FYR was to: 1) determine if the remedy at the sites remains protective of human health and the environment; 2) identify any issues with the remedy; 3) provide recommendations to address any issues; and 4) determine if the current decision documents (NAVFAC, 2013a and 2013b; Foster Wheeler, 2000) remain the most appropriate decision documents for these petroleum sites.

The FYR concludes that the remedies (including free product recovery, compliance/groundwater monitoring, and/or natural attenuation) at Fuel Farms 1, 2, 3, and 4 are functioning as intended based on the current decision documents (NAVFAC, 2013a and 2013b).

- Free Product Recovery: If any well had measurable free product (i.e., >0.02 ft) during a monitoring event, then the free product was removed to the maximum extent practicable, and free product recovery efforts at the well continued on an annual basis. Free product recovery efforts were conducted at Fuel Farms 1, 2, and 3 on an annual basis during this five-year reporting period (i.e., during winter months when free product thickness is greatest allowing for maximum free product recovery). Although free product was detected in well MW-109 at Fuel Farm 4 in 2015 and 2016, the free product thickness was so minimal (i.e., at 0.03 to 0.04 ft) that recovery efforts were not practicable.

- Compliance/Groundwater Monitoring: Activities were conducted at Fuel Farms 1, 2, 3, and 4, but not exactly at the frequency (or including the analytes) specified in the revised decision document (NAVFAC, 2013a). Despite this irregularity, the data are sufficient to: 1) determine groundwater flow direction; and 2) evaluate the nature and extent of dissolved-phase contamination in the subsurface at Fuel Farms 1, 2, 3, and 4. More importantly, the data are sufficient to demonstrate that the dissolved-phase petroleum contaminant plumes at Fuel Farms 1 and 2 do not pose a risk to Crescent Harbor.

- Natural Attenuation: Evaluations of plume stability, electron acceptors, and statistical modeling demonstrate that natural attenuation is occurring in the subsurface at Fuel Farms 1, 2, and 3 to varying degrees depending on subsurface conditions.

A key finding of the technical assessment was that the revised decision documents (NAVFAC, 2013a and 2013b) did not include updated CULs. Consequently, the CULs for some contaminants are significantly different from what the CULs would be based on current standard assumptions and regulatory requirements. There have been substantial changes to exposure assumptions and toxicity data; revisions to state regulations and guidance on remediation of contaminated sites; and promulgation of new state surface water applicable or relevant and appropriate requirements (ARARs). Despite these changes, the remedial actions completed to date, along with the land use controls (LUCs) implemented to prevent exposure to contaminants remaining in place, continue to be protective of human health and the environment, as long as the LUCs remain in place.

The remedies at Fuel Farms 1, 2, 3, and 4 and Building 357 continue to be protective of human health and the environment because: 1) based on compliance/groundwater monitoring, the dissolved-phase petroleum and chlorinated volatile organic compound (VOC) plumes are fully characterized and delineated; 2) natural attenuation is occurring in the subsurface; and 3) existing LUCs prevent exposure to contaminants at concentrations above CULs. However, the following actions are recommended to ensure continued protectiveness in the future:

1. Re-evaluate and optimize the compliance/groundwater monitoring activities;
2. Revisit soil and groundwater CULs based on current standard assumptions and regulatory requirements;
3. Revisit site-specific LUCs and LUC boundaries based on updated/revised soil and groundwater CULs;
4. Revise the current decision document (NAVFAC, 2013a) to include establish/reference updated CULs; revised LUCs and LUC boundaries, and optimized monitoring approach;
5. Prepare a LUC Instruction to ensure LUC maintenance is performed by NAS Whidbey Island personnel;
6. Begin a vulnerability assessment of the remedies to climate change impacts at Fuel Farms 1 and 2 in support of a future adaptation plan for NAS Whidbey Island; and
7. Conduct an additional sampling event at Building 357 to determine current concentrations of dissolved-phase components and if requesting a NFA determination from Ecology is appropriate.

In addition to these recommended actions, the current remedies will continue, including:

- Annual LUC inspections per the *Final Land Use Control Implementation Plan, Naval Air Station Whidbey Island, Oak Harbor, Washington* (Battelle, 2017);
- Free product recovery efforts, particularly at Fuel Farm 3 to enhance natural attenuation;
- Compliance/groundwater monitoring of the nature and extent of dissolved-phase contamination in the subsurface;
- An evaluation of natural attenuation at Fuel Farms 1, 2, and 3; and
- Periodic reviews in the form of a FYR report per Washington Administrative Code 173-340-420(3).

FIVE-YEAR REVIEW SUMMARY FORM

<table>
<tr><th colspan="3">SITE IDENTIFICATION</th></tr>
<tr><td colspan="3">Site Name: Naval Air Station Whidbey Island, Fuel Farms 1, 2, 3, and 4 and Building 357</td></tr>
<tr><td>Region: Northwest</td><td>State: WA</td><td>City/County: Oak Harbor/Island County</td></tr>
<tr><th colspan="3">SITE STATUS</th></tr>
<tr><td colspan="3">Regulatory Agency: Washington State Department of Ecology</td></tr>
<tr><td colspan="3">Regulatory Status: MTCA Petroleum Sites</td></tr>
<tr><td colspan="3">Remedial Status: Free product recovery, compliance/groundwater monitoring, natural attenuation, land use controls (LUCs), and/or periodic reviews</td></tr>
<tr><td>Multiple Sites? Yes (5 Sites)</td><td colspan="2">Has the site achieved construction completion? Yes</td></tr>
<tr><td colspan="3">Area Activity Status: Fuel Farms 1, 2, 3, and 4 are inactive, closed fuel storage facilities. Building 357 is an active single pump diesel fueling station.</td></tr>
<tr><td colspan="3">Has site been put into reuse? No, Fuel Farms 1, 2, 3, and 4 have remained as inactive, closed fuel storage facilities and Building 357 is an active, single pump diesel fueling station. Fuel Farm 1 is designated for industrial use with restricted recreational land use limited to the Upper Area along paved footpaths with traffic confined to specific areas, signs, and barrier vegetation along paved athletic areas. Fuel Farm 2 is designated for non-residential use. Fuel Farms 3 and 4 and Building 357 are designated for industrial use.</td></tr>
<tr><th colspan="3">REVIEW STATUS</th></tr>
<tr><td colspan="3">Lead agency: Navy</td></tr>
<tr><td colspan="3">Author name: Kristeen Bennett</td></tr>
<tr><td colspan="3">Author affiliation: NAVFAC Northwest</td></tr>
<tr><td colspan="3">Review period: July 2012 through January 2017</td></tr>
<tr><td colspan="3">Date of site inspection: August 4, 7, 8, 9, and 10, 2017</td></tr>
<tr><td colspan="3">Type of review: MTCA Five-Year Review</td></tr>
<tr><td colspan="3">Review number: 3 (Third)</td></tr>
<tr><td colspan="3">Triggering action date: September 18, 2012</td></tr>
<tr><td colspan="3">Due date: March 14, 2018</td></tr>
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Five-Year Review Summary Form (Continued)

<table>
<tr><th colspan="5">Issues/Recommendations</th></tr>
<tr><td colspan="5">Issues and Recommendations Identified in the Five-Year Review:</td></tr>
<tr><td rowspan="3">Sites: Fuel Farms 1, 2, 3, and 4 and Building 357</td><td colspan="4">Issue Category: General</td></tr>
<tr><td colspan="4">Issue: Based on review of the compliance/groundwater monitoring activities conducted from 2012 to 2017, additional sampling events have been conducted at Fuel Farms 1, 2, 3, and 4 after four consecutive quarters of TPH-GRO, TPH-DRO, and BTEX results below groundwater CULs (i.e., inconsistent with the well logic presented in the decision document [NAVFAC, 2013a]).</td></tr>
<tr><td colspan="4">Recommendation: Re-evaluate and optimize the compliance/groundwater monitoring activities for Fuel Farms 1, 2, 3, and 4 via a decision document update.</td></tr>
<tr><td>Affect Current Protectiveness</td><td>Affect Future Protectiveness</td><td>Implementing Party</td><td>Oversight Party</td><td>Milestone Date</td></tr>
<tr><td>No</td><td>Yes</td><td>Navy</td><td>Ecology</td><td>June 2018</td></tr>
<tr><td rowspan="3">Sites: Fuel Farms 1, 2, 3, and 4 and Building 357</td><td colspan="4">Issue Category: General</td></tr>
<tr><td colspan="4">Issue: CULs for total petroleum hydrocarbons (TPH) use MTCA Method A which does not take into consideration the site-specific composition of the TPH.</td></tr>
<tr><td colspan="4">Recommendation: Use MTCA Method B to establish updated CULs for TPH (instead of MTCA Method A). MTCA Method B CULs are beneficial where the composition of the petroleum release has significantly changed through remediation, natural attenuation, and/or biodegradation. MTCA Method B takes into consideration the site-specific composition of the TPH and by doing so, allows for a more accurate representation of risk drivers at the site. Conduct groundwater sampling and analysis using the EPH/VPH methods. Use these data and Ecology's TPH worksheet to calculate updated groundwater CULs for TPH. Compare updated CULs to groundwater data.</td></tr>
<tr><td>Affect Current Protectiveness</td><td>Affect Future Protectiveness</td><td>Implementing Party</td><td>Oversight Party</td><td>Milestone Date</td></tr>
<tr><td>No</td><td>Yes</td><td>Navy</td><td>Ecology</td><td>June 2020</td></tr>
<tr><td rowspan="3">Sites: Fuel Farms 1, 2, 3, and 4 and Building 357</td><td colspan="4">Issue Category: General</td></tr>
<tr><td colspan="4">Issue: Soil CULs are not up to date based on CLARC Tool and existing soil data.</td></tr>
<tr><td colspan="4">Recommendation: Use existing soil data and CLARC Tool to calculate updated soil CULs. Compare updated CULs to soil data to reevaluate site 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>No</td><td>Yes</td><td>Navy</td><td>Ecology</td><td>June 2020</td></tr>
</table>

Five-Year Review Summary Form (Continued)

Sites: Fuel Farms 1, 2, 3, and 4 and Building 357	**Issue Category:** General			
	Issue: Specific LUCs and LUC boundaries may no longer be appropriate or needed to maintain remedy protectiveness based on updated/revised soil and groundwater CULs.			
	Recommendation: Re-evaluate LUCs and the LUC boundaries (as related to updated soil and groundwater CULs that have increased due to current ARARs) to determine if still appropriate and needed to maintain remedy protectiveness.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Navy	Ecology	June 2020

Sites: Fuel Farms 1, 2, 3, and 4 and Building 357	**Issue Category:** General			
	Issue: Revised CAP (NAVFAC, 2013a) does not establish/reference CULs based on current standard assumptions and regulatory requirements.			
	Recommendation: Update the revised CAP (NAVFAC, 2013a) to include: 1) an evaluation of current ARARs and resulting/updated soil and groundwater CULs; 2) revised LUCs and LUC boundaries (based on the updated CULs); and 3) an optimized monitoring approach.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Navy	Ecology	June 2020

Sites: Fuel Farms 1, 2, 3, and 4 and Building 357	**Issue Category:** General			
	Issue: Remedy protectiveness at Fuel Farms1, 2, 3, and 4 and Building 357 is dependent on LUC maintenance; however, the LUC Instruction has not been completed to ensure maintenance of LUCs by NAS Whidbey Island personnel.			
	Recommendation: Work with Installation Chain-of Command to prepare a LUC Instruction to ensure maintenance of LUCs by NAS Whidbey Island personnel.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Navy	Ecology	June 2020

Sites: Fuel Farms 1 and 2	**Issue Category:** Specific
	Issue: Due to the shoreline location of Fuel Farms 1 and 2 and the compliance/groundwater monitoring component of their remedy, these petroleum sites may be vulnerable to climate change impacts.
	Recommendation: Leverage ongoing Navy regional planning to begin an assessment of the vulnerability of the remedies to climate change impacts in support of a future adaptation plan for NAS Whidbey Island.

Five-Year Review Summary Form (Continued)

Affect Current Protectiveness	Affect Future Protectiveness	Implementing Party	Oversight Party	Milestone Date
No	Yes	Navy	Ecology	June 2022
Site: Fuel Farm 3	**Issue Category:** Specific			
	Issue: LUCs associated with soil disturbance and land use may not be appropriate/needed based current ARARs.			
	Recommendation: Review existing soil data (from 0 – 15 ft bgs) and compare to current ARARs to determine if LUCs associated with soil disturbance and maintaining current land use are still appropriate and needed to maintain remedy protectiveness.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Navy	Ecology	June 2020
Site: Building 357	**Issue Category:** Specific			
	Issue: Groundwater sampling was most recently conducted at Building 357 in August 2007 and benzene and TPH-GRO concentrations exceeded CULs. Therefore, current concentrations of dissolved-phase components are unknown and the potential for NFA cannot be evaluated at this time.			
	Recommendation: Conduct groundwater sampling and analysis of benzene and TPH-GRO and compare to current ARARs to evaluate current site conditions.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Navy	Ecology	June 2020
Site: Building 357	**Issue Category:** Specific			
	Issue: LUCs associated with characterizing and disposing of soil and maintaining current land use may not be appropriate/needed, since current MTCA Method A CULs for soil have been achieved.			
	Recommendation: Re-evaluate LUCs associated with characterizing and disposing of soil and maintaining current land use to determine if these LUCs are still appropriate and needed to maintain remedy protectiveness, since current MTCA Method A CULs for soil have been achieved.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Navy	Ecology	June 2020

Five-Year Review Summary Form (Continued)

Protectiveness Statement(s)		
Sites: Fuel Farms 1, 2, 3, and 4 and Building 357	**Protectiveness Determination:** Protective	**Addendum Due Date:** NA
Protectiveness Statement: The remedies at Fuel Farms 1, 2, 3, and 4 and Building 357 currently protect human health and the environment because: 1) based on compliance/groundwater monitoring, the dissolved-phase petroleum and chlorinated VOC plumes are characterized and delineated; 2) natural attenuation is occurring in the subsurface; and/or 3) existing LUCs prevent exposure to contaminant concentrations above CULs.		

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SIGNATURE PAGE

Signature page for the Naval Air Station Whidbey Island Third Five-Year Review for Petroleum Sites, 2012-2017.

G.C. Moore
Captain, U.S. Navy
Commanding Officer
Naval Air Station Whidbey Island

3/15/18
Date

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ACRONYMS AND ABBREVIATIONS

ac	acre
amsl	above mean sea level
ARAR	applicable or relevant and appropriate requirement
avgas	aviation gasoline
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene and total xylenes
CAP	Cleanup Action Plan
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLARC	Cleanup Levels and Risk Calculations
COC	contaminant of concern
CSM	conceptual site model
CUL	cleanup level
DCE	dichloroethene
DO	dissolved oxygen
DOH	Department of Health
EC	engineering control
Ecology	Washington State Department of Ecology
Ft	feet
FYR	five-year review
IC	institutional control
IRACR	Independent Remedial Action Closure Report
IRIS	Integrated Risk Information System
LTM	long-term monitoring
LUC	land use control
MNA	monitored natural attenuation
MTCA	Model Toxics Control Act
NAS	Naval Air Station
NAVFAC	Naval Facilities Engineering Command
O&M	operation and maintenance
PAH	polycyclic aromatic hydrocarbon
RAB	Restoration Advisory Board
RAO	remedial action objective
RI	remedial investigation

RSL	Regional Screening Level
TBC	to be considered
TCE	trichloroethene
TEE	terrestrial ecological evaluation
TPH-DRO	for total petroleum hydrocarbons quantified as diesel range organics
TPH-GRO	for total petroleum hydrocarbons quantified as gasoline range organics
U.S. EPA	United States Environmental Protection Agency
USPS	US Postal Service
UST	underground storage tank
VC	vinyl chloride
VOC	volatile organic compound
VPH	volatile-range petroleum hydrocarbon
WAC	Washington Administrative Code

1.0 INTRODUCTION

This report presents the results of the third five-year review (FYR) performed for the five petroleum sites located at Naval Air Station (NAS) Whidbey Island, Oak Harbor, Washington. It summarizes all the remedial activity data collected over the past five years (i.e., July 2012 through January 2017) for Fuel Farms 1, 2, 3, and 4 and Building 357. This FYR report was prepared by Battelle for Naval Facilities Engineering Command (NAVFAC) Northwest (under Contract No. N44255-14-D-9013, Delivery Order No. 0022) in accordance with Washington Administrative Code (WAC) 173-340-420(3) for periodic reviews.

Fuel Farms 1, 2, 3, and 4 and Building 357 are regulated under the Model Toxics Control Act (MTCA) with oversight from the Washington State Department of Ecology (Ecology), the lead regulatory agency. This third FYR was initiated for Fuel Farms 1, 2, 3, and 4 and Building 357 because contaminant concentrations remaining in soil and groundwater at these sites exceeded the MTCA Method A cleanup levels (CULs) that were selected at the time the decision documents were finalized, which would not permit unlimited use and unrestricted exposure. The triggering action for this review was the completion date of the second FYR (i.e., September 18, 2012).

1.1 PURPOSE

The remedies for Fuel Farms 1, 2, and 3 were originally implemented under the *Cleanup Action Plan for Petroleum Sites* (URS, 1999). This cleanup action plan (CAP) was subsequently revised in 2013. Current provisions of the remedies are provided in the *Revised CAP, NAS Whidbey Island, Closed Former Fuel Farms 1, 2, 3 and Fire Training Area* (NAVFAC, 2013a). Similarly, the original remedy for Fuel Farm 4 was implemented under the *Independent Remedial Action Closure Report (IRACR) for Fuel Farm 4, Naval Air Station Whidbey Island* (URS, 2001). This IRACR was subsequently updated and the current remedy for Fuel Farm 4 is provided in the *IRACR Addendum, Site 11 NAS Whidbey Island, Former Fuel Farm 4 and Building 491* (NAVFAC, 2013b). The remedy for Building 357 was implemented under the *Final Independent Remedial Action Closure Report for Remediation of Contaminated Soils at Building 357* (Foster Wheeler, 2000).

The purpose of the FYR is to:

1. Determine if the remedies at the sites remain protective of human health and the environment;
2. Identify any issues with the remedies;
3. Provide recommendations to address any issues; and
4. Determine if the current decision documents (NAVFAC, 2013a and 2013b; Foster Wheeler, 2000) remain the most appropriate decision documents for these sites.

To this end, this FYR report utilizes data presented in annual long-term monitoring (LTM) reports, quarterly technical memoranda, and annual land use control (LUC) inspection reports from 2012 through 2017 to evaluate the protectiveness of the remedies at Fuel Farms 1, 2, 3, and 4 and Building 357. This report does not summarize or evaluate data presented in previous FYR reports. The methods, findings, and conclusions of this FYR are documented here along with any issues identified and associated recommendations to address those issues.

1.2 REGIONAL AND FACILITY DESCRIPTION

NAS Whidbey Island is located on Whidbey Island in Island County, Washington, at the northern end of Puget Sound and the eastern end of the Strait of Juan de Fuca (see Figure 1-1). Whidbey Island is a north-south oriented island approximately 40 miles in length, ranging from 1 to 10 miles in width. NAS Whidbey Island is a Department of the U.S. Navy facility commissioned on September 21, 1942 and comprised of eight geographically distinct areas. Two of these areas contain the five petroleum sites:

1. Ault Field (4,337 acres [ac]; Figure 1-2) includes most of the NAS Whidbey Island operational activities along with some housing and barracks, and contains Fuel Farms 3 and 4.
2. Seaplane Base (2,773 ac; Figure 1-3) is the center for military family activities, supporting the Family Service Center, Navy Housing Office, Commissary, Exchange, and most military housing units, and contains Fuel Farms 1 and 2 and Building 357.

These NAS Whidbey Island facilities are bordered by residential and agricultural land uses and are located near the city of Oak Harbor, which has a population of approximately 22,118 per the 2014 U.S. census.

1.3 REPORT ORGANIZATION AND CONTENT

This FYR report for the five petroleum sites (i.e., Fuel Farms 1, 2, 3, and 4 and Building 357) located at NAS Whidbey Island was developed in accordance with the *Navy Toolkit for Preparing Five-Year Reviews* (NAVFAC, 2013c). As such, this third FYR report includes the following sections:

- <u>Section 1.0 – Introduction:</u> presents the timeframe for this FYR; purpose of the FYR; regulatory requirements; pertinent decision documents; regional and facility background; and the organization of this report.
- <u>Section 2.0 – Site Chronology:</u> summarizes the major activities or events conducted at Fuel Farms 1, 2, 3, and 4 and Building 357 and their respective dates.
- <u>Section 3.0 – Background:</u> presents more detailed background information for Fuel Farms 1, 2, 3, and 4 and Building 357.
- <u>Section 4.0 – Cleanup Actions:</u> presents relevant site activities, including updated decision documents, remedy implementation, groundwater monitoring, LUC inspections, operation and maintenance (O&M) actions, and any changes/issues with remedial components.
- <u>Section 5.0 – Progress Since Last Five-Year Review:</u> describes the progress made addressing the recommendations and follow-up actions included in the second FYR.
- <u>Section 6.0 – Five-Year Review Process:</u> explains the FYR process conducted, including document and data reviews, site inspections, community involvement, interviews, and the schedule for the next FYR.
- <u>Section 7.0 – Technical Assessment:</u> provides data and information to answer the following questions for each of the five petroleum sites:
  - Is the remedy functioning as intended by the decision document?
  - Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?

  - Has any other information come to light that could call into question the protectiveness of the remedy?

- Section 8.0 – Recommendations and Follow-up Actions: identifies any issues that affect current or future protectiveness of the remedy and specifies recommendations and follow-up actions to address these issues.

- Section 9.0 – Certification of Protectiveness: specifies the current protectiveness of the remedies implemented at Fuel Farms 1, 2, 3, and 4 and Building 357.

- Section 10.0 – References: presents full references of documents and reports cited throughout this report.

The data and information presented in Sections 1 through 8 will support the evaluation of the protectiveness of the remedies at Fuel Farms 1, 2, 3, and 4 and Building 357, as specified in Section 9.0.

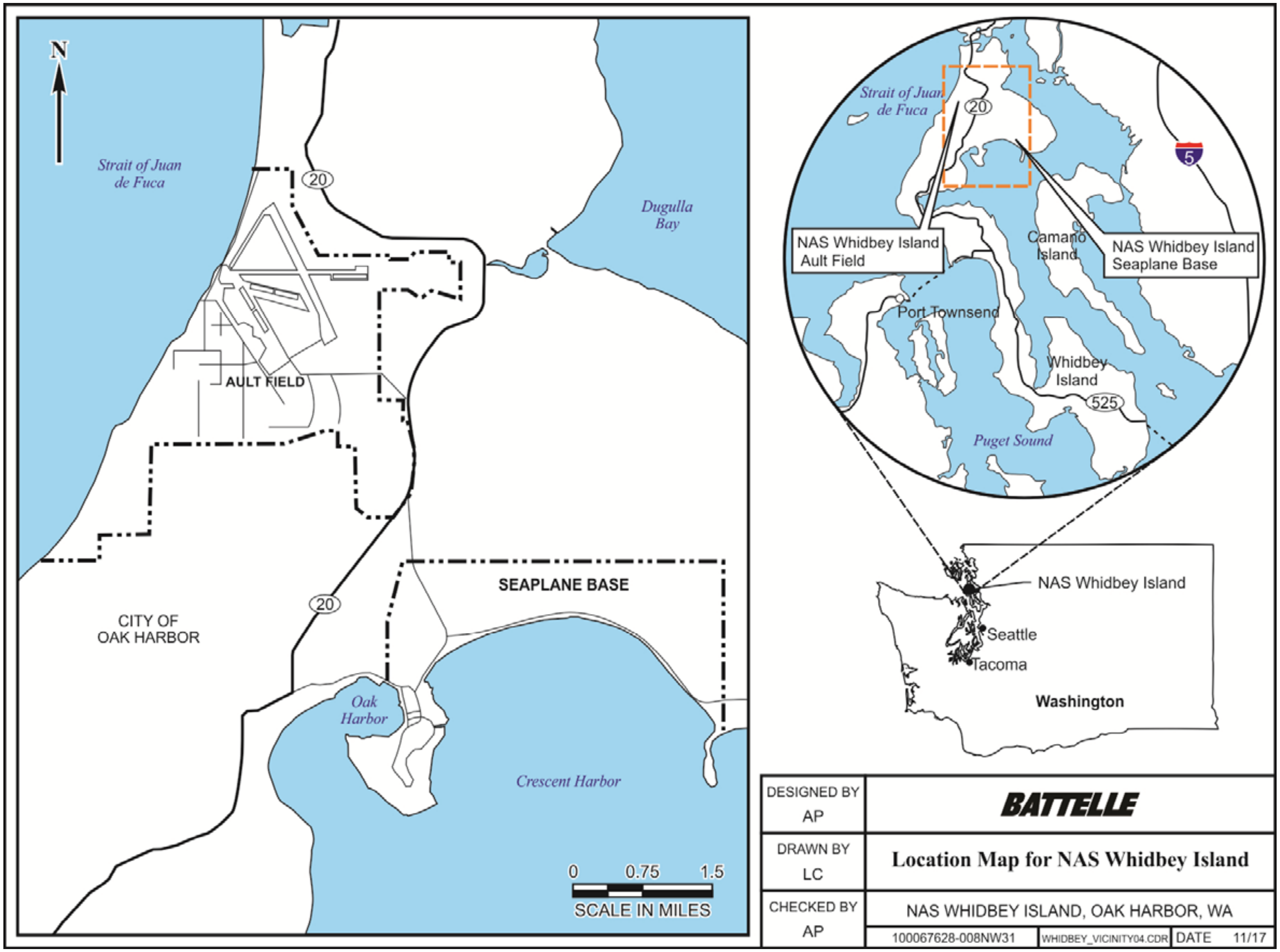

Figure 1-1. Location Map for NAS Whidbey Island

Figure 1-2. Ault Field Site Location Map

Figure 1-3. Seaplane Base Site Location Map

2.0 SITE CHRONOLOGY

This section summarizes dates of major events and activities conducted at Fuel Farms 1, 2, 3, and 4 and Building 357 located at NAS Whidbey Island. Figure 2-1 depicts the chronology of major events for these five petroleum sites relative to site discovery, investigation, and remediation. More detailed information regarding site events and activities is presented in the *Second Five-Year Review, Long-Term Monitoring and Operations Report, 2007-2011, Fuel Farms 1, 2, 3, and 4 and Building 357* (Sealaska, 2012); *Revised CAP, NAS Whidbey Island, Closed Former Fuel Farms 1, 2, 3 and Fire Training Area* (NAVFAC, 2013a); *IRACR Addendum, Site 11 NAS Whidbey Island, Former Fuel Farm 4 and Building 491* (NAVFAC, 2013b); and *Final Independent Remedial Action Closure Report for Remediation of Contaminated Soils at Building 357, Seaplane Base, NAS Whidbey Island* (Foster Wheeler, 2000).

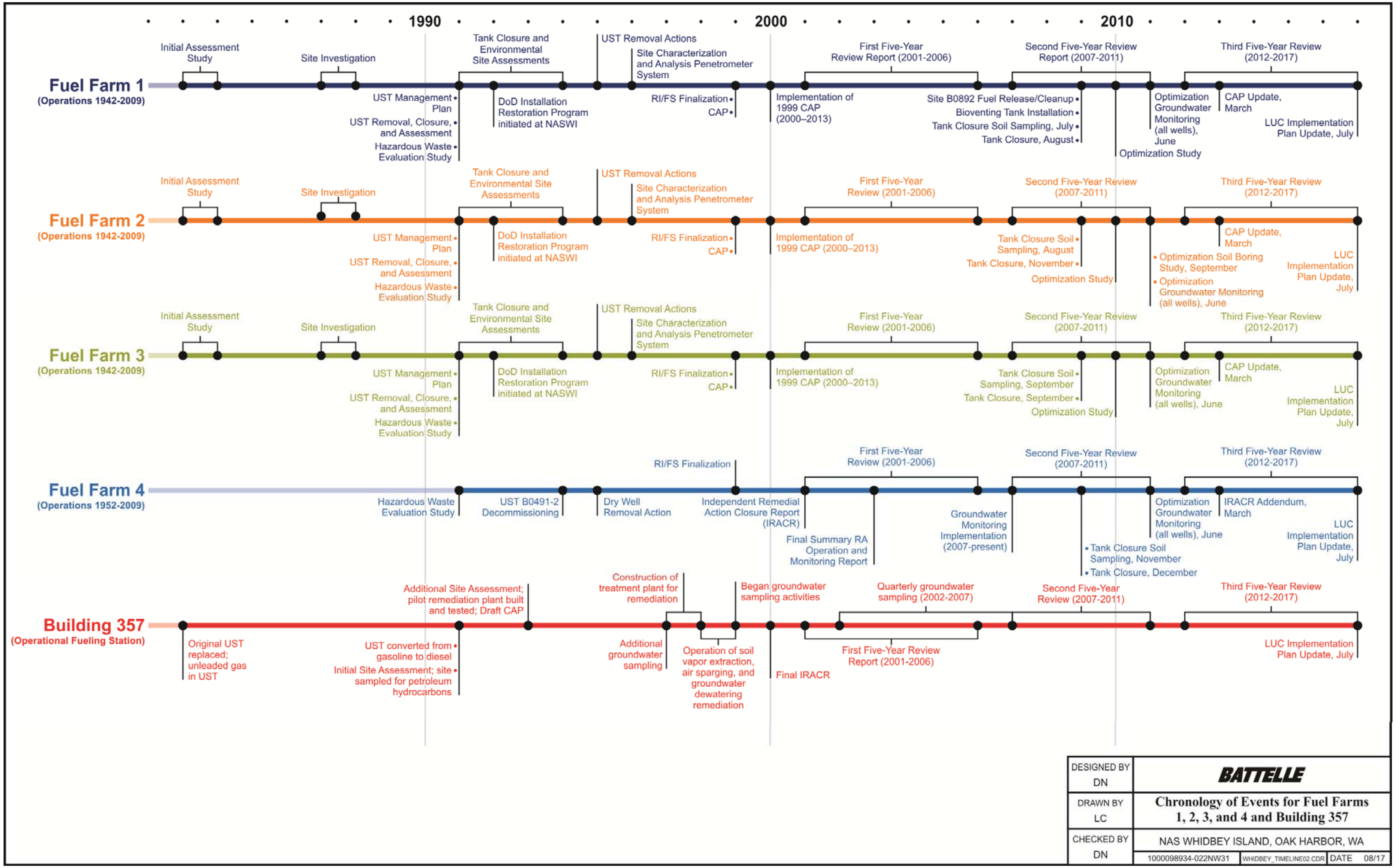

Figure 2-1. Chronology of Events for Fuel Farms 1, 2, 3, and 4 and Building 357

3.0 BACKGROUND

This section summarizes background information for Fuel Farms 1, 2, 3, and 4 and Building 357 located at NAS Whidbey Island. Table 3-1 presents the location and description; history of contamination; physical characteristics; primary threat; and current land and resource use for these five petroleum sites. More detailed information regarding site background is presented in the *Second Five-Year Review, Long-Term Monitoring and Operations Report, 2007-2011, Fuel Farms 1, 2, 3, and 4 and Building 357* (Sealaska, 2012); *Revised CAP, NAS Whidbey Island, Closed Former Fuel Farms 1, 2, 3 and Fire Training Area* (NAVFAC, 2013a); *IRACR Addendum, Site 11 NAS Whidbey Island, Former Fuel Farm 4 and Building 491* (NAVFAC, 2013b); and *Final Independent Remedial Action Closure Report for Remediation of Contaminated Soils at Building 357, Seaplane Base, NAS Whidbey Island* (Foster Wheeler, 2000).

Table 3-1. Background Information Summary for Petroleum Sites at NAS Whidbey Island

Sites	Location and Description	History of Contamination	Physical Characteristics	Risk Evaluation Summary	Land and Resource Use[(a)]
Fuel Farm 1	• Located on a peninsula between Oak Harbor and Crescent Harbor on Seaplane Base between Coral Sea Avenue and Tulagi Avenue (see Figure 3-1). • Total of nine underground storage tanks (USTs) were used to store fuel. • In addition to former fuel farm, includes Building (B) 0048, B0095, B0214, and B0892. • Upper Area encompasses the former fuel storage area. • Lower Area is next to Crescent Harbor and houses the NAS Whidbey Island Morale, Welfare and Recreation marina area and fuel pumping station B0892.	• Fuel spills during various periods between 1942 and 1999 when the fuel farm was a storage facility for marine diesel #1, fuel oil, off-specification fuel and aviation gasoline (avgas).	• Upper Area – o low hill with gradual slope toward the north and west; o lithology is predominantly brown to gray silt to clayey silt; o unconfined aquifer with groundwater flow generally radially away from Tanks 224 through 227; o average depth to groundwater ~22 ft bgs; and o minimal to no tidal influence. • Lower Area – o relatively flat at ~10 ft (feet) above mean sea level (amsl); o lithology is gray to olive-brown clayey silts underlain by a water-bearing, olive-gray to gray-brown silty sand unit with interbedded clay lenses; o hydraulically downgradient from the Upper Area; o average depth to groundwater ~7.5 ft bgs; o groundwater discharges to Crescent Harbor; and o based on historical reporting, there are tidal influences on groundwater.	• No unacceptable risk to humans for restricted recreational activities based on the results of the screening level risk assessment (CH2MHILL, 2011). • Installation of drinking water wells prohibited; therefore, no risk of groundwater exposure to humans. • Ground disturbance and construction activities controlled by dig permit process to minimize risk of soil exposure. • Dredging was conducted in 2011 and has likely been conducted on a regular basis to maintain usability of the fueling pier. Hence, any sediment that may have presented an ecological hazard has been periodically removed from the harbor. • Apart from the contaminant plume at Site B0892, the leading edges of the plumes do not reach the marine environment; therefore, no risk to surface water receptors. • Presence of chlorinated VOCs in groundwater do not pose unacceptable risks associated with vapor intrusion exposure pathway at Buildings 2735 and 81.	• Industrial use with restricted recreational land use limited to the Upper Area along paved footpaths with traffic confined to specific areas, signs, and barrier vegetation along paved athletic areas. • Groundwater is not a potential source of drinking water.
Fuel Farm 2	• Occupies ~12 ac on a peninsula between Oak Harbor and Crescent Harbor on Seaplane Base east of Coral Sea Avenue on Forbes Point overlooking Crescent Harbor (see Figure 3-2). • Total of seven 250,000-gallon USTs were used to store fuel at various times. • Covered by grasses and serviced by paved access roads.	• Fuel spills during various periods between 1942 and 1999 when the fuel farm was a storage facility for JP-5, JP-8, and avgas. • Three JP-5 spills documented from Fuel Farm 2: August 1988, May 1995, and September 1995. • In February 1999, petroleum was observed flowing overland from the area surrounding Tank 229 to the runoff ditch east of the site. Free petroleum product was also observed on the beach below the drainage outfalls.	• Gently slopes to the east (at ~50 ft amsl), then an undercut cliff separates the bluff from the beach area. • Lithology is predominantly gravelly to sandy silt (10-ft thick), overlying clayey silt (up to 20-ft thick), which in turn overlies a continuous silty sand layer. • Predominantly confined aquifer conditions with groundwater flow generally to the northeast. • Average depth to groundwater ~15 ft bgs. • Although site is adjacent to Crescent Harbor, it is elevated ~50 ft amsl and therefore, there is no tidal influence.	• Installation of drinking water wells prohibited; therefore, no risk of groundwater exposure to humans. • Ground disturbance and construction activities controlled by dig permit process to minimize risk of soil exposure. • Modifications to subsurface drainage system in 2000 has eliminated petroleum hydrocarbon-impacts to beach from Fuel Farm 2.	• Non-residential use; open access grass field. • Groundwater is not a potential source of drinking water.
Fuel Farm 3	• Occupies ~3 ac at Ault Field, north of Prowler Street and between Langley Boulevard and Charles Porter Avenue (see Figure 3-3). • Total of two 250,000-gallon USTs were used to store fuel at various times. • Upper Area encompasses the former fuel storage area and lower elevation area to the south. • Lower Area encompasses the lower elevation area to the north of the former fuel tanks.	• Fuel spills during various periods between 1942 and 1999 when the fuel farm was a storage facility for avgas. • In 1955, ~75,000 to 80,000 gallons of avgas spilled from Tank 235. Avgas saturated the ground around the tank and flowed down the hill to the north, flooding the parking lot, approximately 300 yards downgradient from the perimeter of Fuel Farm 3. ~20,000 to 30,000 gallons were recovered.	• USTs are located at the top of a broad, low hill that slopes downward predominantly toward the north and south, away from the USTs. • Lithology is predominantly interbedded layers of silty sands and clean sands with minor clay lenses and gravel. • Predominantly unconfined aquifer conditions with groundwater flow generally to the northeast. • Average depth to groundwater ~27 ft bgs.	• Installation of drinking water wells prohibited; therefore, no risk of groundwater exposure to humans. • Ground disturbance and construction activities controlled by dig permit process to minimize risk of soil exposure.	• Industrial use. • Groundwater is not a potential source of drinking water.
Fuel Farm 4	• Located on Ault Field south of Forrestal Street between Langley Boulevard and Charles Porter Avenue (see Figure 3-4). • Total of three USTs were used to store fuel at various times. • USTs were situated on a north-facing slope, generally covered with grasses.	• Fuel spills during various periods between 1952 and 1999. • From 1950s to 1969, overflow spills of up to 100 gallons were estimated to have occurred ~once per week at Fuel Farm 4. • In September 1973, ~13,500 gallons of JP-5 spilled at UST T0362-1. • In addition, three dry wells (one on the north side of each tank) were possibly used for disposal of tank bottom sludges and other petroleum products.	• Steeply sloped from south at 100 ft amsl to north at 60 ft amsl. • Lithology is predominantly interbedded layers of silty sands and clean sands with minor interbedded gravel zones. • Unconfined aquifer conditions with groundwater flow to the north-northwest. • Average depth to groundwater ~19 ft bgs.	• Installation of drinking water wells prohibited; therefore, no risk of groundwater exposure to humans. • Ground disturbance and construction activities controlled by dig permit process to minimize risk of soil exposure. • No significant groundwater to surface water transport, based on discharge evaluation conducted during the remedial investigation (RI) and pre- and post-tank closure surface water sample results from 2009/2010; therefore, no risk to surface water receptors.	• Industrial use. • Groundwater is not a potential source of drinking water.

Table 3-1. Background Information Summary for Petroleum Sites at NAS Whidbey Island (continued)

Sites	Location and Description	History of Contamination	Physical Characteristics	Risk Evaluation Summary	Land and Resource Use[(a)]
Building 357	• Located on a peninsula between Oak Harbor and Crescent Harbor at Seaplane Base north of Fuel Farm 1 between SE Catalina Drive and Coral Sea Avenue (see Figure 3-5). • Small, active public works fueling station. • One 2,000-gallon UST initially used to dispense leaded and unleaded gasoline and installed in 1983 to replace a leaking UST. • During upgrades in 1991, converted to dispense diesel fuel – its current function.	• A leaking UST reportedly "…full of holes and to have leaked badly" was replaced in 1983.	• Relatively flat at ~10 ft amsl; half of site is paved; and all surrounding areas are paved. • Lithology is artificial fill of fine sand and gravel to a depth of 4 to 9 ft bgs interbedded with organic-rich silt and clay, which overlie glacial and post-glacial sediments. • Groundwater flow is generally to the west-northwest; however, groundwater flow can reach static conditions due to heterogeneity and permeability of the subsurface soils, the proximity to Oak Harbor, and recharge rates from precipitation, groundwater flow conditions can reach an almost static condition. • Average depth to groundwater ~6.4 ft bgs.	• Installation of drinking water wells prohibited; therefore, no risk of groundwater exposure to humans. • Ground disturbance and construction activities controlled by dig permit process to minimize risk of soil exposure. • Paved area with no direct pathway from groundwater to surface water; therefore, no risk to surface water receptors.	• Industrial use; active single pump diesel fueling station. • Groundwater is not a potential source of drinking water.

(a) Land and resource use based on the LUCs presented in the *Land Use Control Implementation Plan, Naval Air Station Whidbey Island, Oak Harbor, Washington* (Battelle, 2017a).

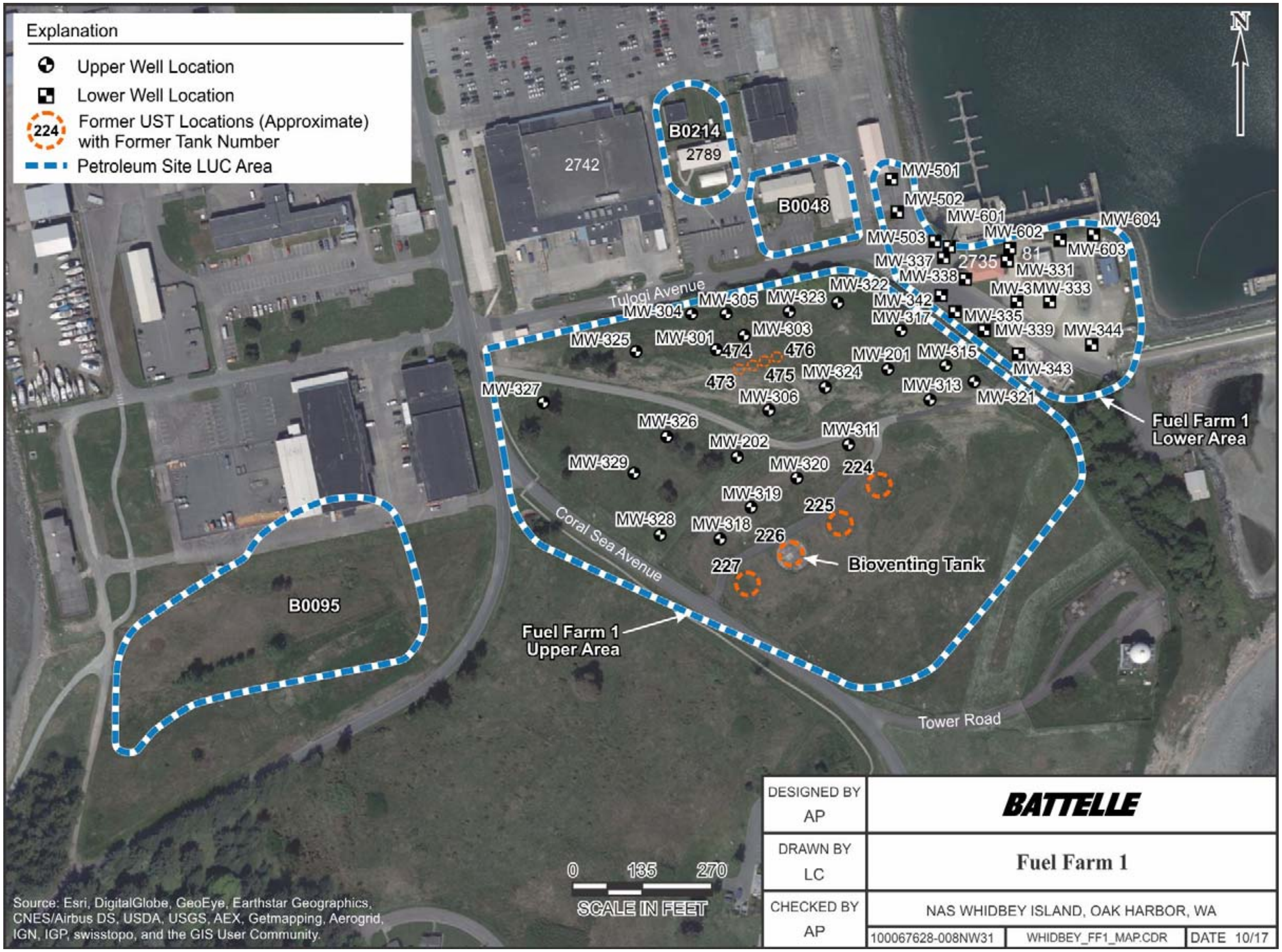

Figure 3-1. Fuel Farm 1

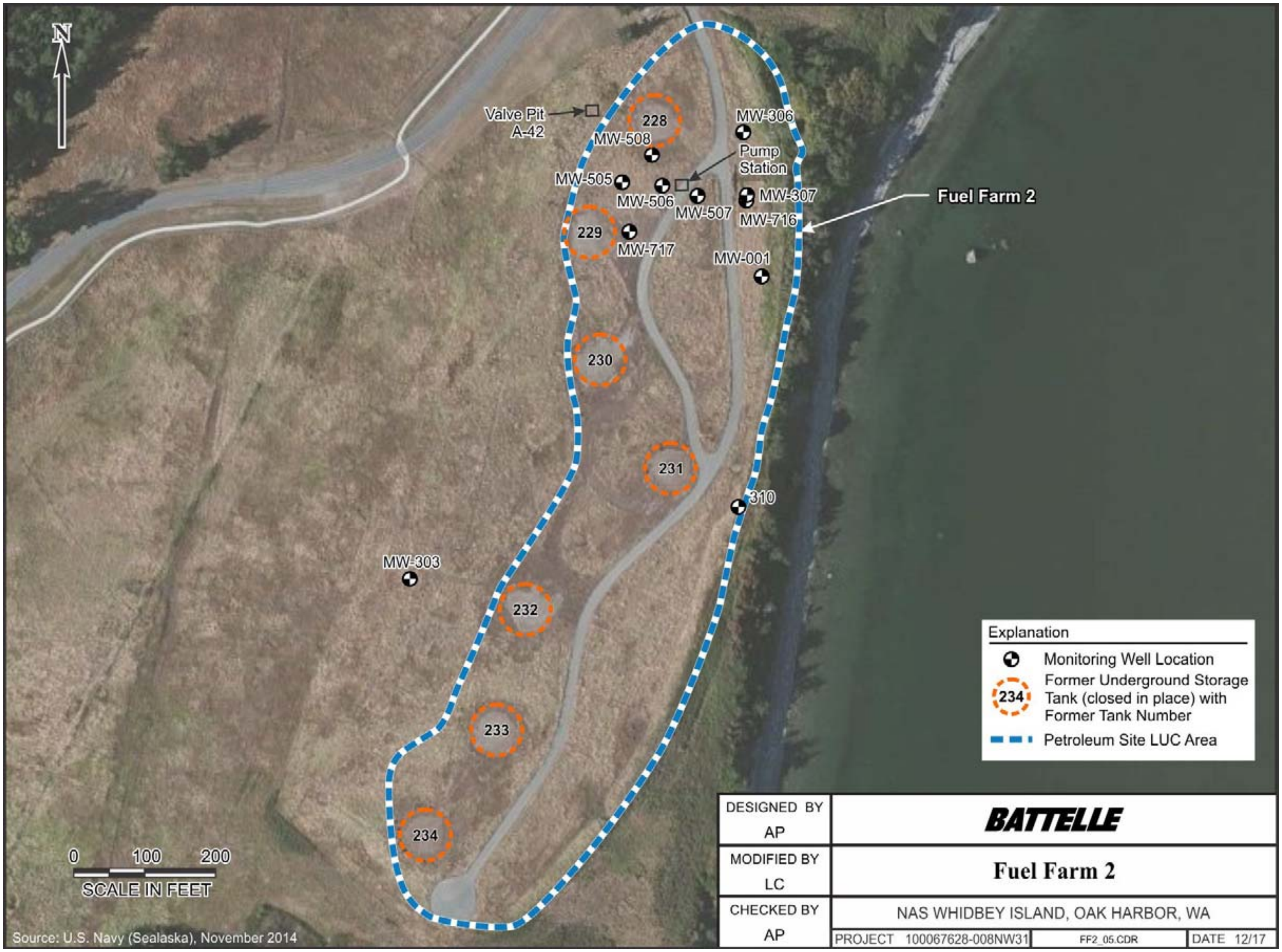

Figure 3-2. Fuel Farm 2

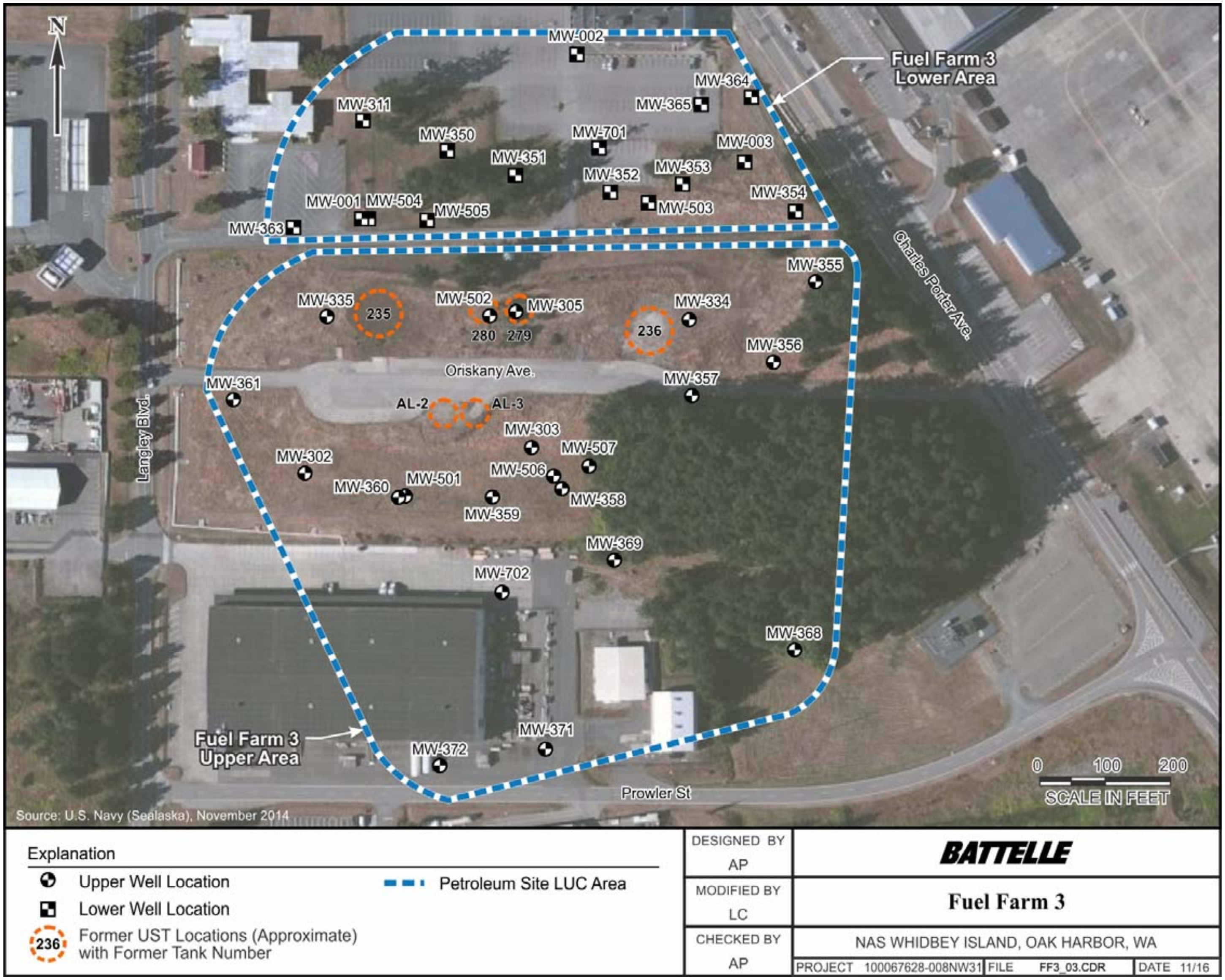

Figure 3-3. Fuel Farm 3

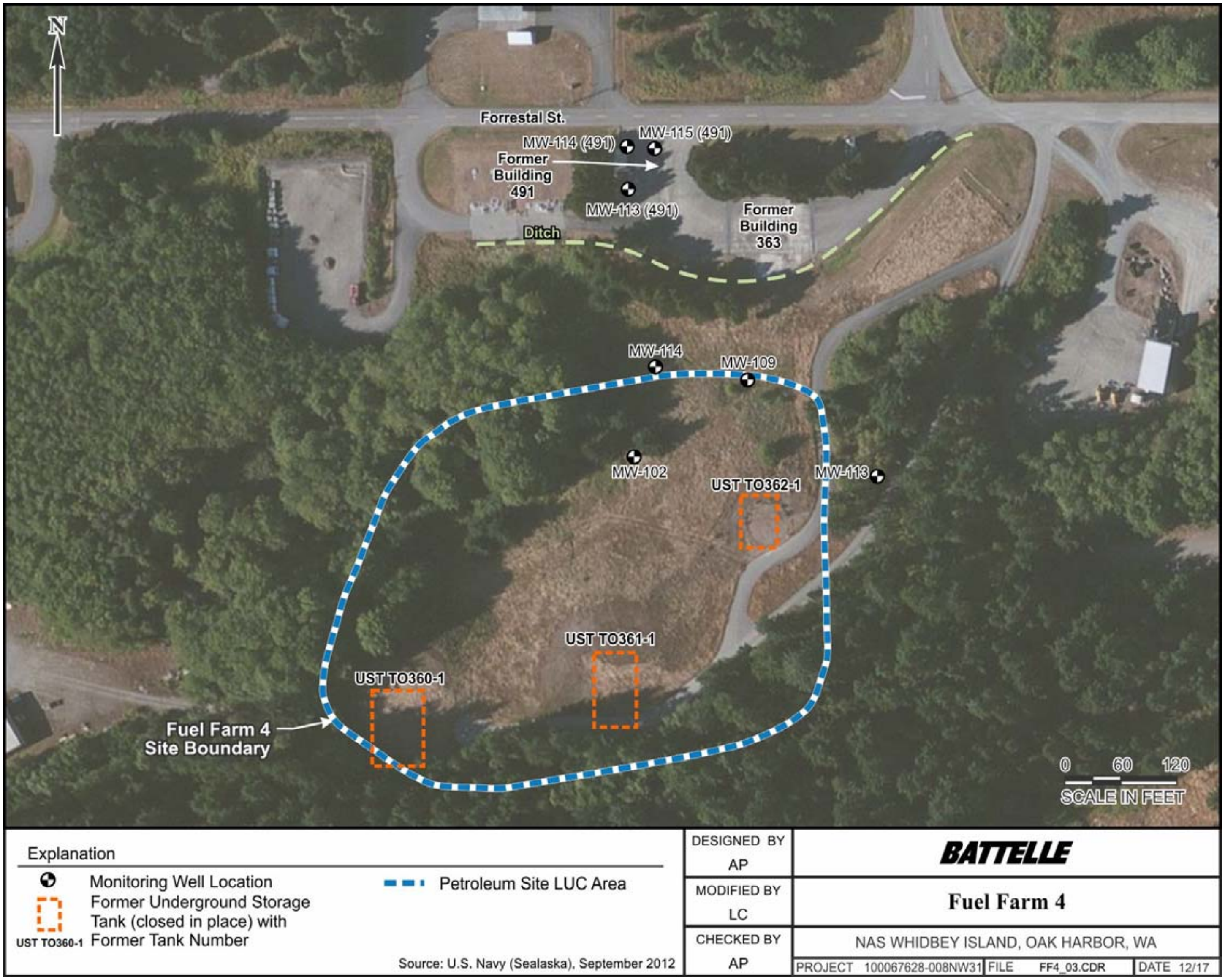

Figure 3-4. Fuel Farm 4

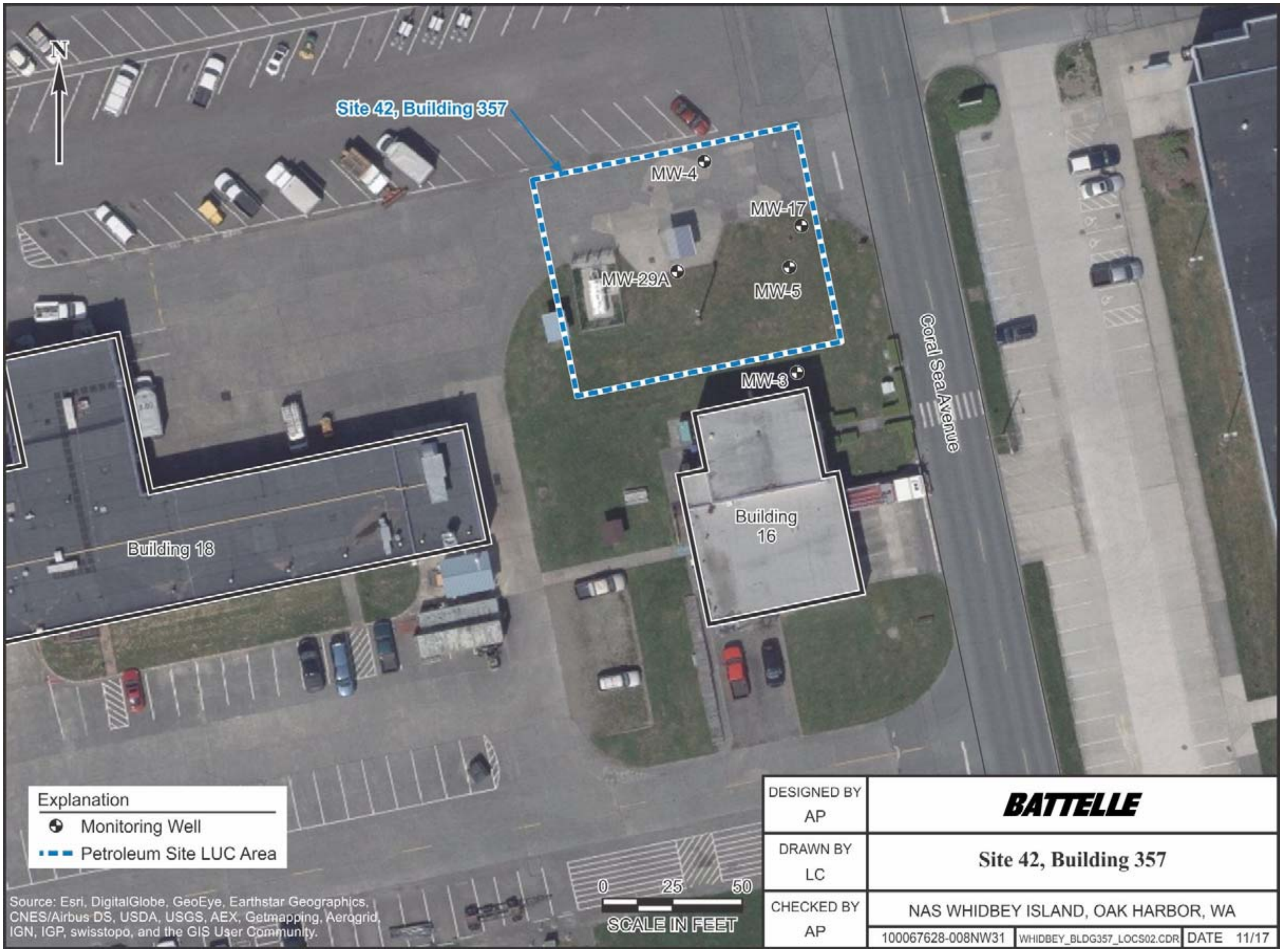

Figure 3-5. Site 42, Building 357

4.0 CLEANUP ACTIONS

This section summarizes cleanup actions for Fuel Farms 1, 2, 3, and 4 and Building 357 at NAS Whidbey Island. Table 4-1 presents a general summary of data, specifically the impacted media, exposure pathways, contaminants of concern (COCs), remedial action objectives (RAOs), remedy components, and O&M and monitoring at each petroleum site.

4.1 REMEDY COMPONENTS

Table 4-1 presents all the remedy components for each petroleum site based on the original decision documents (URS, 1999 and 2001; Foster Wheeler, 2000). The decision documents for Fuel Farms 1, 2, 3, and 4 were updated in 2013 based on: the closure of the fuel farms in 2009; the optimization study conducted in 2010/2011; remedial progress achieved; and site industrial use change from operational to non-operational (NAVFAC, 2013a and 2013b). The remedies for Fuel Farms 1, 3, and 4 include release prevention measures. However, with the closure of the fuel farms and all associated tanks in 2009, the threat of future petroleum spills has been permanently eliminated. Therefore, the release prevention measures remedy component has been completed (NAVFAC, 2013a and 2013b). The remedy for Fuel Farm 2 includes intertidal biological monitoring and modifications to subsurface drainage systems. Biological monitoring was discontinued in 2001 with approval from Ecology and modifications to the subsurface drainage systems were completed in 2000; therefore, these remedy components for Fuel Farm 2 have been completed. The remedy for Fuel Farm 2 also included potential shellfish harvest restrictions. However, beach sediment and intertidal biological sampling has shown no impacts to the beach exist from Fuel Farm 2.

4.2 O&M AND MONITORING

Compliance/Groundwater Monitoring. Table 4-1 also details the O&M and monitoring program as established in the updated decision documents (NAVFAC, 2013a and 2013b). As presented in the *Revised CAP, NAS Whidbey Island, Closed Former Fuel Farms 1, 2, 3 and Fire Training Area* (NAVFAC, 2013a), the well logic chart details the rationale for increasing or decreasing the monitoring frequency and removing wells from the monitoring program. In summary, monitoring wells with contaminant levels below groundwater CULs for total petroleum hydrocarbons quantified as gasoline range organics (TPH-GRO), TPH quantified as diesel range organics (-DRO), and benzene, toluene, ethylbenzene and total xylenes (BTEX) were placed on a quarterly sampling program. After four consecutive quarters, if any well demonstrated contaminant levels below the CULs, then that well was placed into a well abandonment protocol with Ecology. Monitoring wells with contaminant levels above groundwater CULs for TPH-GRO, TPH-DRO, and BTEX were placed on an annual sampling program. If any well in the annual sampling program demonstrated contaminant levels below the CULs, then that well was placed in the quarterly sampling program for potential abandonment. If any well in the quarterly sampling program exceeded the CULs, then that well was placed into the annual sampling program. Tables 4-3 through 4-6 present the details (e.g., monitoring wells, dates, and analytes) of the ongoing monitoring program at Fuel Farms 1, 2, 3, and 4, respectively, from July 2012 through January 2017 (i.e., since the previous FYR [Sealaska, 2012]). The results of the groundwater monitoring activities are presented in Section 7.0, as it relates to functionality of the remedy. Appendix A presents the data from the monitoring activities at these petroleum sites.

Over the course of this FYR period, several monitoring wells at Fuel Farms 1, 2, 3, and 4 demonstrated four consecutive quarters below the groundwater CULs based on the analytical results presented in the annual monitoring reports (Sealaska, 2013a, 2014c, and 2017; see Table 4-2). These monitoring wells were to be removed from the monitoring program and placed into a well abandonment protocol with Ecology, per the well logic chart (NAVFAC, 2013a). In most instances, these monitoring wells were removed from the monitoring program and the well was no longer sampled. However, there were some instances when the monitoring well was later sampled again, as indicated in Tables 4-3 through 4-6 for Fuel Farms 1, 2, 3, and 4, respectively (see gray highlighting). This anomaly occurred most frequently in the Lower Area of Fuel Farm 1, and included sampling for polycyclic aromatic hydrocarbons (PAHs), volatile-range petroleum hydrocarbons (VPHs), and chlorinated VOCs.

Free Product Recovery. During the monitoring events, for any well with measurable free product (i.e., > 0.02 ft) the product was removed using current applicable technology to the maximum extent practicable. Product recovery continued on an annual basis until there was no measurable product (i.e., <0.02 ft). If no measurable product was present in the well, then that well was placed in the annual dissolved-phase sampling program (NAVFAC, 2013a). Tables 4-3 through 4-6 present the events when measurable free product was detected in a monitoring well at Fuel Farms 1, 2, 3, and 4, respectively (noted as ‘FP’ in the tables). As part of the O&M and monitoring program at Fuel Farm 3, five monitoring wells (i.e., MW-352, MW-353, MW-502, MW-504 and MW-505) were placed in a free product recovery program (NAVFAC, 2013a; see Table 4-5). Monitoring well MW-504 was the only well with no free product detected and a dissolved-phase sample was collected and analyzed in July 2016. The results of the free product measurements and recovery efforts are provided in Section 7.0, as they relate to functionality of the remedy.

Annual LUC Inspections. The *Revised CAP, NAS Whidbey Island, Closed Former Fuel Farms 1, 2, 3 and Fire Training Area* (NAVFAC, 2013a) identified the need for a Land Use Institutional Controls Plan and LUC Instruction to ensure the effectiveness of the LUCs. In 2016, the *Land Use Control Implementation Plan Addendum* (Battelle, 2016) was developed, detailing LUC requirements and initiating annual LUC inspections at Fuel Farms 1, 2, 3, and 4 and Site 45 (Former TCE Tank). Site 45 was included in this addendum for the petroleum sites (Battelle, 2016). However, the site is registered on the National Priorities List (NPL) and therefore, is a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site and will be included in the FYRs for CERCLA sites. Site 45 was solely included in the addendum for the petroleum sites (Battelle, 2016) to expedite establishing its LUC requirements and annual inspections. The *Land Use Control Implementation Plan Addendum* (Battelle, 2016) did not include Building 357 as requirements were unclear in the updated decision documents (NAVFAC, 2013a and 2013b). Therefore, an updated *Land Use Control Implementation Plan* (Battelle, 2017a) was developed, detailing the LUC requirements for all sites at NAS Whidbey Island, including Building 357. These LUC requirements for Fuel Farms 1, 2, 3, and 4 and Building 357 are presented in Table 4-7. At Fuel Farms 1, 2, 3, and 4, annual LUC inspections were initiated in 2016 and were conducted in August 2016 and August 2017. For Building 357, annual LUC inspections were initiated in 2017 with the first inspections conducted in August 2017. The results of the latest LUC inspections conducted in August 2017 are summarized in Section 6.0, as part of the FYR process. The LUC Instruction has not been completed at this time. Once the LUC Instruction is completed (in collaboration with the installation), this will serve as the mechanism for NAS Whidbey Island personnel to maintain the LUCs.

Table 4-1. Summary of Remedial Actions

Site	Impacted Media	Exposure Pathways	COCs	Remedial Action Objectives	Remedy Components	O&M and Monitoring
Fuel Farm 1	Groundwater; soil; soil gas.	• Pathway 1 – Possible use of groundwater by humans as drinking water (Upper Area). • Pathway 2 – Direct contact with soils by on-site workers, possible future residents, or ecological receptors. • Pathway 3 – Groundwater migration to surface water and subsequent ingestion of, inhalation of, or dermal contact with the water by on-site workers, possible future residents, or plants and animals that live in, on, or near the water (Lower Area). • Pathway 4 - Vapor intrusion of chlorinated VOCs to indoor air receptors (Lower Area).	• Groundwater: TPH-GRO, TPH-DRO, BTEX, chlorinated VOCs, PAHs, and VPHs. • Soil: TPH-GRO, TPH-DRO, TPH-heavy oil, and PAHs. • Soil gas: chlorinated VOCs.	• Eliminate exposure pathways 1 and 2 by establishing LUCs to prevent the installation of drinking water wells or uncontrolled disturbance of subsurface soils. • Protect ecological receptors by achieving the Pathway 3 surface water CULs for COCs in the area of concern in the vicinity of B0892. • Reduce or permanently eliminate future petroleum spills, and thereby contaminant transport, at Fuel Farm 1 by implementing release prevention measures. • Recover free product to the maximum extent practicable. • Protect human health by eliminating/mitigating Pathway 4 from adjacent occupied buildings, if necessary.	• Release prevention measures (*tank closure in 2009*) • Free product recovery • LUCs • Natural attenuation • Compliance/groundwater monitoring • Periodic reviews	• Compliance/groundwater monitoring: • Upper Area – 28 monitoring wells o 15 wells annual sampling program: 202, 301, 303, 304, 305, 306, 311, 318, 319, 320, 322, 323, 324, 326 and 330 o 13 wells 4 consecutive quarter sampling program: 201, 307, 308, 312, 313, 314, 315, 317, 321, 325, 327, 328, and 329 o Analyzed for TPH-GRO, TPH-DRO, and BTEX • Lower Area – 19 monitoring wells o 5 wells annual sampling program: 333, 338, 339, 344, and 601 o 14 wells 4 consecutive quarter sampling program: 330, 331, 332, 335, 337, 340, 342, 343, 501, 502, 503, 602, 603 and 604 o Analyzed for TPH-GRO, TPH-DRO, and BTEX. Wells 331, 602, and 603 also analyzed for chlorinated VOCs. • Annual LUC inspections.
Fuel Farm 2	Groundwater; soil.	• Pathway 1 – Possible use of groundwater by humans as drinking water. • Pathway 2 – Direct contact with soils by on-site workers, possible future residents, or ecological receptors. • Pathway 3 – Groundwater migration to surface water and subsequent ingestion of, inhalation of, or dermal contact with the water by on-site workers, possible future residents, or plants and animals that live in, on, or near the water.	• Groundwater: TPH-GRO, TPH-DRO, and BTEX. • Soil: TPH-GRO, TPH-DRO, and BTEX.	• Eliminate exposure pathways 1 and 2 by establishing LUCs to prevent the installation of drinking water wells or uncontrolled disturbance of subsurface soils. • Protect ecological and human receptors by achieving the Pathway 2 direct contact CULs for COCs in beach sediments. • Protect ecological receptors by achieving the Pathway 3 surface water CULs for COCs in surface water seeps. • Reduce or permanently eliminate future petroleum spills, and thereby contaminant transport, at Fuel Farm 2 by implementing release prevention measures. • Eliminate the migration of contaminants from Fuel Farm 2 via subsurface drainage systems. • Recover free product to the maximum extent practicable.	• Intertidal biological monitoring (*monitoring discontinued in 2001 with approval from Ecology*) • Modifications to subsurface drainage systems (*modifications completed in 2000*) • Free product recovery • LUCs • Natural attenuation • Compliance/groundwater monitoring • Potential shellfish harvest restrictions *(no impacts to beach; however, shellfish restriction still exists because of DOH mandates and NAS Whidbey Island operational requirements)* • Periodic reviews	• Compliance/groundwater monitoring: o 5 wells annual sampling program: 505, 506, 507, 508, and 716 o 11 wells 4 consecutive quarter sampling program: 001, 002, 301, 302, 303, 306, 307, 309, 310, 311, and 717 o Analyzed for TPH-GRO, TPH-DRO, and BTEX • Annual LUC inspections.
Fuel Farm 3	Groundwater; soil.	• Pathway 1 – Possible use of groundwater by humans as drinking water. • Pathway 2 – Direct contact with soils by on-site workers, possible future residents, or ecological receptors.	• Groundwater: TPH-GRO, TPH-DRO, and BTEX. • Soil: TPH-GRO and TPH-DRO.	• Reduce and contain the dissolved-phase petroleum contamination in groundwater. • Eliminate exposure pathways 1 and 2 by establishing LUCs to prevent the installation of drinking water wells or uncontrolled disturbance of subsurface soils. • Reduce or permanently eliminate future petroleum spills, and thereby contaminant transport, at Fuel Farm 3 by implementing release prevention measures. • Recover free product to the maximum extent practicable.	• Release prevention measures (*tank closure in 2009*) • Free product recovery • LUCs • Natural attenuation • Compliance/groundwater monitoring • Periodic reviews	• Compliance/groundwater monitoring: o 15 wells annual sampling program: 001, 003, 303, 305, 334, 351, 357, 358, 359, 360, 372, 501, 503, 506, and 507 o 17 wells 4 consecutive quarter sampling program: 002, 302, 311, 335, 350, 354, 355, 356, 361, 363, 364, 365, 368, 369, 371, 701, and 702 o Analyzed for TPH-GRO, TPH-DRO, and BTEX • 5 wells for free product recovery: 352, 353, 502, 504 and 505 • Annual LUC inspections.
Fuel Farm 4	Groundwater; soil.	• Pathway 1 – Possible use of groundwater by humans as drinking water. • Pathway 2 – Direct contact with soils by on-site workers, possible future residents, or ecological receptors. • Pathway 3 – Groundwater migration to surface water and subsequent ingestion of, inhalation of, or dermal contact with the water by on-site workers, possible future residents, or plants and animals that live in, on, or near the water.	• Groundwater: TPH-GRO, TPH-DRO, and BTEX. • Soil: TPH-GRO and TPH-DRO.	• Reduce and contain the dissolved-phase petroleum contamination in groundwater. • Eliminate exposure pathways 1 and 2 by establishing LUCs to prevent the installation of drinking water wells or uncontrolled disturbance of subsurface soils. • Reduce or permanently eliminate future petroleum spills, and thereby contaminant transport, at Fuel Farm 4 by implementing release prevention measures. • Recover free product to the maximum extent practicable.	• Release prevention measures (*tank closure in 2009*) • Free product recovery • LUCs • Compliance/groundwater monitoring • Periodic reviews	• Compliance/groundwater monitoring: o 3 wells annual sampling program: 109, 114, and 113 (491) o 9 wells 4 consecutive quarter sampling program: 101, 102, 103, 104, 107, 110, 113, 114 (491), and 115 (491) o Analyzed for TPH-GRO, TPH-DRO, and BTEX • Annual LUC inspections.
Building 357	Groundwater; soil.	• Pathway 1 – Possible use of groundwater by humans as drinking water. • Pathway 2 – Direct contact with soils by on-site workers, possible future residents, or ecological receptors.	• Groundwater: TPH-GRO, BTEX, and lead. • Soil: TPH-GRO, BTEX, and lead.	• Reduce and contain the dissolved-phase petroleum contamination in groundwater. • Eliminate exposure pathways 1 and 2 by establishing LUCs to prevent the installation of drinking water wells or uncontrolled disturbance of subsurface soils.	• LUCs • Natural attenuation • Compliance/groundwater monitoring • Periodic reviews	• Compliance/groundwater monitoring: o 4 consecutive quarter sampling at well MW-17 o Analyze for benzene and TPH-GRO • Annual LUC inspections.

Table 4-2. Monitoring Wells with Four Consecutive Quarters Below Groundwater CULs

Annual Report[(a)]	Area	Monitoring Well
		Fuel Farm 1
2012-2013	Upper	MW-201, **MW-307, MW-308, MW-312, MW-314,** MW-317, MW-325, MW-327, **MW-330**
	Lower	MW-332, MW-335, MW-337, **MW-340,** MW-342, MW-501, MW-502, MW-503, MW-602, MW-603, MW-604
2013-2014	Upper	–
	Lower	MW-333, MW-338, MW-344, MW-601
2015-2016	Upper	–
	Lower	MW-343
		Fuel Farm 2
2012-2013	–	MW-001, **MW-002, MW-301, MW-302, MW-303,** MW-306, MW-307, **MW-309, MW-310, MW-311**
2013-2014	–	–
2015-2016	–	MW-507, MW-508, MW-717
		Fuel Farm 3
2012-2013	–	–
2013-2014	–	MW-002, MW-302, MW-311, MW-335, MW-350, MW-354, MW-355, MW-361, MW-363, MW-364, MW-365, MW-368, MW-369, MW-371, MW-701, MW-702
2015-2016	–	MW-372
		Fuel Farm 4
2012-2013	–	**MW-101, MW-102, MW-103, MW-104, MW-107, MW-110, MW-113,** MW-114 (491), MW-115 (491)
2013-2014	–	–
2015-2016	–	–

Note: Monitoring wells in bold text were decommissioned in July 2015 (Sealaska, 2015b).

(a) 2012-2013 Annual Report (Sealaska, 2013a); 2013-2014 Annual Report (Sealaska, 2014c); and 2015-2016 Annual Report (Sealaska, 2017a).

Table 4-3. Monitoring Program at Fuel Farm 1

Well ID	Sample Date														
	Jul-12	**Oct-12**	**Jan-13**	**Apr-13**	**Sep-13**	**Dec-13**	**Mar-14**	**Jun-14**	**Dec-14**	**Oct-15**	**Jan-16**	**Apr-16**	**Jul-16**	**Nov-16**	**Jan-17**
Upper Area															
Initial Annual Sampling (CAP Update [NAVFAC, 2013a])															
MW-202		✓			✓				✓				✓		
MW-301	✓	✓			✓				✓				✓		
MW-303					✓				✓				✓		
MW-304		✓			✓				✓				✓		
MW-305	✓				✓				✓				✓		
MW-306		✓			✓				✓				✓		
MW-311	✓				✓				FP	FP			FP	FP	
MW-318		✓			✓				✓				✓		
MW-319	✓				✓				✓				FP		
MW-320		✓			✓				✓				✓		
MW-322		✓			✓				✓				✓		
MW-323	✓	✓	✓	✓	✓				✓				✓		
MW-324		✓			✓				✓				✓		
MW-326		✓			✓				✓				✓		
MW-330U	✓	✓	✓	✓											
Initial 4 Consecutive Quarter Sampling (CAP Update [NAVFAC, 2013a])															
MW-201	✓	✓	✓	✓											
MW-307	✓	✓	✓	✓											
MW-308	✓	✓	✓	✓											
MW-312	✓	✓	✓	✓											
MW-313	✓	FP[d]	✓	✓	✓				✓				✓		
MW-314	✓	✓	✓	✓											
MW-315	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓		
MW-317	✓	✓	✓	✓											
MW-321	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓
MW-325	✓	✓	✓	✓											
MW-327	✓	✓	✓	✓											
MW-328	✓	✓	✓	✓	✓				✓				✓		
MW-329	✓	✓	✓	✓	✓				✓				✓		
Lower Area															
Initial Annual Sampling (CAP Update [NAVFAC, 2013a])															
MW-333		✓			✓[a]	✓	✓	✓					[a]		
MW-338		✓			✓	✓	✓	✓							
MW-339		✓			✓				✓				✓		
MW-344		✓			✓[a]	✓	✓	✓					[a]		
MW-601	✓				✓[b, c]	✓	✓	✓					[b, c]		

Table 4-3. Monitoring Program at Fuel Farm 1 (continued)

Well ID	Sample Date														
	Jul-12	**Oct-12**	**Jan-13**	**Apr-13**	**Sep-13**	**Dec-13**	**Mar-14**	**Jun-14**	**Dec-14**	**Oct-15**	**Jan-16**	**Apr-16**	**Jul-16**	**Nov-16**	**Jan-17**
Initial 4 Consecutive Quarter Sampling (CAP Update [NAVFAC, 2013a])															
MW-330L		✓			✓				✓				FP		
MW-331	✓	✓	✓	✓	✓(c)				✓(c)				✓(c)		
MW-332	✓	✓	✓	✓	*(a, b, c)*	*(a, b, c)*	*(a, b, c)*	*(a, b, c)*							
MW-335	✓	✓	✓	✓											
MW-337	✓	✓	✓	✓	*(b)*	*(b)*	*(b)*	*(b)*							
MW-340	✓	✓	✓	✓											
MW-342	✓	✓	✓	✓											
MW-343	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓
MW-501	✓	✓	✓	✓	*(b)*	*(b)*	*(b)*	*(b)*							
MW-502	✓	✓	✓	✓	*(b)*				*(b)*	*(b)*	*(b)*	*(b)*	*(b)*		
MW-503	✓	✓	✓	✓											
MW-602	✓	✓	✓	✓	*(a, c)*				*(a, c)*				*(a, c)*		
MW-603	✓	✓	✓	✓	*(c)*				*(c)*				*(c)*		
MW-604	✓	✓	✓	✓	*(a)*	*(a)*	*(a)*	*(a)*					*(c)*		

Notes – Monitoring wells in bold text were decommissioned in July 2015 (Sealaska, 2015b). Monitoring wells in italic are identified in Table 4-2 as having four consecutive quarters below groundwater CULs, but there are no reports documenting that the well has been abandoned. Sampling events highlighted in grey are events conducted after four consecutive quarters of TPH-GRO, TPH-DRO, and BTEX results below groundwater CULs. FP – free product detected during monitoring event, no dissolved-phase sample collected. ✓ – dissolved-phase sample collected and analyzed for TPH-GRO, TPH-DRO, and BTEX. (a) Dissolved-phase sample collected and analyzed for PAHs. (b) Dissolved-phase sample collected and analyzed for VPHs. (c) Dissolved-phase sample collected and analyzed for chlorinated VOCs. (d) Free product detected in October and December 2012.

Table 4-4. Monitoring Program at Fuel Farm 2

Well ID	**Sample Date**														
	Jul-12	**Oct-12**	**Jan-13**	**Apr-13**	**Sep-13**	**Jun-14**	**Dec-14**	**Mar-15**	**Jun-15**	**Oct-15**	**Jan-16**	**Apr-16**	**Jul-16**	**Nov-16**	**Jan-17**
Initial Annual Sampling (CAP Update [NAVFAC, 2013a])															
MW-505	✓					✓	✓	✓	✓				✓		
MW-506	✓				✓		✓		✓	FP			FP	FP	
MW-507	✓				✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
MW-508	✓				✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
MW-716	✓														
Initial 4 Consecutive Quarter Sampling (CAP Update [NAVFAC, 2013a])															
MW-001	✓	✓	✓	✓											
MW-002	✓	✓	✓	✓											
MW-301	✓	✓	✓	✓											
MW-302	✓	✓	✓	✓											
MW-303	✓	✓	✓	✓											
MW-306	✓	✓	✓	✓											
MW-307	✓	✓	✓	✓											
MW-309	✓	✓	✓	✓											
MW-310	✓	✓	✓	✓											
MW-311	✓	✓	✓	✓											
MW-717	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓

Notes – Monitoring wells in bold text were decommissioned in July 2015 (Sealaska, 2015b). Monitoring wells in italic are identified in Table 4-2 as having four consecutive quarters below groundwater CULs, but there are no reports documenting that the well has been abandoned. Sampling events highlighted in grey are events conducted after four consecutive quarters of results below groundwater CULs. FP – free product detected during monitoring event, no dissolved-phase sample collected. ✓ – dissolved-phase sample collected and analyzed for TPH-GRO, TPH-DRO, and BTEX.

Table 4-5. Monitoring Program at Fuel Farm 3

Well ID	Sample Date										
	Sep-13	**Dec-13**	**Mar-14**	**Jun-14**	**Dec-14**	**Oct-15**	**Jan-16**	**Apr-16**	**Jul-16**	**Nov-16**	**Jan-17**
Initial Annual Sampling (CAP Update [NAVFAC, 2013a])											
MW-001	✓				✓				✓		
MW-003	✓				✓				✓		
MW-303	✓					FP			FP	FP	
MW-305	✓				✓				✓		
MW-334	✓				✓				✓		
MW-351	✓				✓				✓		
MW-357		FP			FP	FP				FP	
MW-358	✓				✓				FP		
MW-359	✓				✓				✓		
MW-360	✓				✓				✓		
MW-372	✓				✓	✓	✓	✓	✓	✓	✓
MW-501	✓				✓				✓		
MW-503	✓				✓				✓		
MW-506	✓				✓				✓		
MW-507	✓				✓				✓		
Initial 4 Consecutive Quarter Sampling (CAP Update [NAVFAC, 2013a])											
MW-002	✓	✓	✓	✓							
MW-302	✓	✓	✓	✓							
MW-311	✓	✓	✓	✓							
MW-335	✓	✓	✓	✓							
MW-350	✓	✓	✓	✓							
MW-354	✓	✓	✓	✓							
MW-355	✓	✓	✓	✓							
MW-356	✓	✓	✓	✓					✓		
MW-361	✓	✓	✓	✓							
MW-363	✓	✓	✓	✓							
MW-364	✓	✓	✓	✓							
MW-365	✓	✓	✓	✓							
MW-368	✓	✓	✓	✓							
MW-369	✓	✓	✓	✓							
MW-371	✓	✓	✓	✓							
MW-701	✓	✓	✓	✓							
MW-702	✓	✓	✓	✓							
Free Product Recovery (CAP Update [NAVFAC, 2013a])											
MW-352[(a)]		FP			FP	FP				FP	
MW-353[(a)]		FP			FP	FP				FP	

Table 4-5. Monitoring Program at Fuel Farm 3 (continued)

Well ID	Sample Date										
	Sep-13	Dec-13	Mar-14	Jun-14	Dec-14	Oct-15	Jan-16	Apr-16	Jul-16	Nov-16	Jan-17
MW-502[(a)]		FP			FP	FP				FP	
MW-504[(b)]									✓		
MW-505[(a)]		FP			FP	FP				FP	

Notes – Monitoring wells in italic are identified in Table 4-2 as having four consecutive quarters below groundwater CULs, but there are no reports documenting that the well has been abandoned. Sampling events highlighted in grey are events conducted after four consecutive quarters of results below groundwater CULs. FP – free product detected during monitoring event, no dissolved-phase sample collected. ✓ – dissolved-phase sample collected and analyzed for TPH-GRO, TPH-DRO, and BTEX. (a) Free product measurement and recovery conducted in December 2012. (b) No free product detected, dissolved-phase sample collected and analyzed in July 2016.

Table 4-6. Monitoring Program at Fuel Farm 4

Well ID	Sample Date																
	Jul-12	Oct-12	Jan-13	Apr-13	Sep-13	Dec-13	Mar-14	Jun-14	Dec-14	Mar-15	Jun-15	Oct-15	Jan-16	Apr-16	Jul-16	Nov-16	Jan-17
Initial Annual Sampling																	
MW-109	✓				✓	✓	✓	✓				FP	FP	FP	FP		
MW-114	✓																
MW-113 (491)	✓				✓				✓	✓	✓				✓		
Initial 4 Consecutive Quarter Sampling																	
MW-101	✓	✓	✓	✓													
MW-102	✓	✓	✓	✓													
MW-103	✓	✓	✓	✓													
MW-104	✓	✓	✓	✓													
MW-107	✓	✓	✓	✓													
MW-110	✓	✓	✓	✓													
MW-113	✓	✓	✓	✓													
MW-114 (491)	✓	✓	✓	✓												✓	✓
MW-115 (491)	✓	✓	✓	✓												✓	✓

Notes – Monitoring wells in bold text were decommissioned in July 2015 (Sealaska, 2015b). Monitoring wells in italic are identified in Table 4-2 as having four consecutive quarters below groundwater CULs, but there are no reports documenting that the well has been abandoned. Sampling events highlighted in grey are events conducted after four consecutive quarters of results below groundwater CULs. FP – free product detected during monitoring event, no dissolved-phase sample collected. ✓ – dissolved-phase sample collected and analyzed for TPH-GRO, TPH-DRO, and BTEX.

Table 4-7. LUC Requirements at Fuel Farms 1, 2, 3, and 4 and Building 357

Site	Site-Specific LUCs
Fuel Farm 1	• Ensure that land use remains industrial with restricted recreational land use limited to the Upper Area along paved footpaths with traffic confined to specific areas, signs, and barrier vegetation and along paved athletic areas. • No use of groundwater from, or downgradient of, the area except for monitoring and remediation as approved by the applicable regulatory agency (U.S. EPA and/or Ecology). • No downgradient well drilling except for monitoring wells and/or remediation system wells authorized by the applicable regulatory agency (U.S. EPA and/or Ecology) in approved plans. • Protect existing monitoring wells. • Prevent ground disturbance or construction activities in Lower Area. • Prevent ground disturbance or construction activities at depths greater than 15 ft bgs in Upper Area. • Maintain controlled access and security fencing for Tank 226 and the Resource Conservation and Recovery Act satellite accumulation point.
Fuel Farm 2	• Ensure that site is used for non-residential purposes only. • No use of groundwater from, or downgradient of, the area except for monitoring and remediation as approved by the applicable regulatory agency (U.S. EPA and/or Ecology). • No downgradient well drilling except for monitoring wells and/or remediation system wells authorized by the applicable regulatory agency (U.S. EPA and/or Ecology) in approved plans. • Protect existing monitoring wells. • Prevent ground disturbance or construction activities. • Ensure site signage indicating restrictions on shellfish harvesting is intact, secure and readable.
Fuel Farm 3	• Ensure that land use remains industrial. • No use of groundwater from, or downgradient of, the area except for monitoring and remediation as approved by the applicable regulatory agency (U.S. EPA and/or Ecology). • No downgradient well drilling except for monitoring wells and/or remediation system wells authorized by the applicable regulatory agency (U.S. EPA and/or Ecology) in approved plans. • Protect existing monitoring wells. • Prevent ground disturbance or construction activities.
Fuel Farm 4	• Ensure that land use remains industrial. • No use of groundwater from, or downgradient of, the area except for monitoring and remediation as approved by the applicable regulatory agency (U.S. EPA and/or Ecology). • No downgradient well drilling except for monitoring wells and/or remediation system wells authorized by the applicable regulatory agency (U.S. EPA and/or Ecology) in approved plans. • Protect existing monitoring wells. • Prevent ground disturbance or construction activities.

Table 4-7. LUC Requirements at Fuel Farms 1, 2, 3, and 4 and Building 357 (continued)

Site	Site-Specific LUCs
Building 357	• Ensure that land use remains industrial. • No use of groundwater from, or downgradient of, the area except for monitoring and remediation as approved by the applicable regulatory agency (U.S. EPA and/or Ecology). • No downgradient well drilling except for monitoring wells and/or remediation system wells authorized by the applicable regulatory agency (U.S. EPA and/or Ecology) in approved plans. • Protect existing monitoring wells. • Ensure that all disturbed or excavated soils at or from the area are properly categorized and disposed of, and that workers are protected during any such disturbance or excavation.

5.0 PROGRESS SINCE LAST FIVE-YEAR REVIEW

The Navy has completed all recommendations and follow-up actions presented in the *Second Five-Year Review, Long-Term Monitoring and Operations Report, 2007-2011, Fuel Farms 1, 2, 3, and 4 and Building 357* (Sealaska, 2012) for Fuel Farms 1, 2, 3, and 4. These recommendations, follow-up actions and notes regarding their completion are summarized in Table 5-1.

The schedule is currently pending for the recommendations and follow-up actions for Building 357 (Sealaska, 2012), including additional groundwater monitoring and applying for a no further action determination from Ecology (see Table 5-1).

In addition, several supplemental (Sup) activities are listed in Table 5-1. These activities were not specifically identified in the second FYR (Sealaska, 2012), but were performed to support the on-going remedies at these petroleum sites to facilitate site closure and ensure protection of human health and the environment.

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

Item No.	Recommendations/ Follow-Up Actions	Completion Date(s)	Notes Regarding Completion	Reference(s)
Fuel Farm 1				
1	Revise the CAP (Navy, 1999) to reflect source removal and achievement of Remedial Action Objectives	March 2013	A revised CAP was prepared to document compliance with the original CAP (Navy, 1999) and provide a revised CAP based on the current conceptual site model, which includes source removal and achievement of RAOs. The endpoint for recovering product (<0.02 ft for one year) was achieved in 2011; hence, the revised CAP acknowledges cessation of routine recovery activities. However, a provision was made for recovery if product is detected in a well during monitoring activities. LUCs remain in place, but the revised CAP provides for developing a LUC Implementation Plan to address requirements to ensure the effectiveness of identified institutional controls (ICs) and engineering controls (ECs), including a LUC instruction that will detail the mechanisms used to maintain the LUCs. Consideration to change from industrial land use to permit restricted recreational activities is considered for the Upper Area. No land use changes are anticipated for the Lower Area; however, a vapor intrusion assessment is required to address potential indoor air quality concerns in the Lower Area. The revised CAP retains natural attenuation for petroleum hydrocarbon constituents and chlorinated VOCs as part of the final remedy to achieve groundwater CULs. Annual and quarterly sampling is required to document MNA and satisfy requirements of the ongoing compliance monitoring program.	NAVFAC, 2013a
2	Continue regulatory oversight of monitoring, reporting, and reviews	July and October 2012; January, April, September, and December 2013; March, June, and December 2014; October 2015; January, April, July, and November 2016; January 2017.	Performed annual and quarterly groundwater monitoring and select analysis for TPH-DRO, TPH-GRO, BTEX, VPHs, VOCs, and PAHs. In July 2016 (most recent comprehensive event), conducted annual sampling of 26 monitoring wells and quarterly sampling of four monitoring wells. Exceedances of groundwater CULs were detected in all monitoring wells except for MW-604(L) for vinyl chloride; therefore, this well was recommended to be placed on the quarterly schedule.	Annual Reports – Sealaska, 2013a, 2014c, and 2017a; Quarterly Technical Memorandum – Sealaska, 2013b, 2014a, 2014b, 2015a, 2016a, 2016b, 2016c, 2017b, and 2017c
3 (Sup)	Vapor Intrusion Study in Lower Area	January 2014	Utilized existing groundwater data to evaluate the vapor intrusion exposure pathway at Buildings 2735 and 81 due to the presence of chlorinated VOCs. All health risk	URS, 2014

Table 5-1. Summary of Progress since Last Five-Year Review (continued)

Item No.	Recommendations/ Follow-Up Actions	Completion Date(s)	Notes Regarding Completion	Reference(s)
			estimates were significantly below acceptable risk thresholds, indicating that vapor intrusion is not likely an issue based on current use.	
4 (Sup)	Decommission monitoring wells	October 2015	Based on the well decommissioning criteria presented in the revised CAP (NAVFAC, 2013a), monitoring wells MW-307, MW-308, MW-312, MW-314, and MW-330 in the Upper Area and monitoring well MW-340 in the Lower Area met the criteria of being below groundwater CULs for four consecutive quarters and were decommissioned in accordance with Ecology requirements.	Sealaska, 2015b
5 (Sup)	Develop LUC Implementation Plan Addendum	May 2016	As identified in the revised CAP (NAVFAC, 2013a), developed a LUC implementation plan detailing the LUC requirements and mechanisms used to maintain the LUCs at Fuel Farms 1, 2, 3, and 4 and Site 45.	Battelle, 2016
6 (Sup)	Develop LUC Implementation Plan	July 2017	Developed to redefine and clarify the LUC requirements for Fuel Farms 1, 2, 3, and 4 and add Building 357.	Battelle, 2017a
7 (Sup)	Continue regulatory oversight of monitoring, reporting, and reviews	December 14, 2017	Conducted geographical survey, including northing and easting using NAD83/11 and ground and casing elevation using NAVD88, of monitoring wells MW-306, MW-318, MW-319, MW-320, MW-328, and MW-329 in the Upper Area of Fuel Farm 1.	–
Fuel Farm 2				
1	Revise the CAP (Navy, 1999) to reflect fuel tank closure and achievement of Remedial Action Objectives	March 2013	A revised CAP was prepared to document compliance with the original CAP (Navy, 1999) and provide a revised CAP based on the current conceptual site model, which includes closure of the fuel tanks and achievement of RAOs. The revised CAP provides for developing a LUC Implementation Plan to address effectiveness of the identified ICs, including a LUC instruction that will detail the mechanisms used to maintain ICs. The land use designation can be modified since Fuel Farm 2 is no longer an operational facility and soils from 0 to 15 ft bgs are below MTCA Method A cleanup levels for unrestricted land use. The LUC Implementation Plan will formally document land use change and the required protective measures that will be implemented. The revised CAP retains natural attenuation for petroleum hydrocarbon constituents as part of the final remedy to achieve groundwater CULs. Annual and quarterly sampling is required to document MNA and satisfy requirements of the ongoing compliance monitoring program.	NAVFAC, 2013a
2	Continue regulatory oversight of monitoring, reporting, and reviews	July and October 2012; January, April, September, and December	Performed annual and quarterly groundwater monitoring and analysis for TPH-DRO, TPH-GRO, and BTEX. In July 2016 (most recent comprehensive event), conducted annual sampling of 2 monitoring wells (MW-505 and MW-506) and quarterly sampling of three monitoring wells (MW-507, MW-508, and MW-717). Monitoring wells MW-505 and MW-506 are to remain on an annual sampling schedule due to	Annual Reports – Sealaska, 2013a, 2014c, and 2017a;

Table 5-1. Summary of Progress since Last Five-Year Review (continued)

Item No.	Recommendations/ Follow-Up Actions	Completion Date(s)	Notes Regarding Completion	Reference(s)
		2013; March, June, and December 2014; March, June, and October 2015; January, April, July, and November 2016; January 2017.	continued detections of TPH-DRO above the groundwater CUL in MW-505 and the presence of free product in MW-506. Monitoring wells MW-507, MW-508, and MW-717 met the criteria of being below groundwater CULs for four consecutive quarters; therefore, were recommended for decommissioning.	Quarterly Technical Memorandum – Sealaska, 2013b, 2014a, 2014b, 2015a, 2015b, 2015c, 2016a, 2016b, 2016c, 2017b, and 2017c
3 (Sup)	Decommission monitoring wells	October 2015	Based on the well decommissioning criteria presented in the revised CAP (NAVFAC, 2013a), monitoring wells MW-002, MW-301, MW-302, MW-303, MW-309, MW-310, and MW-311 met the criteria of being below groundwater CULs for four consecutive quarters and were decommissioned in accordance with Ecology requirements.	Sealaska, 2015b
4 (Sup)	Develop LUC Implementation Plan Addendum	May 2016	As identified in the revised CAP (NAVFAC, 2013a), developed a LUC implementation plan to detail LUC requirements and the mechanisms used to maintain the LUCs at Fuel Farms 1, 2, 3, and 4 and Site 45.	Battelle, 2016
5 (Sup)	Develop LUC Implementation Plan	July 2017	Developed to redefine and clarify the LUC requirements for Fuel Farms 1, 2, 3, and 4 and add Building 357.	Battelle, 2017a
Fuel Farm 3				
1	Revise the CAP (Navy, 1999) to reflect fuel tank closure and achievement of Remedial Action Objectives	March 2013	A revised CAP was prepared to document compliance with the original CAP (Navy, 1999) and provide a revised CAP based on the current conceptual site model, which includes closure of the fuel tanks and achievement of RAOs. Product recovery will continue to be performed, focusing on wells 352, 353, 502, 504 and 505. Recovery will be performed at other wells if greater than 0.2 ft of product is detected during groundwater monitoring activities. The revised CAP provides for developing a LUC Implementation Plan to address effectiveness of the identified ICs, including a LUC instruction that will detail the mechanisms used to maintain ICs. No change in land use, currently designated as industrial, is planned. The revised CAP retains natural attenuation for petroleum hydrocarbon constituents as part of the final remedy to achieve groundwater CULs. Annual and quarterly sampling is required to document MNA and satisfy requirements of the ongoing compliance monitoring program.	NAVFAC, 2013a
2	Continue regulatory oversight of	December 2012;	Performed annual and quarterly groundwater monitoring and analysis for product thickness and TPH-DRO, TPH-GRO, and BTEX. In July 2016 (most recent	Annual Reports –

Table 5-1. Summary of Progress since Last Five-Year Review (continued)

Item No.	Recommendations/ Follow-Up Actions	Completion Date(s)	Notes Regarding Completion	Reference(s)
	monitoring, reporting, and reviews	September and December 2013; March, June, and December 2014; October 2015; January, April, July, and November 2016; January 2017.	comprehensive event), conducted annual sampling of 15 monitoring wells and quarterly sampling of 1 monitoring well (MW-372 [U]). Exceedances of groundwater CULs were detected in all monitoring wells on an annual sampling schedule. Monitoring well MW-372 (U) met the criteria of being below groundwater CULs for four consecutive quarters; therefore, was recommended to be decommissioned.	Sealaska, 2013a, 2014c, and 2017a; Quarterly Technical Memorandum – Sealaska, 2013b, 2014a, 2014b, 2015a, 2015b, 2015c, 2016a, 2016b, 2016c, 2017b, and 2017c
3 (Sup)	Develop LUC Implementation Plan Addendum	May 2016	As identified in the revised CAP (NAVFAC, 2013a), developed a LUC implementation plan to detail LUC requirements and the mechanisms used to maintain the LUCs at Fuel Farms 1, 2, 3, and 4 and Site 45.	Battelle, 2016
4 (Sup)	Develop LUC Implementation Plan	July 2017	Developed to redefine and clarify the LUC requirements for Fuel Farms 1, 2, 3, and 4 and add Building 357.	Battelle, 2017a
Fuel Farm 4				
1	Complete IRACR Addendum to reflect fuel tank closure and achievement of Remedial Action Objectives	March 2013	The status of Fuel Farm 4 was changed from active to inactive after tank and dry well closures, removal of the above ground pipelines, and the 2013 below ground pipeline closure in place, which eliminated the source of soil and groundwater contamination. Quarterly free product measurements were discontinued in 2012 (in accordance with the IRACR) due to the absence of free product. The addendum provides for developing a LUC Implementation Plan to address effectiveness of the identified ICs, including a LUC instruction that will detail the mechanisms used to maintain ICs. No change in land use, currently designated as industrial, is planned. A compliance monitoring program was established for the 12 wells at the fuel farm. Wells with groundwater contamination (i.e., TPH-DRO, TPH-GRO, and BTEX) below the CUL will be monitored quarterly for four consecutive quarters. If COCs remain below the CULs for all four quarters, then the wells will be abandoned in accordance with Ecology requirements. If one or more COCs exceed CULs during quarterly monitoring events, then those wells will be placed into an annual sampling program, until concentrations decrease below their respective CULs, at which time the well will be returned to the quarterly monitoring program. Product recovery will be performed on an annual basis in any well found to contain greater than 0.02 ft of product. No	NAVFAC, 2013b

Table 5-1. Summary of Progress since Last Five-Year Review (continued)

Item No.	Recommendations/ Follow-Up Actions	Completion Date(s)	Notes Regarding Completion	Reference(s)
			sampling of surface water will be performed since samples collected in 2009 and 2010 demonstrated that there is no significant groundwater to surface water transport.	
2	Continue regulatory oversight of monitoring, reporting, and reviews	July and October 2012; January, April, September, and December 2013; March, June, and December 2014; March, June, and October 2015; January, April, July, and November 2016; January 2017.	Performed annual and quarterly groundwater monitoring and analysis for product thickness, TPH-DRO, TPH-GRO, and BTEX. In July 2016, conducted annual sampling of one monitoring well (MW-113 [491]) and quarterly sampling of one monitoring well (MW-109). Monitoring well MW-113 (491) is to remain on an annual sampling schedule due to detection of TPH-GRO above the groundwater CUL. Monitoring well MW-109 was not sampled due to the presence of product (during each quarterly event); therefore, recommended to be included on the product recovery schedule and changed to the annual sampling schedule.	Annual Reports – Sealaska, 2013a, 2014c, and 2017a; Quarterly Technical Memorandum – Sealaska, 2013b, 2014a, 2014b, 2015a, 2015b, 2015c, 2016a, 2016b, 2016c, 2017b, and 2017c
3 (Sup)	Decommission monitoring wells	October 2015	Based on the well decommissioning criteria presented in the IRACR Addendum (NAVFAC, 2013b), monitoring wells MW-101, MW-102, MW-103, MW-104, MW-107, MW-110, and MW-113 met the criteria of being below groundwater CULs for four consecutive quarters and were decommissioned in accordance with Ecology requirements.	Sealaska, 2015b
4 (Sup)	Develop LUC Implementation Plan Addendum	May 2016	As identified in the revised CAP (NAVFAC, 2013a), developed a LUC implementation plan to detail LUC requirements and the mechanisms used to maintain the LUCs at Fuel Farms 1, 2, 3, and 4 and Site 45.	Battelle, 2016
5 (Sup)	Develop LUC Implementation Plan	July 2017	Developed to redefine and clarify the LUC requirements for Fuel Farms 1, 2, 3, and 4 and add Building 357.	Battelle, 2017a
Building 357				
1	Sample well MW-17 for dissolved phase components	Pending	Groundwater sampling was last conducted in August 2007. Natural attenuation was occurring at this site, as indicated by LTM results. Contaminant concentrations have been reduced to less than MTCA cleanup standards for four consecutive quarters in all monitoring wells except for MW-4 (i.e., lead) and MW-17 (i.e., benzene and TPH-GRO).	–
2	Apply for No Further Action	Pending	Once benzene and TPH-GRO concentrations in MW-17 are less than MTCA cleanup standards for four consecutive quarters, the Navy will request a no further action	–

Table 5-1. Summary of Progress since Last Five-Year Review (continued)

Item No.	Recommendations/ Follow-Up Actions	Completion Date(s)	Notes Regarding Completion	Reference(s)
	Determination		determination for the Building 357 site from Ecology.	
3 (Sup)	Develop LUC Implementation Plan	July 2017	Developed to redefine and clarify the LUC requirements for Fuel Farms 1, 2, 3, and 4 and add Building 357.	Battelle, 2017a

(Sup) **–** Activity not specifically identified as a recommendation or follow-up action, but performed in accordance with applicable decision documents to facilitate site closure and ensure protection of human health and the environment.

6.0 FIVE-YEAR REVIEW PROCESS

This third FYR for Fuel Farms 1, 2, 3, and 4 and Building 357 at NAS Whidbey Island was conducted in accordance with the *Comprehensive Five-Year Review Guidance* (U.S. EPA, 2001) and developed in accordance with the *Navy Toolkit for Preparing Five-Year Reviews* (NAVFAC, 2013c). Remedy protectiveness for these petroleum sites at NAS Whidbey Island was evaluated through document and data review, site inspections, community involvement, and interviews as described in the subsections below.

6.1 DOCUMENT REVIEW

This FYR consisted of a review of specific documentation for each petroleum site. First, the original decision documents for Fuel Farms 1, 2, and 3 (URS, 1999), Fuel Farm 4 (URS, 2001), and Building 357 (Foster Wheeler, 2000) were reviewed to identify the initial impacted media, exposure pathways, CULs, RAOs, and the selected remedy components. The information presented in the original decision documents for Fuel Farms 1, 2, 3, and 4 (URS, 1999 and 2001) were then compared to their respective revised decision documents (NAVFAC, 2013a and 2013b) to identify any updates to the remedial approach. Follow-up annual groundwater monitoring reports and quarterly technical memoranda were also reviewed to assess remedy performance and continued protection of human health and the environment. These data and their trends are evaluated and described in Section 7.0. Table 6-1 summarizes all the primary documents and data reviewed for Fuel Farms 1, 2, 3, and 4 and Building 357.

Table 6-1. Primary Documents Reviewed for Third FYR

Year	Title	Summary
1999	*Remedial Investigation/Feasibility Study Report for Petroleum Sites*	Describes investigation results, evaluates remedial alternatives, and details the selected remedy for Fuel Farms 1, 2, 3, and 4.
1999	*Cleanup Action Plan for Petroleum Sites*	Describes the proposed activities needed to perform the additional remedial activities at Fuel Farms 1, 2, and 3.
2000	*Final Independent Remedial Action Closure Report: For Remediation of Contaminated Soils at Building 357, Seaplane Base, NAS Whidbey Island*	Provides summary of the treatment plant that was in operation from July 1998 to September 1999 at Building 357; confirmation soil and groundwater sampling after plant shutdown; and additional groundwater sampling events performed in January and March 2000.
2001	*Independent Remedial Action Closure Report for Fuel Farm 4 Naval Air Station Whidbey Island*	Provides summary of the investigation at Fuel Farm 4, including the area near Building 491 that was conducted to determine the nature and extent of petroleum impacts in the area.
2007	*Third Quarter 2007 Groundwater Long-Term Monitoring Report: For Area 42 (Building 357)*	Provides summary of groundwater monitoring that was conducted at Building 357 on August 20 and 21, 2007.
2011	*Technical Memorandum: Optimization Study Fuel Farms 1, 2, and 3*	Describes the study results for Fuel Farms 1, 2, and 3, including screening level risk assessment results, conducted to assist in updating the remedial approach.
2012	*Second Five Year Review, Long-Term Monitoring and Operations Report, 2007-2011: Fuel Farms 1, 2, 3, and 4 (Sites 36, 35, 13, and 11), and Building 357 (Area 42)*	Evaluates whether the remedy is functioning as intended by the decision documents.

Table 6-1. Primary Documents Reviewed for Third FYR (continued)

Year	Title	Summary
2013	*Revised CAP NAS Whidbey Island Closed Former Fuel Farms 1, 2, 3 and Fire Training Area*	Describes the revised proposed remedial activities for Fuel Farms 1, 2, and 3.
2013	*IRACR Addendum Site 11 NAS Whidbey Island Former Fuel Farm 4 and Building 491*	Serves as an update to the 2001 IRACR for Fuel Farm 4 and Building 491.
2013 – 2017	*2012-2013, 2013-2014, and 2015-2016 Annual Long-Term Monitoring Reports: Fuel Farms 1, 2, 3, and 4 (Sites 36, 35, 13, and 11)*	Field work, including product recovery, and laboratory analytical results for the quarterly groundwater sampling events conducted at Fuel Farms 1, 2, 3, and 4 in July 2012, October 2012, January 2013, April 2013, September 2013, December 2013, March 2014, June 2014, October 2015, January 2016, April 2016, and July 2016.
2013 – 2017	*Quarterly Technical Memorandum, Long-Term Monitoring: Fuel Farms 1, 2, 3, and 4 (Sites 36, 35, 13, and 11)*	Field work and laboratory analytical results obtained during quarterly groundwater sampling event conducted at Fuel Farms 1, 2, 3, and 4 in September 2013, December 2013, March 2014, December 2014, March 2015, June 2015, October 2015, January 2016, April 2016, November 2016, and January 2017.
2014	*Fuel Farm 1 Lower Marina Vapor Intrusion Study*	Vapor intrusion pathway assessment at Fuel Farm 1 Lower Area Buildings 2735 and 81.
2015	*Well Decommissioning Completion Report: Former Closed Fuel Farms 1, 2 and 4 (Site 36, 35, and 11)*	Describes the decommissioning of 20 monitoring wells at Fuel Farms 1, 2, and 4 in July 2015.
2017	*Land Use Control Implementation Plan*	Describes the procedures for implementing LUCs, including ICs and ECs, at 20 specified sites on NAS Whidbey Island.

6.2 SITE INSPECTIONS

Per the *Land Use Control Implementation Plan, Naval Air Station Whidbey Island, Oak Harbor, Washington* (Battelle, 2017a), annual inspections are conducted at specified sites, including Fuel Farms 1, 2, 3, and 4 and Building 357, of NAS Whidbey Island to ensure the effectiveness of LUCs, both ICs and ECs, in protecting human health and the environment. Table 4-7 lists the LUCs for each of these petroleum sites. LUC inspections were most recently conducted in August 2017. During these inspections in 2017, there were no changes in land use; no evidence of on-site or downgradient groundwater well installation or use; and no visual or administrative record of access control issues. The most salient findings were monitoring wells in poor or moderate condition at Fuel Farms 1, 3, and 4 and Building 357, and the lack of signage at all the petroleum sites (with the exception of Fuel Farm 2) to assist in delineating the LUC boundary and informing personnel of restrictions and/or hazards. In addition, there was some evidence of construction-type activities in the area of Fuel Farm 4. The LUC inspection checklists for Fuel Farms 1, 2, 3, and 4 and Building 357 from August 2017 are provided as Appendix B. Table 6-2 provides a summary of the 2017 LUC inspection findings.

The full findings from the 2017 LUC inspections, including field notes, photographic logs, monitoring well inspection checklists, and drinking water well evaluations, are presented in the *2017 Land Use Control Inspection Report, Naval Air Station Whidbey Island, Oak Harbor, Washington* (Battelle, 2017b).

Table 6-2. Summary of 2017 LUC Inspection Findings at Petroleum Sites

Checklist Summary	Fuel Farm 1	Fuel Farm 2	Fuel Farm 3	Fuel Farm 4	Building 357
Land Use Consistent with Requirement?	🟢	🟢	🟢	🟢	🟢
On-site or Downgradient Groundwater Well Installation or Use Since Last Inspection?	🟢	🟢	🟢	🟢	🟢
Groundwater Monitoring Network in Good Condition?	🔴	🟢	🔴	🔴	🔴
Evidence of Soil Excavation or Disturbance?	🟢	🟢	🟢	🟡	🟢
Access Control Maintained?	🟢	🟢	🟢	🟢	🟢
Signage Intact and Readable?	🔴	🟢	🔴	🔴	🔴

🟢 = LUC requirements met; 🟡 = LUC requirements partially met; 🔴 = LUC requirements not met.

6.3 COMMUNITY INVOLVEMENT

To facilitate communication with all parties interested in the cleanup actions at NAS Whidbey Island, the Navy formed a citizen-based Restoration Advisory Board (RAB) in 1994. NAS Whidbey Island was one of the first five "pilot" naval installations to implement the Department of Defense RAB Rule. The RAB reflects the diverse interests of the community and consists of representatives from various local organizations, businesses, and environmental groups as well as municipal officials. Its mission is to provide an open forum for communication among all stakeholders regarding NAS Whidbey Island's environmental restoration program.

At one time, the RAB held meetings as requested, but now meetings are held on a quarterly basis. The most recent RAB meeting was held on October 19, 2017 and focused on the State Petroleum Cleanup Program, Military Munitions Response Program, and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Program. These meetings are advertised in local newspapers and are open to the public. Cleanup documents are provided to RAB members for their review and comment. Briefings regarding the various cleanup activities are also provided to RAB members by the Navy Remedial Project Manager or their Contractor. As the primary forum for communication between NAS Whidbey Island and the community on their environmental restoration program, the information RAB members receive at the meetings is also available to the public.

At the beginning of the third FYR review process, the Navy initiated activities to involve the community in the FYR process for Fuel Farms 1, 2, 3, and 4 and Building 357 at NAS Whidbey Island. First, a notification was published in local newspapers notifying the public that the FYR process was occurring for the petroleum sites at NAS Whidbey Island. The notification was published in the *Whidbey News-Times* and the *South Whidbey Record* on April 29, 2017 (see Appendix C). The community was also informed of the initiation of the FYR process at the RAB meeting held on May 15, 2017. Once the FYR Report has been finalized, a notification will be published in the same local newspapers summarizing the results of the review and noting that the report is available to the public. The FYR Report will be made available electronically at the NAVFAC Northwest public website: https://www.navfac.navy.mil/navfac_worldwide/atlantic/fecs/northwest/about_us/northwest_documents.html.

As cleanup activities at NAS Whidbey Island are of growing interest, the Navy recently solicited requests for community members to join the RAB. As posted in the *Whidbey News-Times* on May 9, 2017, the

Navy is seeking volunteers who would like to learn about the cleanup activities and to have input on NAS Whidbey Island's environmental restoration program via the RAB.

6.4 INTERVIEWS

As part of the FYR, interviews were conducted with persons familiar with the cleanup activities at NAS Whidbey Island. Interview candidates were identified from the Navy (specifically NAVFAC Northwest), Ecology, and the RAB. A set of interview questions and instructions was sent by e-mail to Navy and Ecology interview candidates on April 27, 2017. All interview candidates chose to complete the questionnaire electronically and submitted the responses via e-mail. Hardcopies of the questionnaire were provided to RAB members during the meeting held on May 15, 2017. The hardcopies were pre-printed with US Postal Service (USPS) postage, such that any RAB member could complete the hardcopy questionnaire and submit it via USPS by placing it into any mailbox. None of the RAB members chose to participate. The completed interview records from Navy and Ecology personnel are provided as Appendix D.

Based on Navy responses to the interview questions, the remedies at Fuel Farms 1, 2, 3, and 4 and Building 357 continue to be effective in that they are protective of human health and the environment. There have been no known changes in land use, ownership, access or other site conditions that may impact the protectiveness and/or effectiveness of the remedy. In addition, Navy respondents are not aware of any violations of the IC requirements that could impact the protectiveness and/or effectiveness of this remedy component and are not aware of any concerns from the community regarding implementation or overall protectiveness of the remedies.

While the Navy believes that the remedies at the petroleum sites continue to be effective, one Navy respondent indicated that the historical groundwater monitoring frequency had not been conducted per the decision documents (NAVFAC, 2013a and 2013b; Foster Wheeler, 2000) and that free product recovery has not been conducted per the decision documents (NAVFAC, 2013a and 2013b; Foster Wheeler, 2000). It was also stated that the LUC requirements were not clearly defined in the decision documents (NAVFAC, 2013a and 2013b; Foster Wheeler, 2000) or in the *Land Use Controls Implementation Plan Addendum* (Battelle, 2016). Based on this information, the Navy respondent indicated that the on-going program of LUCs inspection, groundwater monitoring, and maintenance at the petroleum sites has not been sufficiently thorough enough to meet the goals of the decision documents (NAVFAC, 2013a and 2013b; Foster Wheeler, 2000).

The Ecology respondent believes that the remedies at Fuel Farms 1, 2, 3, and 4 and Building 357 are effective in protecting human health and the environment and that the on-going program of LUC inspections, groundwater monitoring, and maintenance at the petroleum sites has been sufficiently thorough enough to meet the goals of the decision documents (NAVFAC, 2013a and 2013b; Foster Wheeler, 2000). To the best of the respondent's knowledge, there has not been: 1) any new scientific findings that might call into question the protectiveness of the remedies; 2) any changes in site conditions that may impact the protectiveness of the remedies; 3) any complaints, violations, or other incidents relating to the petroleum sites; or 4) any community concerns regarding implementation of the remedies at the petroleum sites.

6.5 NEXT FIVE-YEAR REVIEW

The next FYR for the petroleum sites at NAS Whidbey Island will be the fourth, and is scheduled for 2022.

7.0 TECHNICAL ASSESSMENT

7.1 FUNCTIONALITY OF CLEANUP ACTION

This section summarizes and evaluates the data collected during this FYR period to answer the question “Is the cleanup action functioning as intended by the decision documents?”. The functionality of the remedy components applicable to Fuel Farms 1, 2, 3, and 4 and Building 357 are evaluated in the following subsections.

In addition to the remedy components described in the following subsections, LUCs and periodic reviews are also part of the remedies for Fuel Farms 1, 2, 3, and 4 and Building 357. LUCs are established under the *Land Use Control Implementation Plan* (Battelle, 2017a) and detailed in Table 4-7. The results of the 2017 LUC inspections are summarized in Section 6.0. Because some exceedances of CULs were expected to remain in soils and groundwater, a periodic review of the environmental data is required no less frequently than every five years (WAC 173-340-420[3]). This FYR report meets the requirement for periodic reviews.

7.1.1 Fuel Farm 1

Free Product Recovery. A primary objective of the remedy for Fuel Farm 1 is to recover free product until no well contains product at a thickness greater than 0.02 ft (or 0.25 inches), or to the maximum extent practicable for product recovery. Product thickness measurements collected at Fuel Farm 1 during this FYR period indicate that the floating free product was limited to two monitoring wells: MW-311 and MW-313, located downgradient of former Tank 224 in the Upper Area (see Figure 3-1). The product thickness measurements and recovery for Fuel Farm 1 are tabulated in Table 7-1.

Table 7-1. Fuel Farm 1 Product Thickness and Recovery

Well ID	Date	Product Thickness (ft)	Product Recovery (gal)
MW-313	October 2012	0.12	–
	December 2012	0.29	0.03
MW-311	December 2014	0.85	–
	October 2015	1.11	0.13
	November 2016	1.09	0.17

Approximately 0.12 ft of free product was encountered in MW-313 during the October 2012 quarterly sampling event, which prohibited sample collection. Consequently, the well was checked in December 2012 and was found to contain 0.29 ft of free product, and 120 milliliters (0.03 gallons) were recovered at that time.

During this FYR period, MW-311 was monitored for the presence of free product in December 2014, October 2015, and November 2016. In December 2014, approximately 0.85 ft of product was measured; however, there were no product recovery efforts attempted at that time. On October 26, 2015, approximately 1.11 ft of free product was observed, and 0.13 gallons were recovered. In November 2016, 1.09 ft of free product was measured and 0.17 gallons of product was recovered using passive recovery methods (i.e., sorbent socks). Overall, greater product thickness has been observed during the winter months. This observation is most likely due to factors such as increased rainfall and water level fluctuations; therefore, annual recovery efforts are conducted during the winter months to increase the potential for product recovery.

Groundwater/Compliance Monitoring. A total of 15 groundwater monitoring events, from July 2012 to January 2017, have been conducted at Fuel Farm 1 during this FYR period. During each event, water level measurements were collected from the monitoring well prior to initiating groundwater sampling. Appendix A presents the water level measurements collected and groundwater elevations calculated during each monitoring event. The most recent and comprehensive groundwater monitoring event was conducted in July 2016. The groundwater elevations from the July 2016 monitoring event, along with the survey data collected in December 2017, were used to create a potentiometric map for Fuel Farm 1. To create the potentiometric map, the data were gridded and contoured using EarthVision geospatial modeling software. Figure 7-1 illustrates the groundwater elevations along with the resulting potentiometric contours and groundwater flow directions from July 2016. As shown in Figure 7-1, the groundwater contours indicate a north and northeasterly groundwater flow direction, following general topography, from the Upper Area to the Lower Area and towards Crescent Harbor. In addition, groundwater elevations are higher immediately south of the sheet pile wall located along the northern boundary in the Lower Area (i.e., at MW-602) and then lower to the west and especially to the east (i.e., at MW-604) of the wall, where the groundwater is discharging to Crescent Harbor. The general groundwater flow direction at Fuel Farm 1 and groundwater elevations surrounding the sheet pile wall are consistent with the conceptual site model (CSM) and observations presented in the previous FYR (Sealaska, 2012).

Annual and quarterly groundwater sampling was performed in both Upper and Lower Area wells at Fuel Farm 1 for TPH-DRO, TPH-GRO, and BTEX, as well as for PAHs, VPH, and chlorinated VOCs in the Lower Area, as detailed in Table 4-3. Appendix A presents the analytical results from each monitoring event (i.e., July 2012 through January 2017) conducted during this FYR period. During this FYR period, toluene concentrations did not exceed its respective groundwater CUL; however, TPH-DRO, TPH-GRO, benzene, ethylbenzene, m,p-xylene, and o-xylene concentrations did exceed their respective groundwater CULs (see Table 7-2).

Table 7-2. Summary of Groundwater CUL Exceedances at Fuel Farm 1

		Upper Area			Lower Area		
Petroleum Constituent	Groundwater CUL (μg/L)	# Wells Exceeded CUL	Max Conc. (μg/L)	Well ID	# Wells Exceeded CUL	Max Conc. (μg/L)	Well ID
TPH-DRO	800	4	9,200	MW-319	3	7,600	MW-330L
TPH-GRO	700	20	37,100	MW-301	2	3,210	MW-339
Benzene	43	12	7,400	MW-319	1	44	MW-331
Toluene	5,000	0	–	–	0	–	–
Ethylbenzene	86	14	1,500	MW-311	1	110	MW-339
m,p-Xylene	332	4	1,400	MW-313	0	–	–
o-Xylene	332	1	830	MW-313	0	–	–

Previous studies have identified two distinct groundwater contaminant plumes associated with Fuel Farm 1 (Sealaska, 2012). The first is a dissolved-phase hydrocarbon plume that exists in a radial direction from the former fuel farm tanks, extending downhill to the northwest and to the northeast beneath the Lower Area. The northeast component of the plume may have originated from the Building 892 area. The second is a chlorinated VOC plume that exists in a localized area of the Lower Area centered close to monitoring well MW-331. The specific source of this plume is unknown.

Figures 7-2 through 7-4 illustrate the plume contour maps for TPH-GRO, benzene, and ethylbenzene from July 2016. Concentrations of TPH-DRO, toluene, and xylenes did not exceed their respective groundwater CUL during the July 2016 monitoring event; therefore, plume contour maps were not

Figure 7-1. Fuel Farm 1 Potentiometric Map, July 2016

Figure 7-2. TPH-GRO Concentration in Groundwater at Fuel Farm 1, July 2016

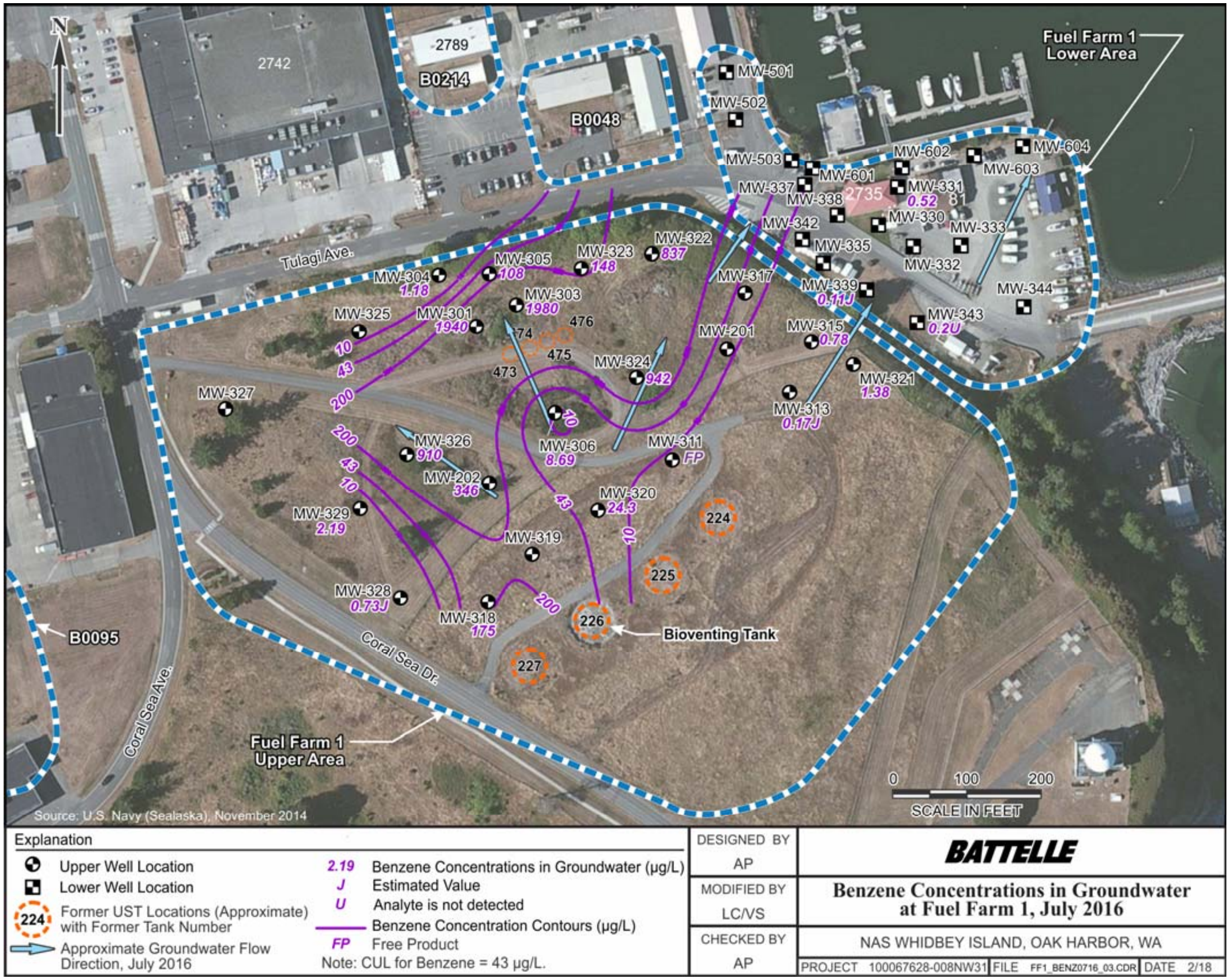

Figure 7-3. Benzene Concentration in Groundwater at Fuel Farm 1, July 2016

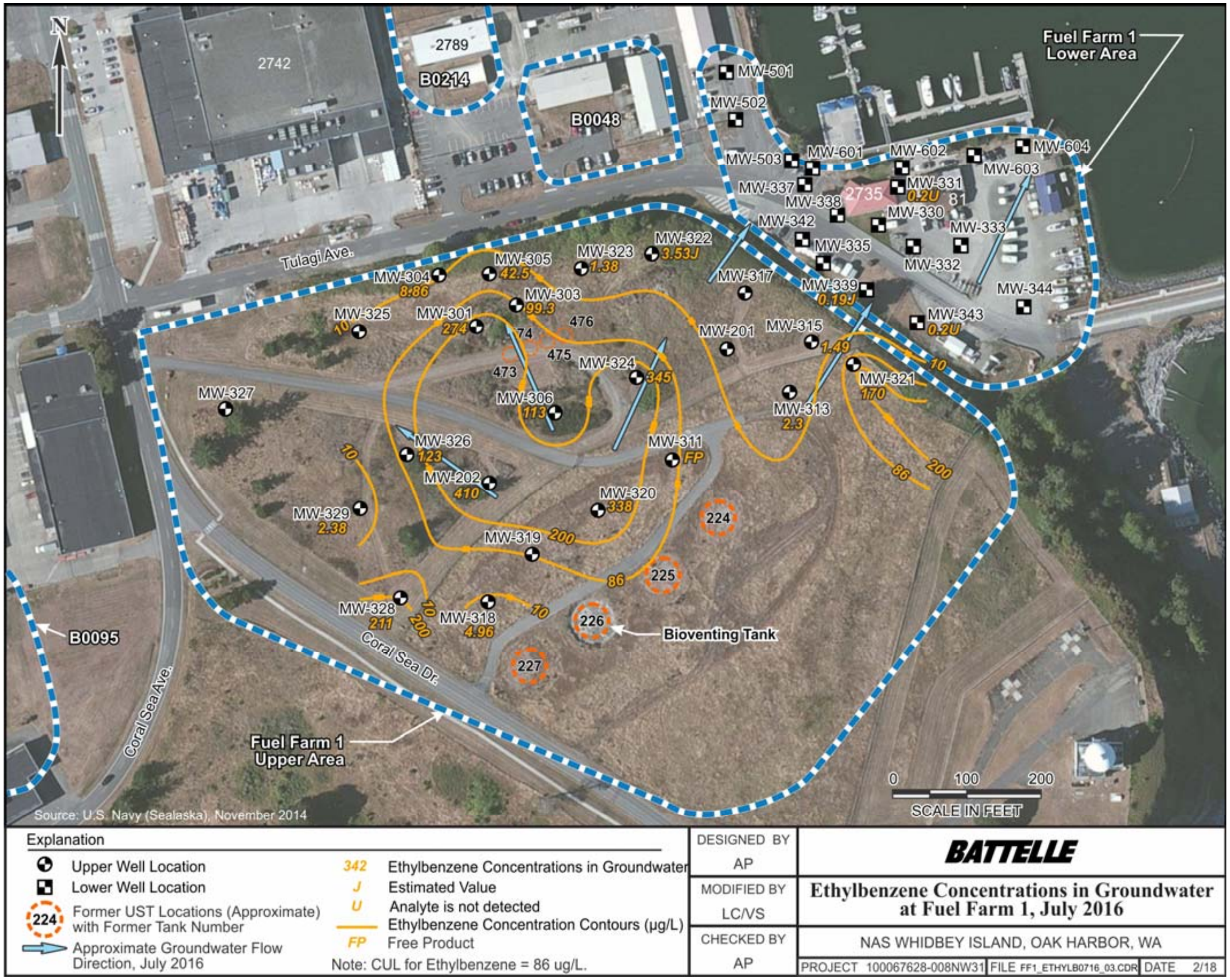

Figure 7-4. Ethylbenzene Concentrations in Groundwater at Fuel Farm 1, July 2016

created for these petroleum constituents. The plume maps were created using the July 2016 sampling results since this is the most recent and comprehensive data set. To create the plume contour maps, the data were gridded and contoured using EarthVision geospatial modeling software. The grids were created using the minimum tension gridding algorithm used by EarthVision. The grid spacing for all gridded surfaces for all contaminants was a 5-foot square grid cell size. The groundwater CULs were included as part of the iso-concentration contours for each contaminant (see Figures 7-2 through 7-4).

As shown in Figure 7-2, TPH-GRO concentrations greater than 5,000 μg/L encompass the northwestern portion of the Upper Area and former Tanks 473 through 476 (see Figure 7-2). The highest TPH-GRO concentration (i.e., 14,100 μg/L) was detected at well MW-301, which is consistent with historical data. Similar to TPH-GRO, the highest benzene and ethylbenzene concentrations were detected in the northwestern portion of the Upper Area (see Figures 7-3 and 7-4, respectively). The highest benzene and ethylbenzene concentrations (i.e., 1,980 and 410 μg/L, respectively) were detected in wells MW-303 and MW-202, respectively. These plume contour maps particularly confirm the presence of the dissolved-phase hydrocarbon plume downhill and to the northwest at Fuel Farm 1. The compliance well locations (i.e., MW-331 and MW-343) in the Lower Area delineate the northeast edge of the plumes with TPH-GRO, benzene, and ethylbenzene concentrations well below their respective groundwater CUL (see Figures 7-2 through 7-4). As such, these plumes do not reach the marine environment and, therefore, complete exposure pathways do not exist.

In addition to petroleum constituents, groundwater samples were collected and analyzed for PAHs, VPHs, and chlorinated VOCs in the Lower Area of Fuel Farm 1, as detailed in Table 4-3. During this FYR period, groundwater samples were collected and analyzed for PAHs from five wells: MW-332, MW-333, MW-344, MW-602, and MW-604. PAH concentrations were compared to their specified Pathway 3 groundwater CUL, since the Lower Area is adjacent to Crescent Harbor. Only 2-methylnaphthalene was detected above its Pathway 3 groundwater CUL of 4.46 μg/L and only at wells MW-333 and MW-344, centrally located in the Lower Area (see Figure 3-1).

To characterize the composition of the dissolved-phase petroleum constituents, groundwater samples were also collected and analyzed for VPHs in the Lower Area (see Table 4-3). During this FYR period, VPH analyses were conducted at five wells: MW-332, MW-337, MW-501, MW-502, and MW-601. Concentrations of C10-C12 aliphatics exceeded their Pathway 3 groundwater CUL of 11 μg/L at well MW-601 and concentrations of C6-C8 aliphatics exceeded their Pathway 3 groundwater CUL of 245 μg/L at wells MW-502 and MW-601. These exceedances are not collocated with PAH exceedances in the Lower Area, but may be an extension of the dissolved-phase benzene plume from the Upper Area (see Figure 7-3). C10-C12 aromatics were detected in well MW-601; however, concentrations were well below the Pathway 3 groundwater CUL of 80,000 μg/L. C12-C13 aromatics, C5-C6 aliphatics, C8-C10 aliphatics, and C8-C10 aromatics were not detected above laboratory reporting limits at all five wells during this FYR period.

Groundwater samples were collected and analyzed for chlorinated VOCs in the Lower Area (see Table 4-3) to evaluate the nature and extent of the localized plume east of Building 2735. During this FYR period, groundwater samples were collected and analyzed from six wells: MW-331, MW-332, MW-601, MW-602, MW-603, and MW-604. Concentrations of chlorinated VOCs were below their respective Pathway 3 groundwater CUL or not detected above laboratory reporting limits in wells MW-332, MW-601, and MW-604. Concentrations of chlorinated VOCs exceeding their respective Pathway 3 groundwater CUL were limited to wells MW-331, MW-602, and MW-603 (located along the south side of the sheet pile wall), confirming that the plume is localized. During the July 2016 event, only vinyl chloride (VC) was analyzed and only at five wells: MW-331, MW-601, MW-602, MW-603, and MW-604. The highest concentrations of VC were detected in MW-331, followed by MW-602, and then MW-

603. This observation indicates that well MW-331 may be within the source area and contamination migrates east-northeast with the predominant groundwater water flow direction (along the south side of the sheet pile wall), towards MW-603, with no detection above laboratory reporting limits in MW-604, delineating the leading edge of the plume (see Figure 7-1 for monitoring well locations and groundwater flow direction).

In 2014, a focused vapor intrusion pathway assessment was conducted in the Lower Area of Fuel Farm 1 to evaluate if chlorinated VOCs in the subsurface may be a concern to indoor air receptors (URS, 2014). Existing groundwater data were used to evaluate the vapor intrusion exposure pathway at Buildings 2735 and 81 due to the presence of chlorinated VOCs in groundwater. All health risk estimates were significantly below acceptable risk thresholds, indicating that vapor intrusion is not likely an issue. Currently, Building 2735 is in the custody of the NAS Whidbey Island Clinic (BUMED) and used for storage and Building 81 belongs to Public Works Department Environmental for the Facility Response Team. However, if the use of Buildings 2735 and/or 81 changes in the future, then soil, soil gas, and groundwater data for chlorinated VOCs in the Lower Area will be re-evaluated with respect to potential risks, if necessary.

Natural Attenuation. Based on the *Revised CAP, NAS Whidbey Island, Closed Former Fuel Farms 1, 2, 3 and Fire Training Area* (NAVFAC, 2013a), risk reduction and migration control for petroleum and chlorinated VOC constituents will continue to occur through natural attenuation mechanisms including biodegradation, volatilization, adsorption, and dispersion. The effectiveness of natural attenuation mechanisms at Fuel Farm 1 is evaluated through an analysis of: 1) plume stability; and 2) electron receptors and metabolic byproducts.

Petroleum Constituents. As indicated previously, the compliance well locations (i.e., MW-331 and MW-343) in the Lower Area delineate the northeast edge of the plume with petroleum constituent concentrations well below their respective groundwater CULs (see Appendix A). Thus, the dissolved-phase petroleum plume is stable along its northeast leading edge. Along the northwest boundary of the plume in the Upper Area, petroleum constituent concentrations (particularly TPH-GRO, benzene, and ethylbenzene) exceed their respective groundwater CULs. However, the most impacted wells (i.e., MW-303 and MW-301) are demonstrating a decreasing concentration trend over time. In addition, their downgradient wells (i.e., MW-305 and MW-304, respectively) are generally demonstrating stable to decreasing concentration trends, suggesting that contaminant mass within the subsurface is decreasing through natural attenuation mechanisms and not just migrating downgradient (see Figure 7-5).

The *Revised CAP, NAS Whidbey Island, Closed Former Fuel Farms 1, 2, 3 and Fire Training Area* (NAVFAC, 2013a) identifies dissolved oxygen (DO), nitrate, sulfate, and methane as natural attenuation parameters for Fuel Farm 1. During biodegradation (a natural attenuation mechanisms), microorganisms transfer electrons from donors (i.e., petroleum hydrocarbons) to electron acceptors and create energy in the process. Electron acceptors include DO, nitrate, and sulfate. Reductive processes using these acceptors generally occur, in order, from aerobic respiration (oxygen) to sulfate reduction, followed by methanogenesis. In general, biodegradation proceeds as long as electron acceptors are present (Wiedemeier, 1998). In the end, petroleum constituents are transformed into carbon dioxide, methane, and water.

During this FYR period, DO was the only geochemical parameter collected and measurements were collected as part of the low-flow groundwater sampling technique during each monitoring event. The final DO measurements collected prior to sample collection, once all water quality parameters have stabilized, are presented in Appendix A. In general, the data suggests that biodegradation is occurring in the Upper Area of Fuel Farm 1 with low DO levels where petroleum constituent concentrations remain high and high DO levels where petroleum constituent concentrations are low or not detected. However, biodegradation may be limited in the Lower Area with low DO levels in both impacted and non-impacted areas, suggesting anaerobic conditions across the area with low levels of the electron acceptors needed to degrade the electron donors (i.e., petroleum constituents).

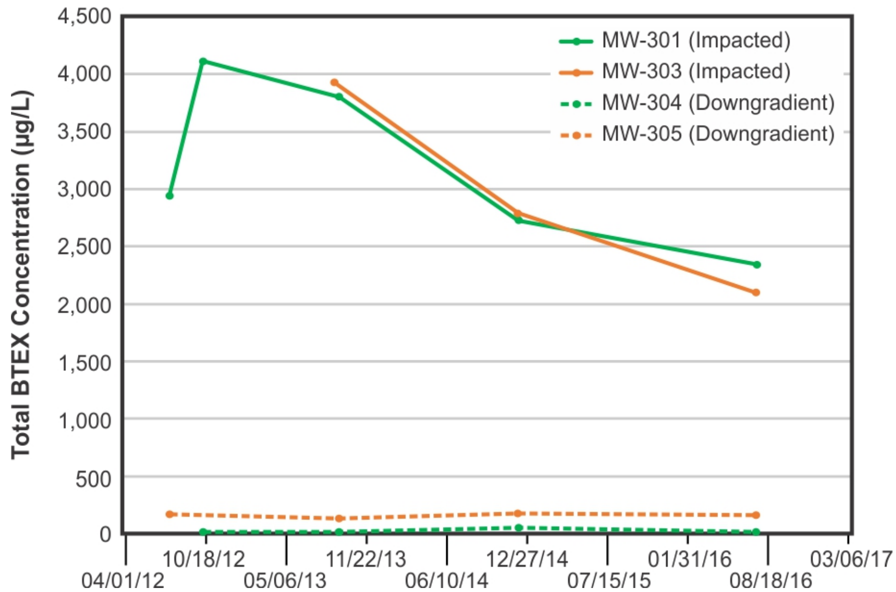

Figure 7-5. Total BTEX Concentrations in Impacted and Respective Downgradient Wells

Chlorinated VOCs. The *Revised CAP, NAS Whidbey Island, Closed Former Fuel Farms 1, 2, 3 and Fire Training Area* (NAVFAC, 2013a) noted that chlorinated VOCs were detected as part of compliance monitoring beginning in 2000. As the remedy to reduce risk and control migration for the petroleum hydrocarbons includes natural attenuation (URS, 1999), the applicability of this remedy was also evaluated for the localized area in the Lower Area where chlorinated VOCs were detected. Compliance monitoring results show that TCE as well as its daughter products (i.e., 1,1-DCE and VC) are primarily detected in three wells: MW-331, MW-602, and MW-603.

Although no source is known for the TCE, well MW-331 has the highest concentrations and has been treated as the source area (i.e., located just east of Building 2735). The first ten years of groundwater monitoring data were documented in the revised CAP (NAVFAC, 2013a) and second FYR (Sealaska, 2012). The contaminant concentration data demonstrated a decreasing trend for TCE and its daughter products and the geochemistry data indicated that the aquifer was anaerobic and supported reductive dechlorination. Therefore, the monitoring results suggested that natural attenuation was occurring in the source area (i.e., MW-331) and downgradient (i.e., MW-602 and MW-603), and natural attenuation would be an appropriate remedy for the chlorinated VOC contamination.

For this FYR, the additional contaminant concentration data collected since the second FYR were compiled with the data in the second FYR (Sealaska, 2012), and then Mann Kendall trends analysis was performed to evaluate plume stability (i.e., increasing, decreasing, or no trend on a well-by-well basis). Specifically, the Mann Kendall Took Kit by GSI Environmental was used to perform an evaluation of the TCE and daughter products concentration trends and ultimately plume stability over time within the source area and downgradient. Table 7-3 presents the results of the concentration trend evaluation.

Table 7-3. Chlorinated VOC Concentrations Trends in Lower Area of Fuel Farm 1

Well ID	Location	Chlorinated VOC	Confidence Factor	Concentration Trend
331	Source Area	TCE	>99.9%	Decreasing
		1,1-DCE	>99.9%	Decreasing
		VC	>99.9%	Decreasing
602	Downgradient	VC	64.0%	No Trend
603	Downgradient	VC	99.9%	Decreasing

Overall, the data trends demonstrate that the plume is decreasing, and biodegradation in the form of reductive dechlorination is likely occurring in the subsurface. All chlorinated VOC concentrations trends are decreasing at MW-331, the source area (see Figure 7-6).

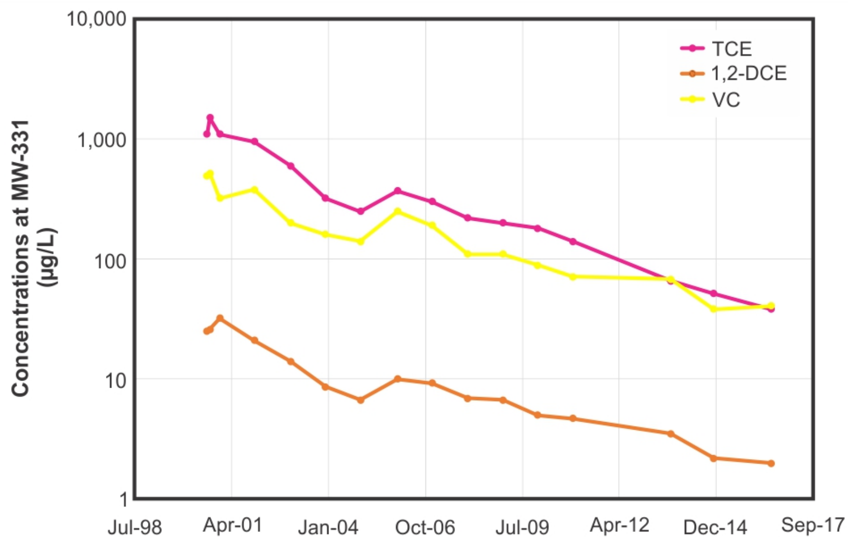

Figure 7-6. Chlorinated VOC Concentrations at Monitoring Well MW-331

In addition, the toe of the plume (i.e., MW-603) has a decreasing VC concentration trend. Well MW-602 is located within the plume, between wells MW-331 and MW-603, and is not demonstrating a VC concentration trend. This suggests that the influx of VC has fluctuated over time, yet the VC degradation rate is sufficient to address this varying influx of VC mass and not allow an increase in VC concentrations at MW-602. Furthermore, when geochemistry data were collect (before 2011), the data indicated that the aquifer geochemistry supported reductive dechlorination as is still observed in wells MW-331, MW-602 and MW-603. As stated previously, VC concentrations at MW-604 do not exceed its groundwater CUL and therefore delineate the leading edge of the plume. Based on this evaluation, it can be concluded that natural attenuation is currently decreasing chlorinated VOC concentrations and will continue to reduce risk and control migration of the chlorinated VOC plume in the Lower Area of Fuel Farm 1.

7.1.2 Fuel Farm 2

Free Product Recovery. Although the *Revised CAP, NAS Whidbey Island, Closed Former Fuel Farms 1, 2, 3 and Fire Training Area* (NAVFAC, 2013a) states that all activities related to product recovery are completed and wells MW-506 and MW-507 can be abandoned, product recovery activities continued at

Fuel Farm 2. The product thickness measurements and product recovery volumes for Fuel Farm 2 are tabulated in Table 7-4.

Table 7-4. Fuel Farm 2 Product Thickness and Recovery

Well ID	Date	Product Thickness (ft)	Product Recovery (gal)
MW-506	October 2015	2.01	0.48
	July 2016	0.36	–
	November 2016	0.91	0.13

During this FYR period, product thickness measurements and product recovery efforts were performed solely at well MW-506, located adjacent to the former pump station (see Figure 3-2). No other monitoring wells sampled during this FYR period were found to contain a measurable amount of free product (i.e., >0.02 ft). In October 2015, approximately 2.01 ft of free product was encountered in well MW-506 and subsequently 0.48 gallons were recovered. Upon the discovery of free product in well MW-506, product recovery efforts were resumed on an annual basis in October 2015. In November 2016, well MW-506 was checked and found to contain 0.91 ft of free product and then 0.13 gallons were recovered.

As shown in Table 7-4, product thickness in MW-506 has been greater during winter months (i.e., October and November) compared to summer months (i.e., July) most likely due to factors such as increased rainfall and water level fluctuations, supporting the conclusion that product recovery efforts are more effectively when performed during winter months (i.e., when free product thickness is greater and the likelihood for free product recovery is greater).

Compliance/Groundwater Monitoring. A total of 15 groundwater monitoring events, from July 2012 through January 2017, have been conducted at Fuel Farm 2 during this FYR period. During each event, water level measurements were collected from each monitoring well prior to initiating sampling activities. Appendix A presents the water level measurements collected and groundwater elevations calculated from the well during each monitoring event. The most recent and comprehensive groundwater monitoring event was conducted in July 2016. Figure 7-7 illustrates the groundwater elevations and general groundwater flow direction for July 2016. As shown in Figure 7-7, the groundwater flow direction is generally east towards Crescent Harbor, which is expected and consistent with the understanding of site conditions and the previous FYR (Sealaska, 2012).

Annual and quarterly groundwater sampling was performed at Fuel Farm 2 for TPH-DRO, TPH-GRO, and BTEX, as detailed in Table 4-4. Appendix A presents the analytical results from each monitoring event (i.e., July 2012 through January 2017) conducted during this FYR period. During the current FYR period, there were no exceedances of groundwater CULs for TPH-GRO, benzene, ethylbenzene, toluene, and xylenes. However, there were four monitoring wells (i.e., MW-505, MW-506, MW-508, and MW-717) that exceeded the groundwater CUL for TPH-DRO of 800 μg/L (see Appendix A). The most recent groundwater monitoring results from January 2017 demonstrate that TPH-DRO concentrations are below the groundwater CUL (of 800 μg/L) at MW-508 (at 268 μg/L) and MW-717 (non-detect). Well MW-506 is part of the free product recovery program; therefore, well MW-505 is the singular well with current dissolved-phase TPH-DRO concentrations exceeding the groundwater CUL (of 800 μg/L) of 1,990 μg/L in July 2016.

As stated previously, the most recent comprehensive groundwater monitoring event was conducted in July 2016. Figure 7-8 presents the analytical results from the July 2016 monitoring event. TPH-DRO is the only contaminant detected at concentrations exceeding its groundwater CUL (of 800 μg/L) and as shown in Figure 7-8, only at well MW-505 (at 1,990 μg/L), located between Tanks 228 and 229.

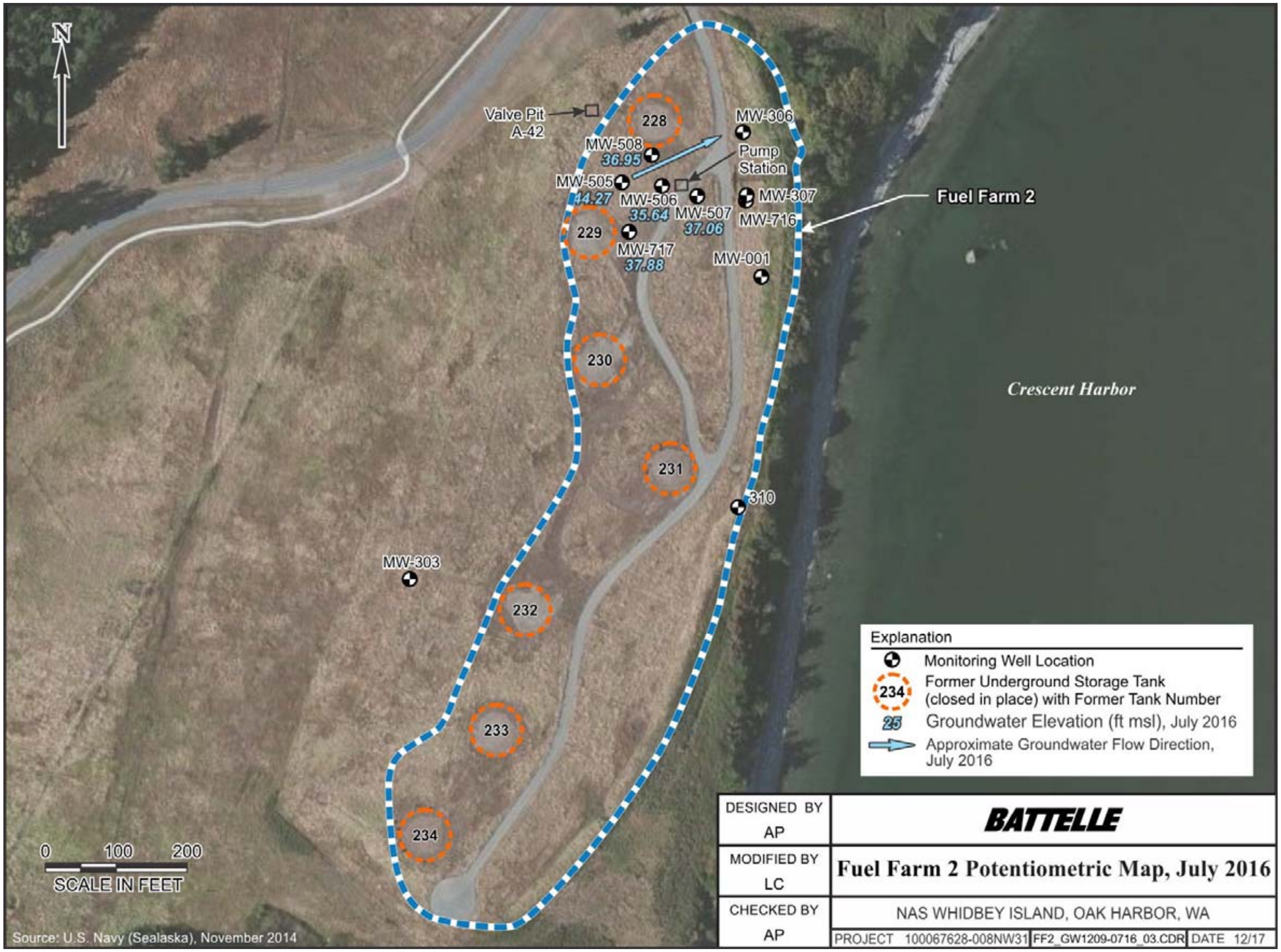

Figure 7-7. Fuel Farm 2 Potentiometric Map, July 2016

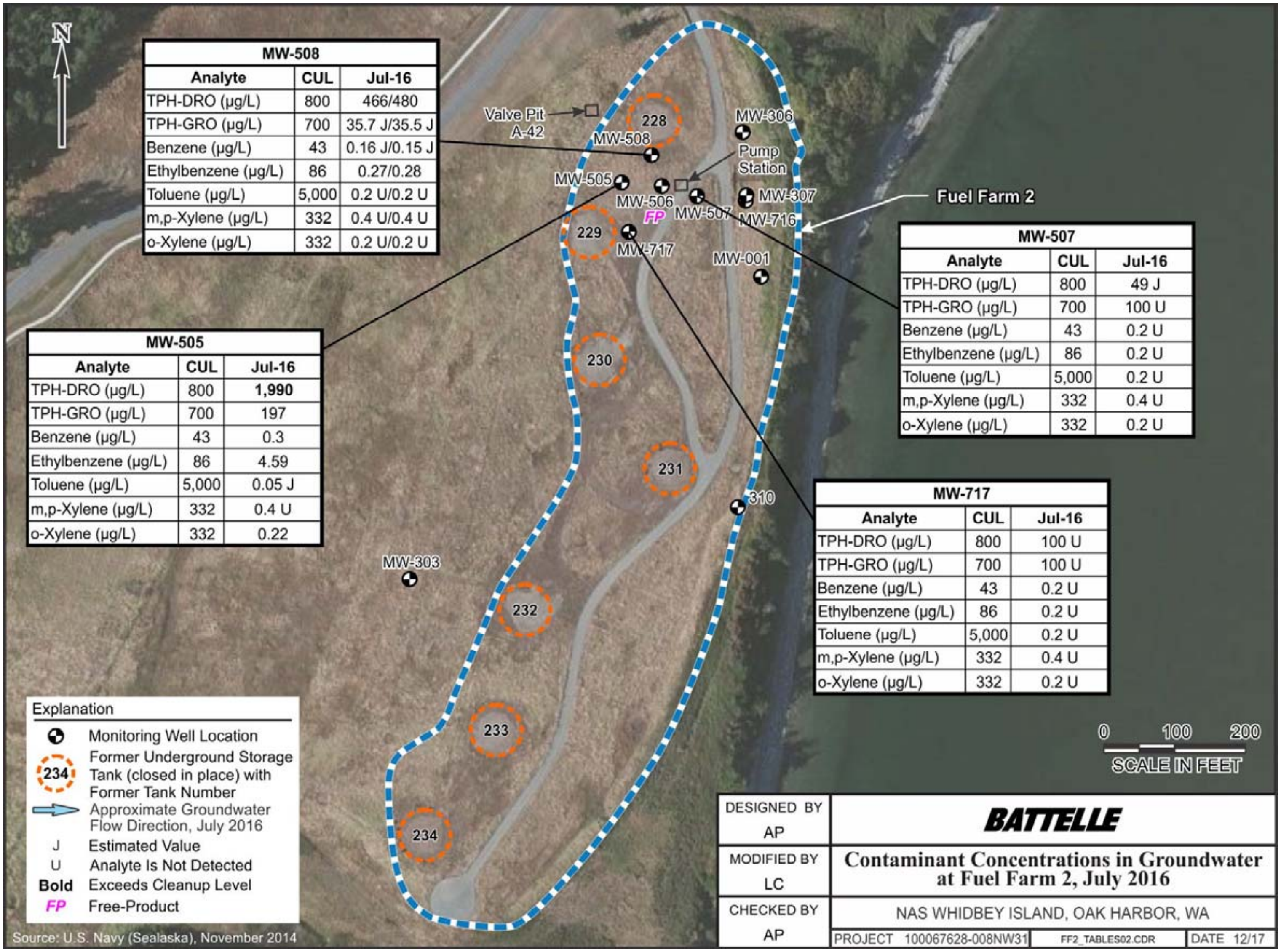

Figure 7-8. Contaminant Concentrations in Groundwater at Fuel Farm 2, July 2016

During the event, free product was encountered in well MW-506, located downgradient of MW-505 and adjacent to the former pump station. However, contaminant concentrations are below their respective groundwater CULs at MW-507, which is in a generally downgradient location from MW-506 (see Figure 7-8).

Natural Attenuation. As stated in the *Revised CAP*, *NAS Whidbey Island*, *Closed Former Fuel Farms 1, 2, 3 and Fire Training Area* (NAVFAC, 2013a), risk reduction and migration control for petroleum constituents at Fuel Farm 2 will occur through natural attenuation mechanisms including biodegradation, volatilization, dispersion, and adsorption as well as photodegradation (but only at the beach). For subsurface soils and groundwater at Fuel Farm 2, the dominant mechanism of natural attenuation is adsorption. The low permeability soils at Fuel Farm 2 provide natural migration control for petroleum-contaminated soil and groundwater: petroleum constituents adsorb strongly to the organic fraction of the clay/silt soils, and any product is strongly bound by high capillary pressures in the small pore spaces. This is observed between well MW-506 (with free product) and downgradient well MW-507 (where contamination was not detected), in an area where contamination is not migrating. Decreases in overall petroleum concentrations or changes in the fractional composition of the petroleum are expected to occur very slowly over time, primarily due to: 1) the limited availability of oxygen and other electron acceptors; and 2) the extremely limited amount of water filtration through the low permeability soils. These factors ultimately limit the effects of biodegradation, volatilization, and dispersion.

7.1.3 Fuel Farm 3

Free Product Recovery. Similar to Fuel Farm 1, a primary objective of the remedy is to recover free product until no well contains product with a thickness greater than 0.02 ft, or to the maximum extent practicable for product recovery. During the current FYR period, product thickness measurements and product recovery efforts were conducted at seven monitoring wells at Fuel Farm 3 (i.e., MW-303, MW-352, MW-353, MW-357, MW-358, MW-502, and MW-505; see Figure 3-3). The product thickness measurements and product recovery efforts for Fuel Farm 3 are tabulated in Table 7-5.

Table 7-5. Fuel Farm 3 Product Thickness and Recovery

Well	Date	Product Thickness (ft)	Product Recovery (gal)
MW-303	10/27/2015	0.3	0.08
	07/25/2016	0.06	–
	11/16/2016	0.03	0.09
MW-352	12/13/2012	0.42	0.05
	12/10/2013	0.69	0.06
	12/15/2014	0.21	0.04
	10/27/2015	0.72	0.24
	11/16/2016	0.13	0.05
MW-353	12/13/2012	0.52	0.03
	12/10/2013	0.7	0.08
	12/15/2014	0.16	0.02
	10/27/2015	0.64	0.09
	11/16/2016	0.29	0.04
MW-357	12/10/2013	1.16	0.22
	12/15/2014	0.47	0.06
	10/27/2015	1.31	0.31
	11/16/2016	0.69	0.3

Table 7-5. Fuel Farm 3 Product Thickness and Recovery (continued)

Well	Date	Product Thickness (ft)	Product Recovery (gal)
MW-358	07/26/2016	0.14	–
MW-502	12/13/2012	0.03	0.32
	12/10/2013	0.39	0.27
	12/15/2014	0.31	0.05
	10/27/2015	0.31	0.31
	11/16/2016	0.28	0.29
MW-505	12/13/2012	1.09	3.78
	12/10/2013	1.15	4.03
	12/15/2014	0.41	2.14
	10/27/2015	1.26	4.75
	11/16/2016	1.36	6.22

Monitoring wells MW-352, MW-353, MW-502, MW-504 and MW-505 were initially placed into the free product recovery program (NAVFAC, 2013a); however, free product was not measured or recovered from well MW-504. Free product was measured at wells MW-303, MW-357, and MW-358 and, therefore, these wells were placed into the product recovery program. Wells MW-357 and MW-505 have consistently demonstrated the greatest product thickness, ranging from 0.41 to 1.36 ft during this FYR period, while well MW-505 (located north of the former fuel tanks) demonstrates a significantly greater product recovery (see Table 7-5). Product recovery was performed annually during the current FYR period, specifically during winter months when product thickness is typically at its maximum thickness and recovery is anticipated to be optimal.

Compliance/Groundwater Monitoring. A total of 11 groundwater monitoring events, from September 2013 to January 2017, have been conducted at Fuel Farm 3 during this FYR period. During each event, water level measurements were collected from the monitoring well prior to initiating sampling activities. Appendix A presents the water level measurements collected and groundwater elevations calculated during each monitoring event. The most recent comprehensive groundwater monitoring event was conducted in July 2016, with 16 monitoring wells. Figure 7-9 presents the groundwater elevations, potentiometric contours, and groundwater flow direction based on July 2016 data from Fuel Farm 3. As presented in Figure 7-9, groundwater flow is generally towards the east-northeast, consistent with the December 2009 and December 2010 potentiometric maps presented in the previous FYR (Sealaska, 2012). Fuel Farm 3 is centrally located at Ault Field; therefore, groundwater flow direction is not influenced by surface water bodies.

Annual and quarterly groundwater sampling was performed at Fuel Farm 3 for TPH-DRO, TPH-GRO, and BTEX, as detailed in Table 4-5. Appendix A presents the analytical results from each monitoring event (i.e., September 2013 through January 2017) conducted during this FYR period. During the current FYR period, no groundwater concentrations exceeded groundwater CULs for TPH-DRO, toluene, or o-xylene at Fuel Farm 3.

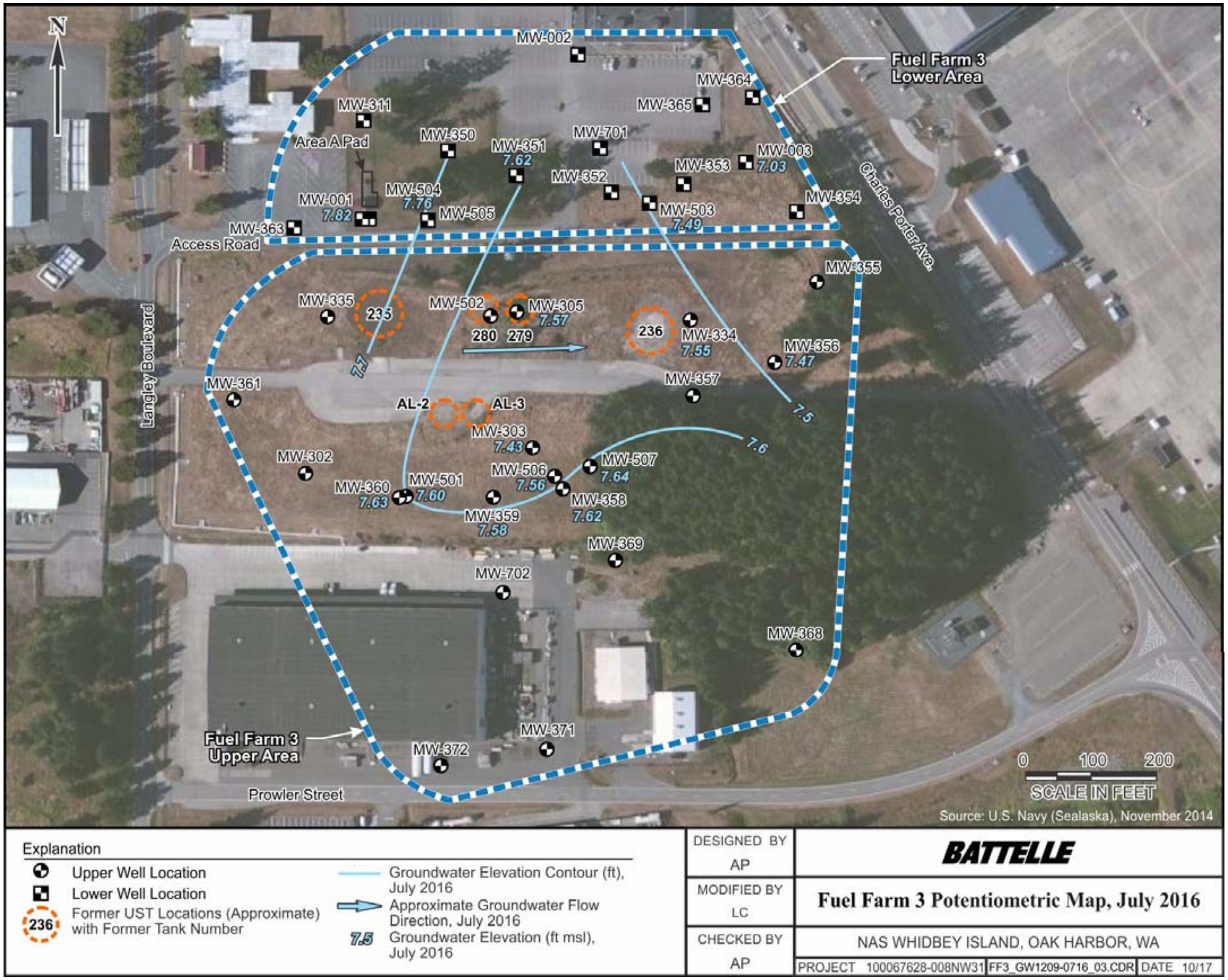

Figure 7-9. Fuel Farm 3 Potentiometric Map, July 2016

There were concentrations of TPH-GRO, benzene, ethylbenzene, and m,p-xylene exceeding their respective groundwater CUL (see Table 7-6).

Table 7-6. Summary of Groundwater CUL Exceedances at Fuel Farm 3

Petroleum Constituent	Groundwater CUL (µg/L)	Number of Wells with CUL Exceedance		July 2016	
		During FYR	July 2016	Max Concentration (µg/L)	Well ID
TPH-DRO	800	0	0	293	MW-501
TPH-GRO	700	15	13	4,630/4,570	MW-305
Benzene	43	2	2	120	MW-504
Toluene	5,000	0	0	38	MW-001
Ethylbenzene	86	5	4	262	MW-504
m,p-xylene	332	4	4	1,210	MW-504
o-xylene	332	0	0	211	MW-504

Figures 7-10 through 7-12 illustrate the plume contour maps for TPH-GRO, benzene, and ethylbenzene, respectively, based on July 2016 data. The plume contour maps were created for July 2016, since the sampling data for July 2016 were the most comprehensive data set. To create the plume contour maps, the data were gridded and contoured using EarthVision geospatial modeling software. The grids were created using the minimum tension gridding algorithm used by EarthVision. The grid spacing for all gridded surfaces for all contaminants was a 5-foot square grid cell size. The groundwater CULs were included as part of the iso-concentration contours for each contaminant (see Figures 7-10 through 7-12).

As shown in Figure 7-10, all but one well (MW-372) had TPH-GRO concentrations that exceeded the groundwater CUL across the site. The highest TPH-GRO concentrations were found near the former tanks, particularly adjacent to Tank 279 with a maximum concentration of 4,630 µg/L at MW-305. Similar to TPH-GRO, the highest benzene and ethylbenzene concentrations were detected in the area of the former tanks (see Figures 7-11 and 7-12). Two wells, MW-305 and MW-504 (located adjacent to a former free product recovery system Area A Pad), had benzene concentrations that exceeded the groundwater CUL (of 43 µg/L) at 93.1 and 120 µg/L, respectively. There were four wells (i.e., MW-001, MW-501, MW-504 and MW-507) with ethylbenzene concentrations that exceeded the groundwater CUL of 86 µg/L. Wells MW-001 and MW-504 are located adjacent to each other just north of the former tanks, and wells MW-501 and MW-507 are located south of the former tanks (see Figure 7-12).

Natural Attenuation. As stated in the *Revised CAP, NAS Whidbey Island, Closed Former Fuel Farms 1, 2, 3 and Fire Training Area* (NAVFAC, 2013a), risk reduction and mitigation control for petroleum constituents at Fuel Farm 3 will continue to occur through natural attenuation mechanisms including biodegradation, volatilization, adsorption, and dispersion. Continued product recovery efforts will enhance natural attenuation results and ultimately, decrease dissolved-phase contaminant concentrations to below groundwater CULs. The effectiveness of natural attenuation mechanisms at Fuel Farm 3 is evaluated through an analysis of: 1) plume stability; and 2) electron receptors and metabolic by-products.

The original CAP (Navy, 1999) included seven wells (i.e., MW-003, MW-334, MW-335, MW-351, MW-356, MW-358, and MW-364) for compliance monitoring. These wells are located downgradient with no free product and, therefore, can be used to assess stability or migration of the free product plume, if it

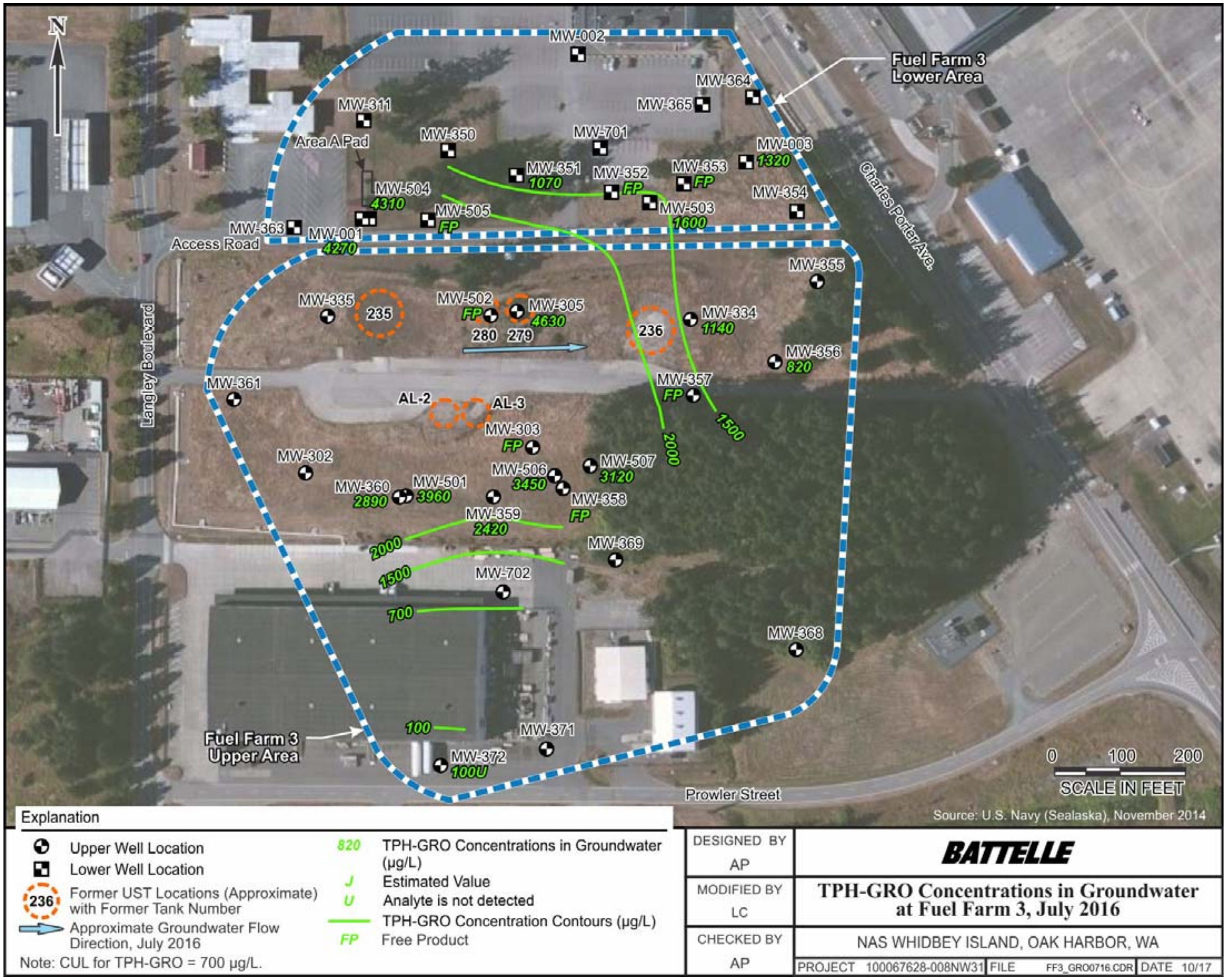

Figure 7-10. TPH-GRO Concentrations in Groundwater at Fuel Farm 3, July 2016

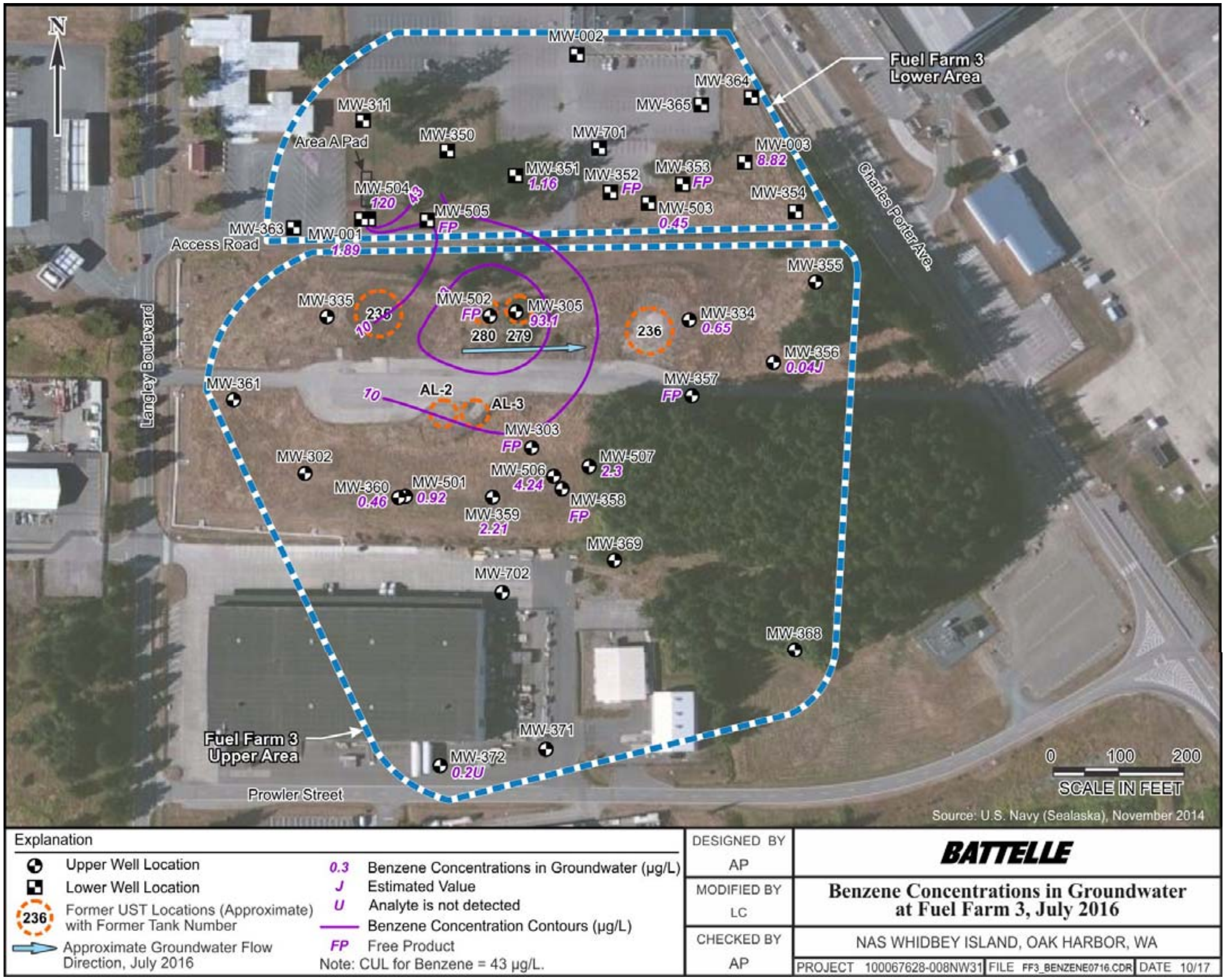

Figure 7-11. Benzene Concentrations in Groundwater at Fuel Farm 3, July 2016

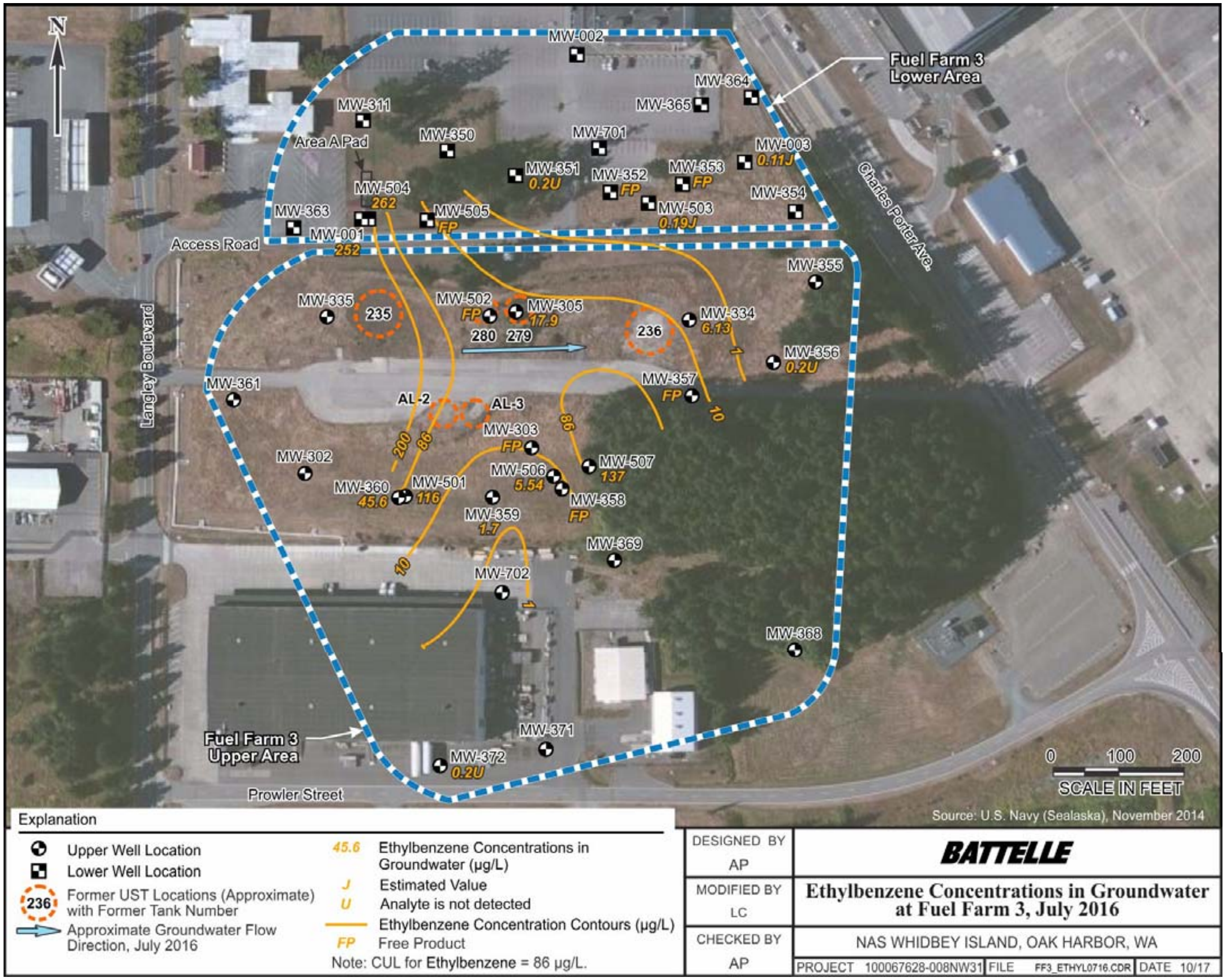

Figure 7-12. Ethylbenzene Concentrations in Groundwater at Fuel Farm 3, July 2016

occurs (NAVFAC, 2013a). During this FYR period, no free product was detected in any of these wells except for MW-358. During the July 2016 monitoring event, approximately 0.14 ft of free product was detected in MW-358. This finding potentially indicates that the free product plume in the area of MW-303 has migrated to the south-southeast in the subsurface. Although the amount of free product in MW-358 is relatively minimal (see Table 7-5), it should continue to be monitored on an annual basis to evaluate plume stability at Fuel Farm 3.

The *Revised CAP, NAS Whidbey Island, Closed Former Fuel Farms 1, 2, 3 and Fire Training Area* (NAVFAC, 2013a) identifies DO, nitrate, sulfate, methane, and ethane as natural attenuation parameters for Fuel Farm 3.

During this FYR period, DO was the only geochemical parameter collected when measurements were collected as part of the low-flow groundwater sampling technique during each monitoring event. The final DO measurement collected prior to sample collection, once all water quality parameters had stabilized, are presented in Appendix A. Using the *Guidance on Remediation of Petroleum-Contaminated Ground Water by Natural Attenuation* (Ecology, 2005), these DO measurements were compared to their respective BTEX concentrations to determine the occurrence of biodegradation in the subsurface. Assuming well MW-502 is a source area (i.e., presence of free product) and groundwater flow direction is towards the east-northeast, the DO levels and total BTEX concentrations were evaluated downgradient, along the centerline, from this source area (see Table 7-7).

Table 7-7. Evaluation of DO Levels and Total BTEX Concentrations at Fuel Farm 3

Well ID	Approx. Distance Downgradient of MW-502 (ft)	July 2016	
		Total BTEX (µg/L)	DO (mg/L)
MW-305	45	118	0.00
MW-334	320	14.2	0.07
MW-356	450	0.54	0.84

Notes: Duplicate sample results were averaged for calculation and concentration not detected above the laboratory reporting limit were calculated as half their reporting limit.

As indicated by the results from July 2016, total BTEX concentrations and DO levels are inversely related downgradient of the source area, along its centerline (see Table 7-7). Overall, DO levels (i.e., electron acceptors) increase while BTEX concentrations (i.e., electron donor) decrease with distance from the source area. This evaluation indicates that the dissolved-phase plume may be degrading with distance along its centerline due to the presence of electron acceptors and that biodegradation is occurring in the subsurface at Fuel Farm 3.

7.1.4 Fuel Farm 4

Free Product Recovery. Although the *IRACR Addendum, Site 11 NAS Whidbey Island, Former Fuel Farm 4 and Building 491* (NAVFAC, 2013b) states that product thickness requirements have been met and therefore quarterly product measurements are terminated, product measurement activities continued at Fuel Farm 4. The product thickness measurements for Fuel Farm 4 are tabulated in Table 7-8.

Table 7-8. Fuel Farm 4 Product Thickness and Recovery

Well ID	Date	Product Thickness (ft)	Product Recovery (gal)
MW-109	October 2015	0.03	–
	January 2016	0.04	–
	April 2016	0.03	–
	July 2016	0.03	–

During this FYR period, free product was solely detected in well MW-109, located downgradient of UST TO362-1 (see Figure 3-4). Free product thickness measurements ranged from 0.03 to 0.04 ft (see Table 7-8). Considering the minimal amount of free product (i.e., minimum of 0.02 ft per requirements), product recovery efforts were not practicable. In addition, there is such a minimal amount of free product that seasonal effects, such as increased rainfall, do not appear to impact the free product thickness.

Compliance/Groundwater Monitoring. A total of 17 groundwater monitoring events, from July 2012 to January 2017, have been conducted at Fuel Farm 4 during this FYR period. During each event, water level measurements were collected from the monitoring well prior to initiating sampling activities. Appendix A presents the water level measurements collected and groundwater elevations calculated during each monitoring event. The most comprehensive groundwater monitoring event was conducted in July 2012. Figure 7-13 presents the groundwater elevations, potentiometric contours, and groundwater flow direction using the water level measurements at wells MW-102, MW-109, MW-113, and MW-114 from July 2012. As presented in Figure 7-13, groundwater flow is generally towards the north-northwest, consistent with the previous FYR (Sealaska, 2012).

Annual and quarterly groundwater sampling was performed at Fuel Farm 4 for TPH-DRO, TPH-GRO, and BTEX, as detailed in Table 4-6. Appendix A presents the analytical results from each monitoring event (i.e., July 2012 through January 2017) conducted during this FYR period. During the current FYR period, there were no exceedances of groundwater CULs for BTEX constituents. There were two monitoring wells (i.e., MW-113 [491] and MW-109) that exceeded the TPH-DRO groundwater CUL of 800 µg/L. Only one well, MW-113 (491), located adjacent to former Building 491, has consistently exceeded the TPH-GRO groundwater CUL of 700 µg/L (see Appendix A).

No plume maps were created for Fuel Farm 4 due to the insufficient number of monitoring wells sampled during each event from September 2013 through January 2017. As indicated previously, there are two monitoring wells with historical detections of TPH-DRO and/or TPH-GRO exceeding their respective groundwater CUL: MW-109 and MW-113 (491). Well MW-109 currently contains free product and, as such, has not been sampled since June 2014. Well MW-113 (491) has been sampled during six events with the most recent event conducted in July 2016. To evaluate the contaminant concentration trends at MW-113 (491), time-series plots were developed. Figure 7-14 illustrates the time-series plots for TPH-DRO, TPH-GRO and BTEX constituents at MW-113(491). For the entire FYR period, benzene, ethylbenzene, toluene, m,p-xylene, and o-xylene are all well below their groundwater CULs of 43 µg/L, 5,000 µg/L, 86 µg/L, 20 µg/L and 20 µg/L, respectively. Benzene concentrations have demonstrated an increasing trend over the past three monitoring events, but are still well below the groundwater CUL of 43 µg/L (i.e., at 3.12/2.76 µg/L in July 2016). This concentration trend will continue to be monitored and evaluated during future events at the site to ensure levels do not continue to increase. As shown in the Figure 7-14, TPH-DRO concentrations have been well below the groundwater CUL of 800 µg/L since March 2015. However, TPH-GRO concentrations have been near or above the groundwater CUL of 700 µg/L for most of the FYR period with the highest concentration detected in July 2016 (at 1,010 µg/L).

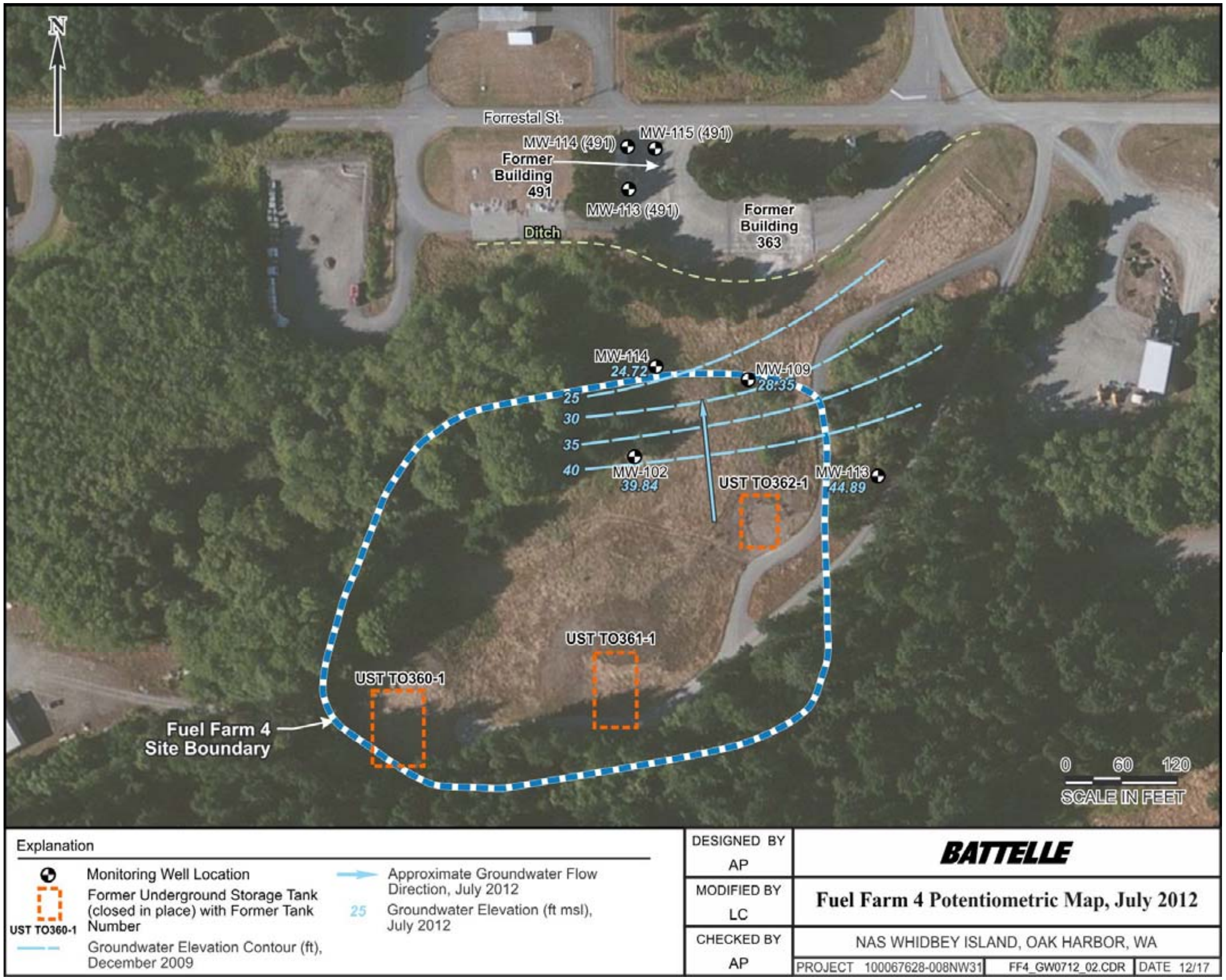

Figure 7-13. Fuel Farm 4 Potentiometric Map, July 2012

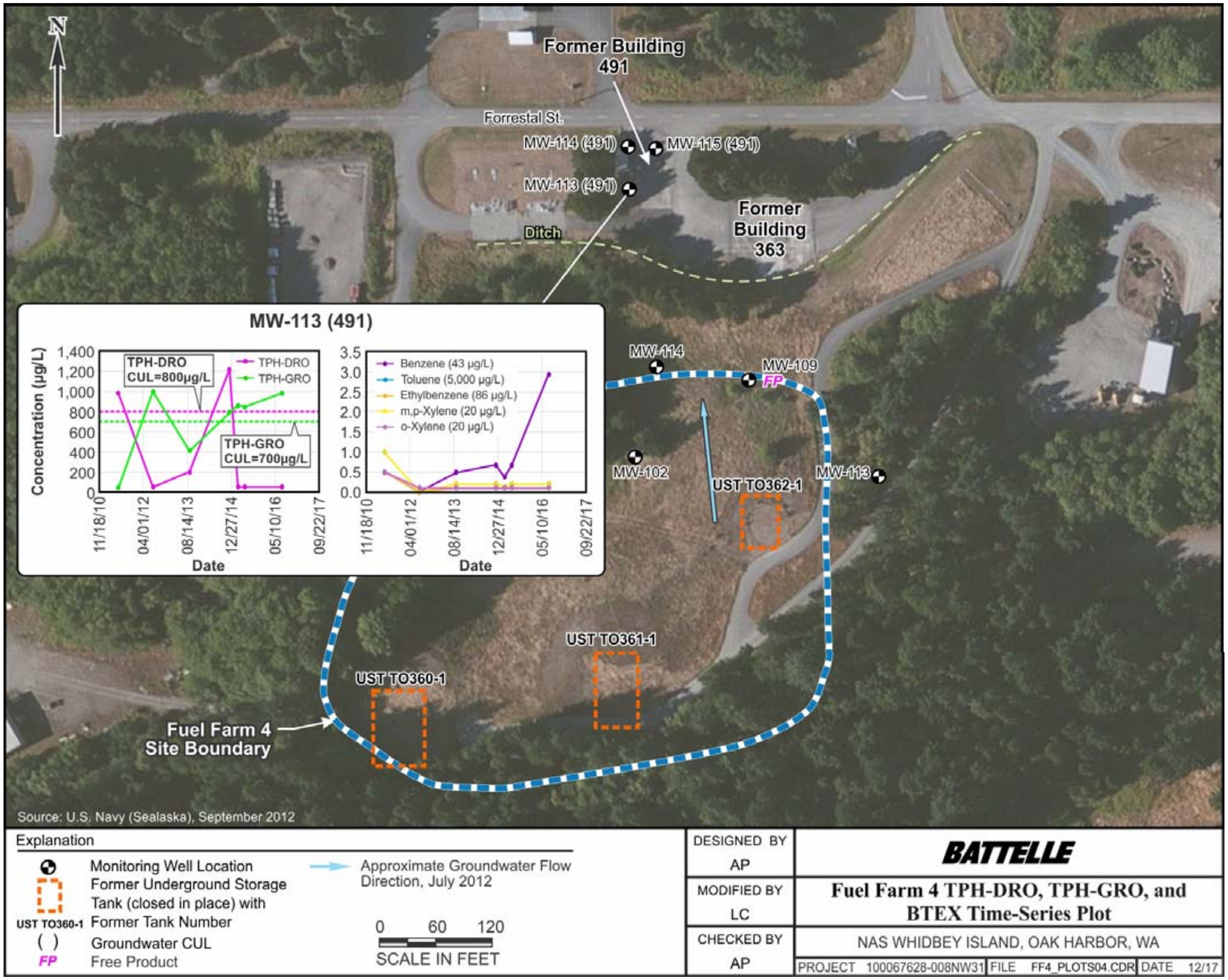

Figure 7-14. Fuel Farm 4 TPH-DRO, TPH-GRO, and BTEX Time-Series Plot

7.1.5 Building 357

In addition to LUCs and periodic reviews, compliance/groundwater monitoring and natural attenuation are part of the remedy for Building 357. However, there are no new data to present in this FYR for Building 357. After Ecology's request that an additional year of confirmation groundwater sampling be conducted (following their concurrence that soil remediation efforts had been completed in June 2000), groundwater sampling was actually conducted for an additional six years (or 26 quarters) from November 2001 through August 2007. August 2007 is the last groundwater sampling event that was conducted at Building 357. The previous FYR (Sealaska, 2012) recommended that confirmation sampling be conducted at monitoring well MW-17 for dissolved-phase components (specifically benzene and TPH-GRO) and the results used to request a no further action determination from Ecology.

7.2 CONTINUED VALIDITY OF DECISION DOCUMENT ASSUMPTIONS

This section answers the question: “Are the exposure assumptions, toxicity data, CULs, and RAOs used at the time of remedy selection still valid?” Therefore, this section evaluates the protectiveness of the cleanup action by reviewing any change to CULs that were proposed in the decision documents and risk assessment assumptions.

In most cases, the ARARs, exposure assumptions, toxicity data, and RAOs have changed substantially since CULs were established in the following decision documents completed over 16 years ago:

- *Cleanup Action Plan for Petroleum Sites, Naval Air Station, Whidbey Island, Oak Harbor, Washington* (URS, 1999);
- *Final Independent Remedial Action Closure Report for Fuel Farm 4, Naval Air Station Whidbey Island, Oak Harbor, Washington* (URS, 2001); and
- *Final Independent Remedial Action Closure Report for Remediation of Contaminated Soils at Building 357, Seaplane Base, NAS Whidbey Island* (Foster Wheeler, 2000).

Since their completion, two of the decision documents were updated in 2013 (NAVFAC, 2013a and 2013b). However, updates to these decision documents did not include updating the CULs. Consequently, the CULs for some of the COCs are significantly different from CUL based on today’s standard assumptions and regulatory requirements. There have been substantial changes to exposure assumptions and toxicity data; revisions to state regulations and guidance on remediation of contaminated sites; and promulgation of new state surface water ARARs. Despite these changes, the remedial actions completed to date, along with the use of LUCs to prevent exposure to COCs remaining in place, continue to protect human health and the environment, as long as LUCs are maintained.

The CULs were developed for exposure pathways defined in the *Final Remedial Investigation/Feasibility Study Report for Petroleum Sites* (Navy, 1999) based on a CSM and evaluation of transport to a receptor developed based on Ecology Guidance at the time (Ecology, 1997). The CSM provided three possible exposure pathways by which petroleum residuals in on-site media could be transported to human and ecological receptors; thus, the CULs were categorized as “Pathways 1, 2, or 3”:

- Pathway 1 **–** possible use of groundwater by humans as drinking water.
- Pathway 2 **–** direct contact with soils by on-site workers, possible future residents, or ecological receptors.

- Pathway 3 – groundwater migration to surface water and subsequent ingestion of, inhalation of, or dermal contact with the water by on-site workers, possible future residents, or animals that live in, on, or near the water.

The three exposure pathways were applied on a site-by-site basis, as appropriate, to select site-specific CULs. Application of regulatory criteria to a specific COC measured in the exposure media depended on the target receptors and exposure pathways considered to be of concern for the particular sampling location and the medium being analyzed.

Criteria considered for selection of CULs included Ecology MTCA Method A, B, and C cleanup values, Federal Marine Ambient Water Quality Criteria (40 Code of Federal Regulations [CFR] 131), and Whidbey Island background concentrations for total and dissolved lead. The MTCA Method A (aesthetic) criterion was given lower priority for chemicals for which there was a risk-based criterion. For example, because it is risk-based, if both MTCA Method A and B values were available for a chemical, the Method B value was used even if it was less restrictive (i.e., higher). If no other criterion existed, the MTCA Method A value was used by default.

Based on the above, potential criteria identified in the decision documents for evaluating Pathway 1 included MTCA Method A, B, and C cleanup values for groundwater. Ecological receptors were not considered for Pathway 1. Potential criteria used for evaluating Pathway 2 included MTCA Method A, B, and C values for soil. For an exposure pathway that applied to both human and ecological receptors, the criteria for both types of receptors were applicable and the lower of the two values (i.e., human or ecological) was selected as the CUL for that pathway. Potential criteria used for evaluating Pathway 3 included MTCA Method A values for groundwater, MTCA Method B and C values for surface water, and Federal Marine Ambient Water Quality Criteria for marine surface water.

The *Revised CAP NAS Whidbey Island Closed Former Fuel Farms 1, 2, 3 and Fire Training Area* (NAVFAC, 2013a) maintained the CULs developed under the original CAP (URS, 1999) based on the same pathways listed above. Similarly, for Fuel Farm 4, the *IRACR Addendum Site 11 NAS Whidbey Island Former Fuel Farm 4 and Building 491* (NAVFAC, 2013b) also maintained the original CULs in the original IRACR (URS, 2001) apart from the use of the Pathway 1 MTCA Method A for TPH-GRO and TPH-DRO in groundwater.

For Building 357, a CAP was not completed; therefore, groundwater and soil sampling results were compared with MTCA Method A values listed in the *Final Independent Remedial Action Closure Report for Remediation of Contaminated Soils at Building 357, Seaplane Base, NAS Whidbey Island* (Foster Wheeler, 2000).

This section describes the changes, if any, to ARARs (i.e., the standards and the "to be considered" [TBC] policies and guidance), and basic risk assessment assumptions (methods, exposure, and toxicity) that have occurred since development of the CULs. Changes associated with the CULs are presented below for COCs identified in the most recent decision documents (NAVFAC, 2013a and 2013b and Foster Wheeler, 2000) and for COCs remaining in the environment that have been addressed using LUCs.

7.2.1 Review of Applicable or Relevant and Appropriate Requirements

U.S. EPA FYR Guidance (U.S. EPA, 2001) indicates that the question of interest in developing the FYR is not whether a standard, in this case a CUL, in the decision document has changed in the intervening period, but whether such a change to a standard calls into question the protectiveness of the cleanup action. If the change in the standard would be more stringent, the next stage is to evaluate and compare the old and the new standards and their associated risks and/or health hazards. This comparison is done to assess whether the currently calculated risk associated with the standard identified in the decision document is still at or below Ecology's acceptable excess cancer risk of $1x10^{-5}$, and the hazard index does not exceed one (1) for noncancer effects. If the old standard is not considered protective, a new cleanup standard may need to be adopted through regulatory processes necessary for modifying a remedy (e.g., revised CAP).

As part of this FYR, the ARARs used as the basis for the CULs identified in the respective decision documents for the COCs were reviewed for changes that could affect the protectiveness of the cleanup actions. The standards that were reviewed are the following:

- Washington State MTCA Regulations (WAC 173-340)
- Washington State Marine Surface Water Quality Standards for Protection of Aquatic Life and Human Health (WAC 173-201A-240)[1]

In addition, fractionated TPH CULs based on MTCA Method B for the former fuel farms were derived using an *Interim Interpretive and Policy Statement: Cleanup of Total Petroleum Hydrocarbons (TPH)* (Ecology, 1997), which is now replaced by current guidance, the *Guidance for Remediation of Petroleum Contaminated Sites* (Ecology, 2016a), originally published in 2011 and revised in 2016. Therefore, Ecology's current petroleum guidance was reviewed to identify changes that could affect the protectiveness of the cleanup actions with respect to fractionated TPH cleanup values.

ARAR changes found that would call into question the protectiveness of the CULs or cleanup actions are presented below for each of the petroleum sites. The result of changes to the regulations is in some instances the lowering of a numeric ARAR. In these instances, the revised ARAR must be evaluated to determine whether there is a negative effect on the protectiveness of the remedy. In other instances, the ARAR remains unchanged or has been raised. In these instances, no further discussion is provided, because the protectiveness of the remedy is not affected.

Tables are provided that compare ARARs selected as CULs to current ARARs, with highlights of any changes (red indicates decrease in ARAR concentration, more restrictive; green indicates an increase in ARAR concentration, less restrictive; and blue indicates no change in ARAR concentration) for COCs identified in the decision documents. In addition, review of CULs for those COCs remaining in soil where LUCs are used to prevent exposure is also provided to evaluate the protectiveness of the remedy.

7.2.1.1 Fuel Farm 1

The COCs for the upper and lower (i.e., Marina) areas of Fuel Farm 1, as identified in the *Revised CAP NAS Whidbey Island Closed Former Fuel Farms 1, 2, 3 and Fire Training Area* (NAVFAC, 2013a), and their associated CULs are summarized in Table 7-9. COCs for soil, as identified in the original CAP (URS, 1999), and associated CULs are provided in Table 7-10. Current ARARs are also provided on these tables for comparison. As shown on Table 7-9, Pathway 1 CULs are used to compare against groundwater sampling results for monitoring wells located in the upper area. Pathway 1 CULs were based on the groundwater being used as drinking water. Pathway 3 CULs are used to compare against groundwater sampling results for monitoring wells located in the lower, or Marina, area of the fuel farm. Pathway 3 CULs were based on the groundwater to surface water transport pathway and subsequent surface water exposures. Changes in ARARs are due to changes in toxicity and exposure assumptions that have occurred since issuance of the original CAP (URS, 1999).

Table 7-9. Fuel Farm 1 Groundwater Cleanup Levels

COC[1]	Cleanup Levels[1] (µg/L)		Current MTCA Cleanup Level[2] (µg/L)		Maximum Concentration Detected (µg/L) as Reported in the 2015-2016 Annual Long-Term Monitoring Report[8]
Pathway 1 (Upper Area)					
Benzene	1.51	MTCA B	0.795	MTCA B	**1,980**
Ethylbenzene	800	MTCA B	800	MTCA B	410
Toluene	1,600	MTCA B	640	MTCA B	18.1
m,p-Xylenes	16,000	MTCA B	1,600	MTCA B	165
o-Xylene	16,000	MTCA B	1,600	MTCA B	21
TPH-GRO	700	MTCA A	800[3]	MTCA A	**14,100**
TPH-DRO	800	MTCA A	500	MTCA A	**662**
Pathway 3 (Marina, or Lower Area)					
Benzene	43	MTCA B (surface water)	1.6	WAC 173-201A-240[5]	0.52
Ethylbenzene	86	Interim Policy Eco Marine Water Standard[4]	270	WAC 173-201A-240[5]	0.19 J
Toluene	5,000	Interim Policy Eco Marine Water Standard[4]	410	WAC 173-201A-240[5]	0.2 U
m,p-Xylenes	332	Interim Policy Eco Marine Water Standard[4]	1,600	MTCA B (groundwater)	0.4 J
o-Xylene	332	Interim Policy Eco Marine Water Standard[4]	1,600	MTCA B (groundwater)	0.1 J
1,1-Dichloroethene	1.93	MTCA B (surface water)	4100	WAC 173-201A-240[5]	2.03
Trichloroethene	55.6	MTCA B (surface water)	0.86	WAC 173-201A-240[5]	**39.1**
Vinyl chloride	2.92	MTCA B (surface water)	0.26	WAC 173-201A-240[5]	**41.7**
Naphthalene	76.9	Interim Policy Eco Marine Water Standard[4]	160	MTCA B GW	0.01 U
2-Methylnaphthalene	4.46	Interim Policy Eco Marine Water Standard[4]	32	MTCA B GW	27.3
Acenaphthylene	26.3	Interim Policy Eco Marine Water Standard[4]	NA		0.004 J
Acenaphthene	40.4	Interim Policy Eco Marine Water Standard[4]	110	WAC 173-201A-240[5]	0.649
Fluorene	1.63	Interim Policy Eco Marine Water Standard[4]	610	WAC 173-201A-240[5]	0.101
Phenanthrene	8.26	Interim Policy Eco Marine Water Standard[4]	NA		0.01 U
Anthracene	8.36	Interim Policy Eco Marine Water Standard[4]	4,600	WAC 173-201A-240[5]	0.006 J
Fluoranthene	2.96	Interim Policy Eco Marine Water Standard[4]	16	WAC 173-201A-240[5]	0.049
Pyrene	12.02	Interim Policy Eco	460	WAC 173-	0.025

Table 7-9. Fuel Farm 1 Groundwater Cleanup Levels (continued)

COC[1]	**Cleanup Levels[1] (µg/L)**		**Current MTCA Cleanup Level[2] (µg/L)**		**Maximum Concentration Detected (µg/L) as Reported in the 2015-2016 Annual Long-Term Monitoring Report[8]**
		Marine Water Standard[4]		201A-240[5]	
Benzo(a)anthracene	0.0296	MTCA B (surface water)	0.021	WAC 173-201A-240[5]	0.01 U
Chrysene	0.0296	MTCA B (surface water)	2.1	WAC 173-201A-240[5]	0.01 U
Benzo(b)fluoranthene	0.0296	MTCA B (surface water)	0.021	WAC 173-201A-240[5]	0.01 U
Benzo(k)fluoranthene	0.0296	MTCA B (surface water)	0.21	WAC 173-201A-240[5]	0.01 U
Benzo(a)pyrene	0.02	Interim Policy Eco Marine Water Standard[4]	0.0021	WAC 173-201A-240[5]	0.01 U
Indeno(1,2,3-cd)pyrene	0.02	Interim Policy Eco Marine Water Standard[4]	0.021	WAC 173-201A-240[5]	0.01 U
Dibenzo(a,h)anthracene	0.01	Interim Policy Eco Marine Water Standard[4]	0.0021	WAC 173-201A-240[5]	0.01 U
Benzo(g,h,i)perylene	0.02	Interim Policy Eco Marine Water Standard[4]	NA		0.01 U
C5-C6 Aliphatics	516	Interim Policy Eco Marine Water Standard[4]	54	WAC 173-340-720, Method B[6]	50 U
C6-C8 Aliphatics	245	Interim Policy Eco Marine Water Standard[4]	367	WAC 173-340-720, Method B[6]	**432**
C8-C10 Aliphatics	52	Interim Policy Eco Marine Water Standard[4]	54	WAC 173-340-720, Method B[6]	50 U
C10-C12 Aliphatics	11	Interim Policy Eco Marine Water Standard[4]	54	WAC 173-340-720, Method B[6]	**105 J**
C8-C10 Aromatics	127,000	Interim Policy Eco Marine Water Standard[4]	54	WAC 173-340-720, Method B[6]	50 U
C10-C12 Aromatics	80,000	Interim Policy Eco Marine Water Standard[4]	54	WAC 173-340-720, Method B[6]	85
C12-C13 Aromatics	NA	Interim Policy Eco Marine Water Standard[4]	54	WAC 173-340-720, Method B[6]	50 U
TPH-GRO	NA		800[3]	MTCA A[7]	**1,530**
TPH-DRO	NA		500	MTCA A[7]	200

[1] As identified in the 1999 Corrective Action Plan (URS Greiner, 1999) and cited in the Revised 2013 Corrective Action Plan (NAVFAC, 2013a).

[2] Department of Ecology, State of Washington, CLARC Data Tables (July 2015); complies with MTCA Cleanup Regulation, WAC 173-340 (As revised 2013). Risk assessment assumptions and toxicity were verified against current values.

Table 7-9. Fuel Farm 1 Groundwater Cleanup Levels (continued)

[3] Two cleanup levels are provided in WAC 173-340. The lower value is used for comparison here because benzene is present in the ground water samples.
[4] This publication is not current and not available through this site. It has been replaced by "Guidance for Remediation of Petroleum Contaminated Sites"
[5] Chapter 173-201A WAC: Water Quality Standards for Surface Waters of the State of Washington (August 2016). WAC 173-201A-240 for Toxic substances: Human Health Criteria for Consumption of Organisms only.
[6] Values were calculated by using the Washington State Department of Ecology Toxics Cleanup Program, MTCATPH11.1, December 2007. Only fractionated TPH components were evaluated using median values as input for fractions that were detected at least once in the past three years and one-half the detection limit used as input for those fractions not detected in the past three years.
[7] Under MTCA, surface water cleanup level must be at least as stringent as all applicable State and Federal laws. Given the lack of values for surface water, MTCA Method B groundwater values were used as conservative substitutes along with MTCA Method A values for aesthetics for comparison to ARAR.
[8]Sealaska Environmental Services, LLC. 2017.
Red highlighted cell indicates the current regulatory value is less than the cleanup value designated in the decision document.
Blue highlighted cell indicates the current regulatory value is the same as the cleanup value designated in the decision document.
Green highlighted cell indicates the current regulatory value is greater than the cleanup value designated in the decision document.
Bolded values exceed Pathway CUL.
J – The reported value is an estimate.
U – Compound was not detected at the method-reporting limit.

Table 7-10. Pathway 2 Soil Cleanup Levels for Fuel Farm 1

COC[1]	Cleanup Levels[1] (mg/kg)		Current MTCA Cleanup Level[2] (mg/kg)	
TPH-GRO	100	MTCA A	100	MTCA A
TPH-DRO	200	MTCA A	2,000	MTCA A
TPH-Heavy oil	400	MTCA A	2,000	MTCA A
Benzo[a]anthracene	0.137	MTCA B	1.37	MTCA B
Benzo[a]pyrene	0.137	MTCA B	0.137	MTCA B
Benzo[b]fluoranthene	0.137	MTCA B	1.37	MTCA B
Benzo[k]fluoranthene	0.137	MTCA B	13.7	MTCA B
Chrysene	0.137	MTCA B	137	MTCA B
Dibenzo[a,h]anthracene	0.137	MTCA B	0.137	MTCA B
Indeno[1,2,3-cd]pyrene	0.137	MTCA B	1.37	MTCA B

TPH-GRO – total petroleum hydrocarbons gasoline range organics
TPH-DRO – total petroleum hydrocarbons diesel range organics
[1] As identified in the 1999 Corrective Action Plan (URS Greiner, 1999).
[2] Department of Ecology, State of Washington, CLARC Data Tables (July 2015); complies with MTCA Cleanup Regulation, WAC 173-340 (As revised 2013). Risk assessment assumptions and toxicity were verified against current values in September 2017.
Blue highlighted cell indicates the current regulatory value is the same as the cleanup value designated in the decision document.
Green highlighted cell indicates the current regulatory value is greater than the cleanup value designated in the decision document.

Groundwater – Pathway 1. ARARs for Pathway 1 were based on MTCA Method B drinking water criteria for benzene, toluene, ethylbenzene, and xylenes (m, p- and o-; BTEX) and MTCA Method A criteria for TPH. Current values are lower for benzene, toluene, xylenes (m, p- and o-), and TPH-DRO. The ARAR for ethylbenzene has remained the same, while that for TPH-GRO has increased; therefore, ethylbenzene and TPH-GRO CULs remain protective.

Benzene is evaluated as a carcinogen. The current MTCA Method B value is notably less than the MTCA Method B value selected as the CUL (i.e., 0.795 versus 1.51 μg/L). However, the calculated risk associated with the CUL would continue to be at the 10^{-6} risk level and therefore, the CUL remains protective.

The CULs for toluene and xylenes are based on noncarcinogenic endpoints, or adverse health effects. The assessed health hazards would be more than twice the acceptable hazard quotient of 1 for the toluene CUL and would be an order of magnitude higher than 1 for the xylenes CULs. However, the most recent groundwater monitoring results from January 2017 (Sealaska, 2017c) indicate that concentrations of these COCs are either not detected above laboratory reporting limits or orders of magnitude less than their current MTCA Method B values. In addition, LUCs are in place, and the remedy remains protective for these COCs.

The TPH-DRO MTCA Method A value is based on aesthetics (e.g., taste, odor, staining), not toxicity. As LUCs are in place, the remedy remains protective.

Groundwater – Pathway 3. ARARs for Pathway 3 were based on MTCA Method B surface water criteria and interim policy ecological marine water standards (Ecology, 1997) as summarized in Table 7-9. ARARs for TPH-GRO and TPH-DRO for this groundwater exposure pathway were not available previously. However, under MTCA, surface water cleanup levels must be at least as stringent as all applicable State and Federal laws, and in this case, given the lack of values for surface water, MTCA Method B groundwater values were used as conservative substitutes along with MTCA Method A values for aesthetics for comparison to ARARs.

Current ARAR values are the same as or higher than CULs for indeno(1,2,3-cd)pyrene, ethylbenzene, xylenes, 1,1-dichloroethene (DCE), naphthalene, 2-methylnaphthalene, acenaphthene, fluorene, anthracene, fluoranthene, pyrene, chrysene, benzo(k)fluoranthene, and aliphatic TPH fractions (C6-C8, C8-C10, C10-C12). Thus, the remedy for these COCs remains protective.

Current ARAR values are lower for benzene, toluene, trichloroethene (TCE), vinyl chloride, benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, dibenz(a,h)anthracene, and TPH fractions (C5-C6 aliphatics, C8-C10 aromatics, C10-C12 aromatics). Based on the last three years of groundwater monitoring results, these COCs (except for TCE, vinyl chloride, and C10-C12 aromatics) are present in groundwater at concentrations less than the current ARAR or are not detected above laboratory reporting limits. As such, the remedy for these COCs remains protective.

For the COCs that may be present in groundwater above current ARAR values (i.e., TCE, vinyl chloride, fractionated TPH), the environmental risk posed by contaminated groundwater entering Crescent Harbor is assumed to be low for the following reasons, as stated in the original CAP (URS, 1999):

- Contaminants are dispersed immediately upon entering the marina area;
- The fractionated TPH components do not bioaccumulate and natural attenuation will occur rapidly in surface waters; and
- The impacted area is contained within constructed seawalls, has limited habitat quality, and contains no known shellfish resources.

Therefore, there are no ARAR revisions for the COCs in groundwater that would affect the protectiveness of the remedy, assuming environmental risks to Crescent Harbor are low, as justified in the original CAP (URS, 1999).

Soil – Pathway 2. Table 7-10 compares current ARAR values for soil with those provided in the original CAP (URS, 1999). ARARs were based on MTCA Method A for TPH, while MTCA Method B values were used for the individual COC constituents. ARARs for COCs in soil have either increased or remained the same since the original CAP (URS, 1999). Therefore, there are no ARAR revisions for the COCs in soil that would affect the protectiveness of the remedy. However, it is recommended that the LUCs be reviewed in relation to these increased values to determine whether LUCs are still required to maintain the protectiveness of the remedy.

Lower Marina Vapor Intrusion Study. Ecology requires more stringent CULs than specified in WAC 173-340-720 in order to protect other beneficial uses or otherwise protect human health and the environment. Since compliance monitoring began in 2000, groundwater concentrations of TCE, DCE, and vinyl chloride have consistently exceeded site-specific CULs. The extent of chlorinated VOCs is limited to a localized area within the lower marina area. Chlorinated VOCs are often associated with potential vapor intrusion concerns because of their volatility, mobility in groundwater, and relatively high toxicity. As such, a focused vapor intrusion pathway assessment was conducted at the Fuel Farm 1 Lower Marina (URS, 2014).

For this third FYR, MTCA Method C indoor air concentrations and groundwater CULs from the 2014 vapor intrusion evaluation (URS, 2014) were compared to current MTCA Method C indoor air and groundwater CULs for vapor intrusion as referenced in Ecology vapor intrusion guidance ([Ecology, 2016b] and provided in Ecology's Vapor Intrusion Table update April 6, 2015 located at http://www.ecy.wa.gov/programs/tcp/policies/VaporIntrusion/vig.html. The comparisons are provided in Table 7-11. ARAR values for indoor air concentrations have remained the same over time for TCE and DCE and have increased for vinyl chloride. ARAR values for groundwater to indoor air concentrations have increased (see Table 7-11). Results of the vapor intrusion study indicated vapor intrusion risks were of low concerns at the Fuel Farm 1 Lower Marina. Comparisons of current indoor air and groundwater ARARs to ARARs reported in the vapor intrusion report (URS, 2014) demonstrate that current ARARs are the same or higher than the previous values. As such, the remedy selected for Fuel Farm 1 remains protective.

Table 7-11. Fuel Farm 1 Lower Marina Vapor Intrusion Study Cleanup Levels

Chemical	MTCA C Indoor Air Cleanup Level[1] (μg/m^3)	MTCA C Indoor Air Cleanup Level[2] (μg/m^3)	MTCA C Groundwater Cleanup Level[1] (μg/L) (4)	MTCA C Groundwater Cleanup Level[2] (μg/L)
1,1-Dichloroethene	200	200	186	284
Trichloroethene	2	2	5	8.4
Vinyl chloride	0.29	2.8	0.3	3.47

1 Cleanup values as reported in URS, 2014.
2 Department of Ecology, State of Washington, CLARC Data Tables (July 2015); complies with MTCA Cleanup Regulation, WAC 173-340 (As revised 2013). Risk assessment assumptions and toxicity were verified against current values.
Blue highlighted cell indicates the current regulatory value is the same as the cleanup value designated in the decision document.
Green highlighted cell indicates the current regulatory value is greater than the cleanup value designated in the decision document.

7.2.1.2 Fuel Farm 2

The COCs for the Upland and Beach Areas of Fuel Farm 2, as identified in the revised CAP (NAVFAC, 2013a), and their associated CULs are summarized in Table 7-12. COCs for soil, as identified in the original CAP (URS, 1999), and associated CULs are provided in Table 7-13. Current ARARs also are provided on these tables for comparison. Changes in ARARs are due to changes in toxicity and exposure assumptions that have occurred since 1999.

Table 7-12. Fuel Farm 2 Groundwater Cleanup Levels

Chemical Name	**Cleanup Levels[1] (µg/L)**		**Current MTCA Cleanup Level[2] (µg/L)**		**Maximum Concentration Detected as Reported in the 2015-2016 Annual Long-Term Monitoring Report[8]**
Pathway 1					
TPH-GRO	700	MTCA A	800[3]	MTCA A	197
TPH-DRO	800	MTCA A	500	MTCA A	**1,990**
Benzene	1.51	MTCA B	0.795	MTCA B	**0.97**
Ethylbenzene	800	MTCA B	800	MTCA B	4.59
Toluene	1,600	MTCA B	640	MTCA B	0.05 J
m,p-Xylenes	16,000	MTCA B	1,600	MTCA B	0.3 J
o-Xylene	16,000	MTCA B	1,600	MTCA B	0.22
Pathway 3					
TPH-GRO	NA		800[3]	MTCA A[5]	197
TPH-DRO	NA		500	MTCA A[5]	**1,990**
Benzene	43	MTCA B (surface water)	1.6	WAC 173-201A-240[6]	0.97
Ethylbenzene	86	Interim Policy Eco Marine Water Standard[4]	270	WAC 173-201A-240[6]	4.59
Toluene	5,000	Interim Policy Eco Marine Water Standard[4]	410	WAC 173-201A-240[6]	0.05 J
m,p-Xylenes	332	Interim Policy Eco Marine Water Standard[4]	1600	MTCA B (groundwater)[7]	0.3 J
o-Xylene	332	Interim Policy Eco Marine Water Standard[4]	1600	MTCA B (groundwater)[7]	0.22

NA – not available
TPH-GRO – total petroleum hydrocarbons gasoline range organics
TPH-DRO – total petroleum hydrocarbons diesel range organics
1 As identified in the 1999 Corrective Action Plan (URS Greiner, 1999) and cited in the Revised 2013 Corrective Action Plan (NAVFAC, 2013a).
2 Department of Ecology, State of Washington, CLARC Data Tables (July 2015); complies with MTCA Cleanup Regulation, WAC 173-340 (As revised 2013). Risk assessment assumptions and toxicity were verified against current values.
3 Two cleanup levels are provided in WAC 173-340. The lower value is used for comparison here because benzene is present in the ground water samples.

Table 7-12. Fuel Farm 2 Groundwater Cleanup Levels (continued)

4 This publication is not current and not available. It has been replaced by "Guidance for Remediation of Petroleum Contaminated Sites" (Ecology, 2016a).
5 Under MTCA, surface water cleanup level must be at least as stringent as all applicable State and Federal laws, and in this case, that would-be persons using the surface water as a source of drinking water and the MTCA value for aesthetics is chosen as the ARAR.
6 Chapter 173-201A WAC: Water Quality Standards for Surface Waters of the State of Washington (August 2016). WAC 173-201A-240 for Toxic substances: Human Health Criteria for Consumption of Organisms only.
7 No surface water CUL available; therefore, cleanup level chosen as the potable groundwater cleanup level established to protect drinking water beneficial uses under WAC 173-340-720.
8 Sealaska Environmental Services, LLC. 2017.
Red highlighted cell indicates the current regulatory value is less than the cleanup value designated in the decision document.
Blue highlighted cell indicates the current regulatory value is the same as the cleanup value designated in the decision document.
Green highlighted cell indicates the current regulatory value is greater than the cleanup value designated in the decision document.
Bolded values exceed Pathway CUL.
J – The reported value is considered to be an estimate.
U – Compound was not detected at the method-reporting limit.

Table 7-13. Soil Cleanup Levels for Fuel Farm 2

Chemical Name	Cleanup Levels[1] (mg/kg)		Current MTCA Cleanup Level[2] (mg/kg)	
TPH-GRO	100	MTCA A	100	MTCA A
TPH-DRO	200	MTCA A	2,000	MTCA A
Benzene	34.5	MTCA B	18.2	MTCA B
Ethylbenzene	8,000	MTCA B	8,000	MTCA B
Toluene	16,000	MTCA B	6,400	MTCA B
Xylenes	3,070	Interim Policy Ecological Soil Standard[3]	16,000	MTCA B

TPH-GRO – total petroleum hydrocarbons gasoline range organics
TPH-DRO – total petroleum hydrocarbons diesel range organics
1 As identified in the 1999 Corrective Action Plan (URS Greiner, 1999).
2 Department of Ecology, State of Washington, CLARC Data Tables (July 2015); complies with MTCA Cleanup Regulation, WAC 173-340 (As revised 2013).
3 This publication is not current and not available. It has been replaced by "Guidance for Remediation of Petroleum Contaminated Sites" (Ecology, 2016a).
Red highlighted cell indicates the current regulatory value is less than the cleanup value designated in the decision document.
Blue highlighted cell indicates the current regulatory value is the same as the cleanup value designated in the decision document.
Green highlighted cell indicates the current regulatory value is greater than the cleanup value designated in the decision document

Groundwater – Pathway 1. ARARs for Pathway 1 were based on MTCA Method B drinking water criteria for BTEX and MTCA Method A criteria for TPH. Current values are lower for benzene, toluene, xylenes (m, p- and o-), and TPH-DRO. The ARAR for ethylbenzene has remained the same, while that of TPH-GRO has increased; therefore, CULs for ethylbenzene and TPH-GRO remain protective.

Benzene is evaluated as a carcinogen. The current MTCA Method B value is notably less than the MTCA Method B value selected as the CUL (i.e., 0.795 versus 1.51 μg/L). However, the calculated risk associated with the CUL would continue to be at the 10^{-6} risk level and therefore, the CUL remains protective. The CULs for toluene and xylenes are based on noncarcinogenic endpoints, or adverse health effects. The assessed health hazards would be more than twice the acceptable hazard quotient of 1 for the toluene CUL and would be an order of magnitude higher than 1 for the xylenes CULs. However, the most recent groundwater monitoring results from January 2017 (Sealaska, 2017c) indicate that concentrations of these COCs are not detected above laboratory reporting limits or are orders of magnitude less than their current MTCA Method B values. In addition, LUCs are in place. Therefore, the remedy remains protective for these COCs.

Although the TPH-DRO MTCA Method A value has been reduced, it is based on aesthetics (e.g., taste, odor, staining) not toxicity. As LUCs are in place, the remedy remains protective.

Groundwater – Pathway 3. ARARs for Pathway 3 were based on MTCA Method B surface water criteria for benzene and interim policy ecological marine standards (Ecology, 1997) for ethylbenzene, toluene, and xylenes (m, p- and o-), as noted in Table 7-12. ARARs for TPH-GRO and TPH-DRO for this groundwater exposure pathway were not available previously. However, under MTCA, surface water CUL must be at least as stringent as all applicable State and Federal laws, and in this case, given the lack of values for surface water, MTCA Method B groundwater values were used as conservative substitutes along with MTCA Method A values for aesthetics for comparison to ARARs. Current values are lower for benzene and toluene, while current values for ethylbenzene and xylenes (m, p- and o-) are higher.

Note that the benzene groundwater CUL for protection of surface water, as shown in Table 7-12, was based on the MTCA Method B surface water criterion. However, the current regulatory level for many chemicals have changed due to new Washington surface water quality criteria for protection of human health (effective December 28, 2016). Therefore, the current benzene ARAR value shown in Table 7-12 for Pathway 3 was selected as the regulatory value for "human health consumption for organism only" promulgated in WAC 173-201A-240. The new surface water quality criterion differs from the MTCA Method B surface water CUL by including a higher fish ingestion rate. Benzene is evaluated as a carcinogen. The current ARAR value is significantly less than the MTCA Method B surface water value selected as the CUL (i.e., 1.6 versus 43 μg/L). As such, the calculated risk associated with the CUL would be greater than MTCA's acceptable individual cancer risk level of 10^{-6}. However, recent groundwater monitoring results for Fuel Farm 2 indicate that benzene concentrations have been reduced to levels below the current ARAR value of 1.6 μg/L. Therefore, the remedy remains protective.

For ethylbenzene, toluene, and xylenes, CULs were selected as the lower of the MTCA Method B marine surface water standards or values originating from the now outdated Interim Interpretive and Policy Statement. According to the current Petroleum Guidance (Ecology, 2016a), surface water CULs shall be based on estimates of the highest beneficial use and the reasonable maximum exposure expected to occur under both current and potential future site use conditions as described in WAC 173-340-730. Criteria to select from include MTCA Method B, State and Federal water quality criteria, including criteria based on the protection of aquatic organisms (acute and chronic criteria) and human health. Therefore, current ARAR values shown in Table 7-12 for these three COCs for Pathway 3 were selected as the regulatory value for "human health consumption for organism only" promulgated in WAC 173-201A-240. The new surface water quality criterion differs from the MTCA Method B surface water CUL by including updated toxicity values and a higher fish ingestion rate. Current values are lower for toluene and higher for ethylbenzene and xylenes (m, p- and o-). Similar to benzene concentrations, recent groundwater monitoring results for Fuel Farm 2 indicate that concentrations for these three COCs have been reduced to levels below the current ARAR values. Therefore, the remedy remains protective.

Soil – Pathway 2. Table 7-13 compares soil CULs developed in the original CAP (URS, 1999) with current ARARs for soil. The current ARARs for benzene and toluene are less than the CULs. The current ARARs for TPH-DRO and xylenes have increased, while the current ARARs for TPH-GRO and ethylbenzene have remained the same compared to their CULs; therefore, the CULs for these four COCs remain protective.

Benzene is evaluated as a carcinogen. The current MTCA Method B value is less than the MTCA Method B value selected as the CUL (i.e., 18.2 versus 34.5 mg/kg). However, the calculated risk associated with the CUL would continue to be at the 10^{-6} risk level and therefore, the CUL remains protective.

Toluene is evaluated for adverse health effects. The current MTCA Method B value is less than the MTCA Method B value selected as the CUL (i.e., 6,400 versus 16,000 mg/kg). As such, the health hazard for the toluene CUL would be more than double the acceptable hazard quotient of 1. However, based on historical soil sampling results, residual concentrations of toluene in soil are much less than the current ARAR. In addition, LUCs are in place and therefore, the remedy for soil remains protective.

For this FYR, it is recommended that the LUCs for soil be reviewed in relation to these increased soil ARAR values to determine whether LUCs are still required to maintain the protectiveness of the remedy.

7.2.1.3 Fuel Farm 3

Groundwater COCs for Fuel Farm 3, as identified in the revised CAP (NAVFAC, 2013a), and their associated CULs are summarized in Table 7-14. COCs for soil, as identified in the original CAP (URS, 1999), and associated CULs are provided in Table 7-15. Current ARARs also are provided on these tables for comparison. There are no surface water bodies within 1 mile of Fuel Farm 3; therefore, only Pathways 1 and 2 were evaluated. Changes in ARARs are due to changes in toxicity and exposure assumptions that have occurred since 1999.

Table 7-14. Groundwater Cleanup Levels for Fuel Farm 3

Chemical	Cleanup Levels[1] (µg/L)		Current MTCA Cleanup Level[2] (µg/L)		Maximum Concentration Detected as Reported in the 2015-2016 Annual Long-Term Monitoring Report[4]
TPH-GRO	700	MTCA A	800[3]	MTCA A	**4,630**
TPH-DRO	800	MTCA A	500	MTCA A	293
Benzene	1.51	MTCA B	0.795	MTCA B	**120**
Ethylbenzene	800	MTCA B	800	MTCA B	262
Toluene	1,600	MTCA B	640	MTCA B	18
m,p-Xylenes	16,000	MTCA B	1,600	MTCA B	1,210

Table 7-14. Groundwater Cleanup Levels for Fuel Farm 3 (continued)

Chemical	Cleanup Levels[1] (µg/L)		Current MTCA Cleanup Level[2] (µg/L)		Maximum Concentration Detected as Reported in the 2015-2016 Annual Long-Term Monitoring Report[4]
o-Xylene	16,000	MTCA B	1,600	MTCA B	211

TPH-GRO – total petroleum hydrocarbons gasoline range organics
TPH-DRO – total petroleum hydrocarbons diesel range organics
[1] As identified in the 1999 Corrective Action Plan (URS Greiner, 1999) and cited in the Revised 2013 Corrective Action Plan (NAVFAC, 2013a).
[2] Department of Ecology, State of Washington, CLARC Data Tables (July 2015); complies with MTCA Cleanup Regulation, WAC 173-340 (As revised 2013). Risk assessment assumptions and toxicity were verified against current values.
[3] Where benzene is present in the groundwater, the CUL is set at 800 ug/L for TPH-GRO. If no detectable benzene is in the groundwater, then the CUL is set at 1,000 ug/L for TPH-GRO.
[4] Sealaska Environmental Services, LLC. 2017.
Red highlighted cell indicates the current regulatory value is less than the cleanup value designated in the decision document.
Blue highlighted cell indicates the current regulatory value is the same as the cleanup value designated in the decision document.
Green highlighted cell indicates the current regulatory value is greater than the cleanup value designated in the decision document.
Bolded values exceed Pathway CUL.

Table 7-15. Soil Cleanup Levels for Fuel Farm 3

Chemical	Cleanup Levels (mg/kg) [1]	Current MTCA A Cleanup Level[2] (mg/kg)
TPH-GRO	100	100
TPH-DRO	200	2,000

TPH-GRO – total petroleum hydrocarbons gasoline range organics
TPH-DRO – total petroleum hydrocarbons diesel range organics
[1] As identified in the 1999 Corrective Action Plan (URS Greiner, 1999).
[2] Department of Ecology, State of Washington, CLARC Data Tables (July 2015); complies with MTCA Cleanup Regulation, WAC 173-340 (As revised 2013). Risk assessment assumptions and toxicity were verified against current values.
Blue highlighted cell indicates the current regulatory value is the same as the cleanup value designated in the decision document.
Green highlighted cell indicates the current regulatory value is greater than the cleanup value designated in the decision document.

Groundwater – Pathway 1. ARARs for Pathway 1 were based on MTCA Method B drinking water criteria for BTEX and MTCA Method A criteria for TPH. Current ARAR values are lower for benzene, toluene, xylenes (m, p- and o-), and TPH-DRO. The current ARAR for ethylbenzene has remained the same, while that of TPH-GRO has increased; therefore, the CULs for these two COCs remain protective.

Benzene is evaluated as a carcinogen. The current MTCA Method B value is less than the MTCA Method B value selected as the CUL (i.e., 0.795 versus 1.51 µg/L). However, the calculated risk associated with the CUL would continue to be at the 10^{-6} risk level and therefore, the CUL remains protective.

The CULs for toluene and xylenes are based on noncarcinogenic endpoints, or adverse health effects. The assessed health hazards would be more than double the acceptable hazard quotient of 1 for the toluene CUL and would be an order of magnitude higher than 1 for xylenes. However, the most recent groundwater monitoring results from January 2017 (Sealaska, 2017c) indicate that concentrations of these COCs are not detected above laboratory reporting limits or are present at levels much lower than current ARARs. In addition, LUCs are in place. Therefore, the remedy remains protective for these COCs.

Although the TPH-DRO MTCA Method A value has been reduced, it is based on aesthetics (e.g., taste, odor, staining), not toxicity. As LUCs are in place, the remedy remains protective.

Soil – Pathway 2. Table 7-15 compares current ARAR values for soil with those provided in the original CAP (URS, 1999). ARARs for COCs in soil have either increased or remained the same since the original CAP (URS, 1999). Therefore, there are no ARAR revisions for the COCs in soil that would affect the protectiveness of the remedy.

For this FYR, it is recommended that the LUCs for soil be reviewed in relation to these increased soil ARAR values to determine whether LUCs are still required to maintain the protectiveness of the remedy.

7.2.1.4 Fuel Farm 4

The COCs for Fuel Farm 4, as identified in the revised IRACR Addendum (NAVFAC, 2013b), and their associated CULs are summarized in Table 7-16. COCs for soil, as identified in the original IRACR (URS, 2001), and associated CULs are provided in Table 7-17. Current ARARs also are provided on these tables for comparison. Changes in ARARs are due to changes in toxicity and exposure assumptions that have occurred since 2001.

Table 7-16. Fuel Farm 4 Groundwater Cleanup Levels

Chemical Name	**Cleanup Levels[1] (µg/L)**		**Current MTCA Cleanup Level[2] (µg/L)**		**Maximum Concentration Detected as Reported in the 2015-2016 Annual Long-Term Monitoring Report[8]**
Pathway 1					
TPH-GRO	700	MTCA A	800 [3]	MTCA A	**1,010**
TPH-DRO	800	MTCA A	500	MTCA A	100 U
Benzene	1.51	MTCA B	0.795	MTCA B	**3.12**
Ethylbenzene	800	MTCA B	800	MTCA B	0.2 U
Toluene	1,600	MTCA B	640	MTCA B	0.2 U
m,p-Xylenes	16,000	MTCA B	1,600	MTCA B	0.4 U
o-Xylene	16,000	MTCA B	1,600	MTCA B	0.2 U
Pathway 3					
TPH-GRO	NA		800[3]	MTCA A[5]	**1,010**
TPH-DRO	NA		500	MTCA A[5]	100 U

Table 7-16. Fuel Farm 4 Groundwater Cleanup Levels (continued)

Chemical Name	Cleanup Levels[1] (µg/L)		Current MTCA Cleanup Level[2] (µg/L)		Maximum Concentration Detected as Reported in the 2015-2016 Annual Long-Term Monitoring Report[8]
Benzene	43	MTCA B (surface water)	1.6	WAC 173-201A-240[6]	**3.12**
Ethylbenzene	86	Interim Policy Eco freshwater Standard[4]	270	WAC 173-201A-240[6]	0.2 U
Toluene	5,000	Interim Policy Eco freshwater Standard[4]	410	WAC 173-201A-240[6]	0.2 U
m,p-Xylenes	20	MTCA A (groundwater)	1000[7]	MTCA A (groundwater)	0.4 U
o-Xylene	20	MTCA A (groundwater)	1000[7]	MTCA A (groundwater)	0.2 U

NA – not available
TPH-GRO – total petroleum hydrocarbons gasoline range organics
TPH-DRO – total petroleum hydrocarbons diesel range organics

1 As identified in the Independent Remedial Action Closure Report for Fuel Farm 4 (URS, 2001) and cited in the Revised Independent Remedial Action Closure Report for Fuel Farm 4 (NAVFAC, 2013b).
2 Department of Ecology, State of Washington, CLARC Data Tables (July 2015); complies with MTCA Cleanup Regulation, WAC 173-340 (As revised 2013). Risk assessment assumptions and toxicity were verified against current values.
3 Where benzene is present in the groundwater, the CUL is set at 800 ug/L for TPH-GRO. If no detectable benzene is in the groundwater, then the CUL is set at 1,000 ug/L for TPH-GRO.
4 This publication is not current and not available. It has been replaced by "Guidance for Remediation of Petroleum Contaminated Sites" (Ecology, 2016a).
5 Under MTCA, surface water cleanup level must be at least as stringent as all applicable State and Federal laws, and in this case, that would-be persons using the surface water as a source of drinking water and the MTCA value for aesthetics is chosen as the ARAR.
6 Chapter 173-201A WAC: Water Quality Standards for Surface Waters of the State of Washington (August 2016). WAC 173-201A-240 for Toxic substances: Human Health Criteria for Consumption of Water and Organisms.
7 Cleanup level based on a total value for all xylenes.
8 Sealaska Environmental Services, LLC. 2017.

Red highlighted cell indicates the current regulatory value is less than the cleanup value designated in the decision document.
Blue highlighted cell indicates the current regulatory value is the same as the cleanup value designated in the decision document.
Green highlighted cell indicates the current regulatory value is greater than the cleanup value designated in the decision document.
Bolded values exceed Pathway CUL.
J – The reported value is an estimate.
U – Compound was not detected at the method-reporting limit.

Table 7-17. Fuel Farm 4 Soil Cleanup Levels

Chemical	Cleanup Levels[1] (mg/kg)		Current MTCA Cleanup Value[2] (mg/kg)	
TPH-GRO	100	MTCA A	100[3]	MTCA A
TPH-DRO	200	MTCA A	2,000	MTCA A

1 As identified in the Independent Remedial Action Closure Report for Fuel Farm 4 (URS, 2001).
2 Department of Ecology, State of Washington, CLARC Data Tables (July 2015); complies with MTCA Cleanup Regulation, WAC 173-340 (As revised 2013).
3 Two cleanup levels are provided in WAC 173-340; the higher value of 100 mg/kg is used for Fuel Farm 4 because benzene concentrations in soil were non-detect and the total of ethyl benzene, toluene and xylene were less than 1% of the gasoline mixture.
Blue highlighted cell indicates the current regulatory value is the same as the cleanup value designated in the decision document.
Green highlighted cell indicates the current regulatory value is greater than the cleanup value designated in the decision document.

Groundwater – Pathway 1. ARARs for Pathway 1 were based on MTCA Method B drinking water criteria for BTEX and MTCA Method A criteria for TPH. Current ARAR values are lower for benzene, toluene, xylenes (m, p- and o-), and TPH-DRO. The current ARAR for ethylbenzene has remained the same, while that of TPH-GRO has increased; therefore, the CULs for these two COCs remain protective.

Benzene is evaluated as a carcinogen. The current MTCA Method B value is less than the MTCA Method B value selected as the CUL (i.e., 0.795 versus 1.51 μg/L). However, the calculated risk associated with the CUL would continue to be at the 10^{-6} risk level and therefore, the CUL remains protective.

The CULs for toluene and xylenes are based on noncarcinogenic endpoints, or adverse health effects. The assessed health hazards would be more than double the acceptable hazard quotient of 1 for the toluene CUL and would be an order of magnitude higher than 1 for xylenes. However, the most recent groundwater monitoring results from January 2017 (Sealaska, 2017c) indicate that concentrations of these COCs are below the laboratory reporting limit. In addition, LUCs are in place. Therefore, the remedy remains protective for these COCs.

Although the TPH-DRO MTCA Method A value has been reduced, it is based on aesthetics (e.g., taste, odor, staining), not toxicity. The most recent groundwater monitoring results from January 2017 (Sealaska, 2017c) indicate that concentrations of TPH-DRO are below the laboratory reporting limit. In addition, LUCs are in place. Therefore, the remedy remains protective.

Groundwater – Pathway 3. Whereas Pathway 3 groundwater CULs for Fuel Farms 1 and 2 were based on groundwater migration to marine water, ARARs for Pathway 3 at Fuel Farm 4 were based on groundwater migration to drainage ditches across the site. These drainage ditches were considered freshwater in the IRACR (URS, 2001). So, original CULs were based on MTCA Method B surface water criteria for benzene and interim policy ecological freshwater standards (Ecology, 1997) for ethylbenzene, toluene, and xylenes (m, p- and o-), as noted in Table 7-16. ARARs for TPH-GRO and TPH-DRO for this groundwater exposure pathway were not available previously. However, under MTCA, the surface water CUL must be at least as stringent as all applicable State and Federal laws, and in this case, given the lack of values for surface water, MTCA Method B groundwater values were used as conservative substitutes along with MTCA Method A values for aesthetics for comparison to ARARs. Current ARAR values are lower for benzene and toluene, while current ARAR values for ethylbenzene and xylenes (m, p- and o-) are higher.

Note that the benzene groundwater CUL for protection of surface water, as shown in Table 7-16, was based on the MTCA Method B surface water criterion, which is based on a fish consumption rate of 54 gram per day (g/day). However, the current regulatory level for many chemicals have changed due to new Washington surface water quality criteria for protection of human health (effective December 28, 2016). The current benzene ARAR shown in Table 7-16 for Pathway 3 is the regulatory value for "human health consumption for organism only" promulgated in WAC 173-201A-240, which uses a fish consumption rate of 174 g/day. The new surface water quality criterion differs from the MTCA Method B surface water CUL by including a higher fish ingestion rate (refer to Section 7.2.2). Benzene is evaluated as a carcinogen. The current ARAR value is less than the MTCA Method B surface water value selected as the CUL (i.e., 1.6 versus 43 μg/L). Recent groundwater monitoring results for Fuel Farm 4 indicate that the benzene concentration in monitoring well MW-113 (near former Building 491) was recently detected at 3 μg/L, above the current ARAR value of 1.6 μg/L, but much lower than the CUL. Benzene concentrations detected in this well between 2011 and 2015 have been below the current ARAR. The risk associated with the most recent benzene concentration would be on the order of 10^{-6}, still within Ecology's acceptable excess cancer risk range of 10^{-6}. Note that comparison of groundwater data to ARARs for the protection of humans consuming fish is very conservative assumption for a groundwater to drainage ditch discharge transport scenario. Despite the ARAR change, the remedy remains protective.

For ethylbenzene, toluene and xylenes, CULs were selected as the lower of the MTCA Method B freshwater surface water standards or values originating from the now outdated Interim Interpretive and Policy Statement. According to the current Petroleum Guidance (Ecology, 2016a), surface water cleanup levels shall be based on estimates of the highest beneficial use and the reasonable maximum exposure expected to occur under both current and potential future site use conditions as described in WAC 173-340-730. Criteria to select from include MTCA Method B, State and Federal water quality criteria, including criteria based on the protection of aquatic organisms (acute and chronic criteria) and human health. Therefore, current ARAR values shown in Table 7-16 for these COCs for Pathway 3 are the regulatory values for "human health consumption for organism only" promulgated in WAC 173-201A-240. The new surface water quality criterion differs from the MTCA Method B surface water CUL by including updated toxicity values and a higher fish ingestion rate. Current ARAR values are lower (i.e., more restrictive) for toluene and higher for ethylbenzene and xylenes (m, p- and o-; i.e., less restrictive). Recent groundwater monitoring results for Fuel Farm 3 indicate that concentrations for these COCs have been reduced to levels below the current ARAR values. Thus, the remedy remains protective.

Soil – Pathway 2. Land use at Fuel Farm 4 is classified as industrial use only; therefore, soils were left in place (NAVFAC, 2013b). Existing soil contaminant concentrations for TPH-GRO and TPH-DRO exceeded CULs at four shallow locations less than 10 ft bgs. Three of the locations are associated with the now closed underground storage tanks. The fourth location is associated with a former underground storage tank in the vicinity of Building 491 and is beneath an electrical vault, electrical lines, and concrete paving. LUCs ensure continued protection of human health and the environment to prevent exposure to COCs in soil. Table 7-17 compares soil CULs with current ARAR values for soil. ARARs for COCs in soil have either increased or remained the same. Therefore, there are no ARAR revisions for the COCs in soil that would affect the protectiveness of the remedy.

For this FYR, it is recommended that the LUCs for soil be reviewed in relation to these increased soil ARAR values to determine whether LUCs are still required to maintain the protectiveness of the remedy.

7.2.1.5 Building 357

The independent cleanup action conducted at Building 357 resulted in the remediation of fuel-contaminated soils. No contaminants (gasoline, BTEX, and lead) were reported above MTCA Method A cleanup values in confirmation soil samples. However, residual levels of gasoline and BTEX remained in groundwater at three wells on site. It was expected that the residual fuel and related BTEX would rapidly attenuate over several months and reach MTCA Method A cleanup levels (Foster Wheeler, 2000).

Groundwater. Groundwater CULs for Building 357 are summarized in Table 7-18 along with the current groundwater ARAR cleanup levels. TPH-GRO and BTEX CULs developed for Pathway 1 were selected as the MTCA Method A values. Current ARAR values for ethylbenzene, lead, toluene, and xylenes are higher than the groundwater CULs and the current benzene ARAR is the same as the groundwater CUL. Therefore, ARAR revisions for these COCs in groundwater do not affect the protectiveness of the remedy.

The current TPH-GRO groundwater ARAR is lower than the groundwater CUL. Groundwater concentrations in monitoring well MW-17 were detected above CULs for benzene and TPH-GRO during monitoring events in August 2006 and August 2007. Groundwater monitoring was discontinued after August 2007, but the change in ARARs does not affect the decision to stop monitoring, as these COCs were above the CUL regardless. However, to assess whether concentrations are lower than the current ARARs and assess protectiveness if LUCs were to be removed, additional sampling of monitoring well MW-17 is recommended. The MTCA Method A cleanup levels are protective of human health and the environment; however, the shallow aquifer is not used as a source of potable water due to its proximity to saltwater. Therefore, the remedy remains protective as long as the LUC preventing installation of potable wells remains in place.

Table 7-18. Groundwater Cleanup Levels for Building 357

Chemical	Cleanup Level[1] (µg/L)	Current MTCA Method A Value[2] (µg/L)	Maximum Concentration Detected as Reported in the 3rd Quarter 2007 Groundwater Long-Term Monitoring Report[5]
Benzene	5.0	5	**14**
Ethylbenzene	30	700	15
Lead	5.0	15	1.0 B
Toluene	40	1,000	0.67 J
TPH-GRO	1000	800[3]	**2,000 Y**
m,p-Xylenes	20	1,000[4]	4.1
o-Xylenes	20	1,000[4]	0.08 U

Table 7-18. Groundwater Cleanup Levels for Building 357 (continued)

TPH-GRO – total petroleum hydrocarbons gasoline range organics
[1] Target cleanup levels for all remedial activities followed the MTCA Method A cleanup levels as detailed in Table I, Section 173-340-720 and Table II, Section 173-340-740 as reported in the IRACR for Building 357 (Foster Wheeler, 2000).
[2] Department of Ecology, State of Washington, CLARC Data Tables (July 2015); complies with MTCA Cleanup Regulation, WAC 173-340 (As revised 2013). Risk assessment assumptions and toxicity were verified against current values.
[3] Where benzene is present in the groundwater, the CUL is set at 800 ug/L for TPH-GRO. If no detectable benzene is in the groundwater, then the CUL is set at 1,000 ug/L for TPH-GRO.
[4] Cleanup level based on a total value for all xylenes.
[5] SES Tech, 2007.
Red highlighted cell indicates the current regulatory value is less than the cleanup value designated in the decision document.
Blue highlighted cell indicates the current regulatory value is the same as the cleanup value designated in the decision document.
Green highlighted cell indicates the current regulatory value is greater than the cleanup value designated in the decision document.
Bolded values exceed Pathway CUL.
J – The reported value is an estimate.
U – Compound was not detected at the method-reporting limit.
B – Reported value is less than the contract required detection limit but greater than the instrument detection limit.
Y – The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.

Soil. Following shutdown of the treatment plant in September 1999, soil confirmation samples were collected to determine the effectiveness of site remediation and compared to MTCA Method A CULs (see Table 7-19). Analytical results for the organic COCs were reported as below the laboratory reporting limit and less than the CUL for lead (Foster Wheeler, 2000). Ecology concurred that the soil remediation efforts had been completed for the soil remedial action. For comparison purposes as part of the FYR, current MTCA Method A soil CULs are shown on Table 7-19. ARAR values for lead and TPH-GRO have remained the same, but ARAR values for BTEX have been lowered. Since BTEX and TPH-GRO were not detected in soil at or above laboratory reporting limits, which are less than the current ARAR levels, and residual lead concentrations are less than the current ARAR value, the remedy remains protective. It is recommended that any LUCs associated with restricting contact with soils within the Building 357 area be re-evaluated, as current MTCA Method A soil CULs have been achieved and these LUCs may not be required to maintain remedy protectiveness.

Table 7-19. Soil Cleanup Levels for Building 357

Chemical	IRACR Cleanup Level[1] (mg/kg)	Current MTCA Method A Value[2] (mg/kg)
Benzene	0.5	0.03
Ethylbenzene	20	6.0
Lead (total)	250	250
Toluene	40	7.0
TPH-GRO	100	100
Xylenes	20	9.0

IARCR - Independent Remedial Action Closure Report
TPH-GRO – total petroleum hydrocarbons gasoline range organics
[1] Target cleanup levels for all remedial activities followed the MTCA Method A cleanup levels as detailed in Table I, Section 173-340-720 and Table II, Section 173-340-740 as reported in the IRACR for Building 357 (Foster Wheeler, 2000).
[2] Department of Ecology, State of Washington, CLARC Data Tables (July 2015); complies with MTCA Cleanup Regulation, WAC 173-340 (As revised 2013). Risk assessment assumptions and toxicity were verified against current values.
Red highlighted cell indicates the current regulatory value is less than the cleanup value designated in the decision document.
Blue highlighted cell indicates the current regulatory value is the same as the cleanup value designated in the decision document.

7.2.2 Review of Risk Assessment Assumptions for Human Health

Changes to toxicity criteria have occurred since issuance of the decision documents. These changes have been highlighted on Tables 7-9 through 7-19 as differences between the decision document regulatory values and current regulatory values. Current regulatory values for MTCA Methods A, B, and C were obtained from Ecology’s Cleanup Levels and Risk Calculations (CLARC) tables, which were last updated in August 2015 with toxicity values used by EPA to calculate the Regional Screening Levels (RSLs). The toxicity values used to calculate RSLs are selected using a hierarchy of toxicological sources, with the Integrated Risk Information System (IRIS) as its number one source. In addition, the toxicity values provided in the CLARC data tables were reviewed for each of the COCs and were found to be consistent with the latest IRIS toxicity criteria for all COCs.

In most instances, where differences between the old and new regulatory values have been highlighted, changes to toxicity values do not affect the protectiveness of the remedy. The protectiveness is not affected since LUCs preventing exposure to residual COCs in soil and groundwater are functioning as intended. However, any future decision to remove LUCs should consider the latest ARAR values at that time.

Toxicity values for the supplemental vapor intrusion risk evaluations were also reviewed. Inhalation toxicity values used in the Fuel Farm 1 Lower Marina Vapor Intrusion Study (URS, 2014) are consistent with current inhalation toxicity values. Thus, the results of the vapor intrusion evaluation that indicated health risks were low have not changed.

Exposure parameters currently used in the development of MTCA Method B CULs have remained the same as those used when the CULs were identified in the decision documents. However, the fish consumption rate currently used in the calculation of the revised state water quality criteria for human health increased to 175 g/day versus the 54 g/day that is used in the MTCA Method B surface water cleanup criteria. The increased consumption rate takes into account populations in the area who are more likely to consume greater amounts of fish (e.g., local tribes). Use of a higher consumption rate is more conservative. However, in most cases, the current MTCA Method B surface water quality criterion for humans (based on the higher consumption rate) is greater than the criterion provided in the decision document. And for those current MTCA Method B surface water quality criterion for humans less than values in the decision document, the differences are not significant (i.e., less than 0.01). Therefore, the remedy remains protective.

7.2.3 Review of Risk Assessment Assumptions for Ecological Health

Ecological health risk assessment assumptions also were reviewed as part of the requirement to assess protectiveness of the cleanup actions. The upland portions of Fuel Farm 1, Fuel Farm 2, Fuel Farm 3, Fuel Farm 4, and Building 357 are not considered suitable terrestrial habitat based on historical and current industrial activities and because the depth to petroleum contamination is greater than 15 ft bgs. Contamination at this depth in the upland areas prevents contact for any ecological receptor if future land use become less industrial in nature. As such, ecological health is not considered a part of the RAOs for the upland areas.

Ecology released a new guidance for petroleum contamination since the second FYR was completed. The new Petroleum Guidance (Ecology, 2016a) requires a terrestrial ecological evaluation (TEE) be conducted at all sites to evaluate potential impacts on upland plants and animals. However, sites are not required to perform a TEE if the soil contamination is located below the point of compliance of 15 ft. As stated above, not only is the upland soil contamination at all of the sites greater than 15 ft, but ecological receptors would not find the sites as suitable habitats because of the industrial nature of the area in general. As such, TEEs would not be required for any of the sites included in this FYR.

Ecological receptors at for the sites evaluated in this FYR are limited to marine aquatic habitats and RAOs to protect the marine aquatic habitats were only determined for Fuel Farm 1, Fuel Farm 2, and Fuel Farm 4. Marine aquatic habitats are not present at Fuel Farm 3 and Building 357.

Summaries of the ecological evaluations performed for the three sites with RAOs to protect the marine aquatic habitat is provided below.

7.2.3.1 Fuel Farm 1

The remedial strategy for Fuel Farm 1 was designed to protect ecological receptors by achieving the Pathway 3 surface water CULs for COCs in groundwater (i.e., groundwater migration to Crescent Harbor). Aquatic life criteria for the COCs identified at the petroleum site have not been derived for WAC 173-201A-240, nor are they available in Federal aquatic life criteria regulations (e.g., 304 of the Clean Water Act, National toxics rule 40 C.F.R. Part 131). MTCA Method B cleanup values selected as CULs for the groundwater to surface water exposure pathway are as stringent as applicable State and Federal laws for protection of human health, as aquatic criteria for COCs are not available. Therefore, there have been no new risk assessment assumptions or state-specific regulations that would change the protectiveness of the remedies for ecological receptors.

7.2.3.2 Fuel Farm 2

The remedial strategy for Fuel Farm 2 was designed to protect ecological receptors by achieving the Pathway 3 surface water CULs for COCs in surface water seeps and Pathway 2 direct contact CULs for COCs in beach sediments adjacent to Crescent Harbor. Aquatic life criteria for the COCs identified at the petroleum site have not been derived for WAC 173-201A-240, nor are they available in Federal aquatic life criteria regulations (e.g., 304 of the Clean Water Act, National toxics rule 40 C.F.R. Part 131). MTCA Method B cleanup values selected as CULs for the groundwater to surface water exposure pathway are as stringent as applicable State and Federal laws for protection of human health, as aquatic criteria for COCs are not available. The ecological soil standard for xylenes identified as the CUL at Fuel Farm 2 for soil is no longer current and there is no current state or federal sediment standard for xylenes for ecological receptors. Therefore, there have been no new risk assessment assumptions or state-specific regulations that would change the protectiveness of the remedies for ecological receptors.

7.2.3.3 Fuel Farm 4

The remedial strategy for Fuel Farm 4 was designed to protect ecological receptors by achieving the Pathway 3 surface water CULs for COCs in groundwater (i.e., groundwater migration to downgradient ditch). Aquatic life criteria for the COCs identified at the petroleum site have not been derived for WAC 173-201A-240, nor are they available in Federal aquatic life criteria regulations (e.g., 304 of the Clean Water Act, National toxics rule 40 C.F.R. Part 131). MTCA Method B cleanup values selected as CULs for the groundwater to surface water exposure pathway are as stringent as applicable State and Federal laws for protection of human health, as aquatic criteria for COCs are not available. Therefore, there have been no new risk assessment assumptions or state-specific regulations that would change the protectiveness of the remedies for ecological receptors.

7.3 NEW INFORMATION

This section is in response to the question “Has any other information come to light that could call into question the protectiveness of the cleanup actions?”

While climate change is not ‘new” information, the Navy has identified climate change as a significant risk to not only base infrastructure, but also to shoreline sites with conditions that do not allow for unlimited use and unrestricted exposure. Climate change modeling of the Salish Sea, currently underway by Pacific Northwest National Laboratory, indicates that the combined effect of warming and saltwater intrusion would impact fate and transport of contaminants. In addition, increased precipitation in the region could result in an increased potential for contaminant leaching. As such, the remedies at the NAS Whidbey Island petroleum sites may be vulnerable to climate change impacts (i.e., warming, saltwater intrusion, and increased precipitation) not apparent during remedy selection in 1999 (Navy, 1999).

In particular, due to the shoreline location of Fuel Farms 1 and 2 and the compliance/groundwater monitoring component of their remedy, these petroleum sites may be vulnerable to climate change impacts. The purpose of the monitoring activities is to collect data to determine groundwater flow (i.e., direction and gradient) and monitor the nature and extent of contamination. *If* the fate and transport of contaminants in soil and groundwater at Fuel Farms 1 and 2 are impacted due to warming, saltwater intrusion, and/or increased precipitation, *then* the current monitoring activities (including the monitoring well network) may no longer accurately characterize site conditions, including potential exposure pathways.

No other information reviewed during this FYR period, apart from the information discussed previously in this document, affects the protectiveness of the cleanup actions at Fuel Farms 1, 2, 3, and 4 and Building 357.

7.4 TECHNICAL ASSESSMENT SUMMARY

In general, the remedies (i.e., free product recovery, compliance/groundwater monitoring, and/or natural attenuation) at Fuel Farms 1, 2, 3, and 4 are functioning as intended based on the revised decision documents (NAVFAC, 2013a and 2013b).

If any well had measurable free product (i.e., >0.02 ft) during a monitoring event, then the free product was removed to the maximum extent practicable and free product recovery efforts at the well continued on an annual basis. Free product recovery efforts are being conducted on an annual basis (i.e., during winter months when free product thickness is greatest allowing for maximum free product recovery) at Fuel Farms 1, 2, and 3. Although free product is detected in well MW-109 at Fuel Farm 4, the free product thickness is so minimal (i.e., at 0.03 to 0.04 ft) that recovery efforts are not practicable.

Compliance/groundwater monitoring activities, including water level measurements, are being conducted at Fuel Farms 1, 2, 3, and 4, but not exactly at the frequency (or analytes) as specified in the *Revised CAP, NAS Whidbey Island, Closed Former Fuel Farms 1, 2, 3 and Fire Training Area* (NAVFAC, 2013a). Despite this irregularity, the compliance/groundwater monitoring activities, particularly during the most recent and comprehensive monitoring event in July 2016, are providing sufficient data to: 1) determine groundwater flow direction and 2) evaluate the nature and extent of dissolved-phase contamination in the subsurface at Fuel Farms 1, 2, 3, and 4. More importantly, the data are sufficient to demonstrate that the dissolved-phase petroleum contaminant plumes at Fuel Farms 1 and 2 do not pose a risk to Crescent Harbor:

- *Fuel Farm 1:* Compliance wells (i.e., MW-331 and MW-343) in the Lower Area delineate the northeast edge of the dissolved-phase petroleum contaminant plumes.

- *Fuel Farm 2:* Dissolved-phase contaminant concentrations are below their respective groundwater CULs at MW-507, which is downgradient from free product detections (i.e., at well MW-506), delineating the eastern edge of the plume.

Natural attenuation is a remedy component for Fuel Farms 1, 2, and 3, but has varying degrees of effectiveness depending on subsurface conditions:

- *Fuel Farm 1:*

    - Upper Area: The plume is stable, and biodegradation is occurring with low electron acceptor levels where petroleum constituent concentrations remain high and high electron acceptor levels where petroleum constituent concentrations are low/non-detect.

    - Lower Area: Based on the inadequate presence of electron acceptors in areas of low petroleum hydrocarbon contamination, natural attenuation of the dissolved-phase petroleum contaminant plume may be limited. Statistical modeling demonstrates that natural attenuation of the chlorinated VOC plume is occurring in the subsurface.

- *Fuel Farm 2:* The limited plume (i.e., limited to MW-505 and MW-506) demonstrates that natural attenuation is occurring with adsorption being the dominant mechanism. The low permeability soils at Fuel Farm 2 provide natural migration control for petroleum-contaminated soil and groundwater.

- *Fuel Farm 3:* Although plume stability may be uncertain in the area of MW-358, the inversely proportional trend of electron acceptors and petroleum hydrocarbon contamination indicates that biodegradation is occurring in the subsurface. Continued free product recovery efforts will enhance natural attenuation.

While climate change is not ‘new” information, the Navy has identified climate change as a significant risk to not only base infrastructure, but also to shoreline sites with conditions that do not allow for unlimited use and unrestricted exposure. In particular, due to the shoreline location of Fuel Farms 1 and 2 and the compliance/groundwater monitoring component of their remedy, these petroleum sites may be vulnerable to climate change impacts. *If* the fate and transport of contaminants in soil and groundwater at Fuel Farms 1 and 2 are impacted due to warming, saltwater intrusion, and/or increased precipitation, *then* the current monitoring activities (including the monitoring well network) may no longer accurately characterize site conditions, including potential exposure pathways.

In addition to LUCs and periodic reviews, compliance/groundwater monitoring and natural attenuation are part of the remedy for Building 357. However, there are no new data to present in this FYR for Building 357. Groundwater sampling was last conducted at Building 357 in August 2007. An additional sampling event is needed to determine current contaminant concentrations and if they support a request for NFA determination from Ecology.

An important finding of the technical assessment was that the revised decision documents (NAVFAC, 2013a and 2013b) did not include updated CULs. Consequently, the CULs for some of the COCs are significantly different from CULs based on current standard assumptions and regulatory requirements. There have been substantial changes to exposure assumptions and toxicity data; revisions to state regulations and guidance on remediation of contaminated sites; and promulgation of new state surface water ARARs. Despite these changes, the remedial actions completed to date, along with the use of LUCs to prevent exposure to COCs remaining in place, continue to protect human health and the environment.

7.5 ISSUES

Table 7-20 lists the issues identified as a result of this FYR that appear to have the potential to affect the protectiveness of the cleanup actions at Fuel Farms 1, 2, 3, and 4 and Building 357.

Table 7-20. Issues Identified through FYR Process

Item No.	Issue	Affects Protectiveness	
		Current	**Future**
Fuel Farms 1, 2, 3, and 4 and Building 357			
1	Based on review of the compliance/groundwater monitoring activities conducted from 2012 to 2017, additional sampling events have been conducted at Fuel Farms 1, 2, 3, and 4 after four consecutive quarters of TPH-GRO, TPH-DRO, and BTEX results below groundwater CULs (i.e., inconsistent with the well logic presented in the decision document [NAVFAC, 2013a]).	No	Yes
2	CULs for TPH use MTCA Method A which does not take into consideration the site-specific composition of the TPH.	No	Yes
3	Soil CULs are not up to date based on CLARC Tool and existing soil data.	No	Yes
4	Specific LUCs and LUC boundaries may no longer be appropriate or needed to maintain protectiveness based on updated/revised soil and groundwater CULs.	No	Yes
5	Revised CAP (NAVFAC, 2013a) does not establish/reference CULs based on current standard assumptions and regulatory requirements.	No	Yes
6	Remedy protectiveness at Fuel Farms 1, 2, 3, and 4 and Building 357 is dependent on LUC maintenance; however, the LUC Instruction has not been completed to ensure maintenance of LUCs by NAS Whidbey Island personnel.	No	Yes
Fuel Farms 1 and 2			
7	Due to the shoreline location of Fuel Farms 1 and 2 and the compliance/groundwater monitoring component of their remedy, these petroleum sites may be vulnerable to climate change impacts.	No	Yes
Fuel Farm 3			
8	LUCs associated with soil disturbance and land use may not be appropriate/needed based current ARARs.	No	Yes

Table 7-20. Issues Identified through FYR Process (continued)

Item No.	Issue	Affects Protectiveness	
		Current	**Future**
Building 357			
9	Groundwater sampling was most recently conducted at Building 357 in August 2007 and benzene and TPH-GRO concentrations exceeded CULs. Therefore, current concentrations of dissolved-phase components are unknown and the potential for NFA cannot be evaluated at this time.	No	Yes
10	LUCs associated with characterizing and disposing of soil and maintaining current land use may not be appropriate/needed, since current MTCA Method A CULs for soil have been achieved.	No	Yes

8.0 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

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

Table 8-1. Recommendations and Follow-Up Actions

Item No.	Recommendation/Follow-Up Action	Party Responsible	Oversight Agency	Milestone Date	Follow-Up Action: Affects Protectiveness	
					Current	**Future**
	Fuel Farms 1, 2, 3, and 4 and Building 357					
1	Re-evaluate and optimize the compliance/groundwater monitoring activities for Fuel Farms 1, 2, 3, and 4 via a decision document update.	Navy	Ecology	June 2018	No	Yes
2	Use MTCA Method B to establish updated CULs for TPH (instead of MTCA Method A). MTCA Method B CULs are beneficial where the composition of the petroleum release has significantly changed through remediation, natural attenuation, and/or biodegradation. MTCA Method B takes into consideration the site-specific composition of the TPH and by doing so, allows for a more accurate representation of risk drivers at the site. Conduct groundwater sampling and analysis using the EPH/VPH methods. Use these data and Ecology's TPH worksheet to calculate updated groundwater CULs for TPH. Compare updated CULs to groundwater data.	Navy	Ecology	June 2020	No	Yes
3	Use existing soil data and CLARC Tool to calculate updated soil CULs. Compare updated CULs to soil data to reevaluate site risks.	Navy	Ecology	June 2020	No	Yes
4	Re-evaluate LUCs and the LUC boundaries (as related to updated soil and groundwater CULs that have increased due to current ARARs) to determine if still appropriate and needed to maintain remedy protectiveness.	Navy	Ecology	June 2020	No	Yes
5	Update the revised CAP (NAVFAC, 2013a) to include: 1) an evaluation of current ARARs and resulting/updated soil and groundwater CULs; 2) revised LUCs and LUC boundaries (based on the updated CULs); and 3) an optimized monitoring approach.	Navy	Ecology	June 2020	No	Yes
6	Work with Installation Chain-of-Command to prepare a LUC Instruction to ensure maintenance of LUCs by NAS Whidbey Island personnel.	Navy	Ecology	June 2020	No	Yes
	Fuel Farms 1 and 2					
7	Leverage ongoing Navy regional planning to begin an assessment of the vulnerability of the remedies to climate change impacts in support of a future adaptation plan for NAS Whidbey Island.	Navy	Ecology	June 2022	No	Yes

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

Item No.	Recommendation/Follow-Up Action	Party Responsible	Oversight Agency	Milestone Date	Follow-Up Action: Affects Protectiveness	
					Current	Future
	Fuel Farm 3					
8	Review existing soil data (from 0 – 15 ft bgs) and compare to current ARARs to determine if LUCs associated with soil disturbance and maintaining current land use are still appropriate and needed to maintain remedy protectiveness.	Navy	Ecology	June 2020	No	Yes
	Building 357					
9	Conduct groundwater sampling and analysis of benzene and TPH-GRO and compare to current ARARs to evaluate current site conditions.	Navy	Ecology	June 2020	No	Yes
10	Re-evaluate LUCs associated with characterizing and disposing of soil and maintaining current land use to determine if these LUCs are still appropriate and needed to maintain remedy protectiveness, since current MTCA Method A CULs for soil have been achieved.	Navy	Ecology	June 2020	No	Yes

9.0 CERTIFICATION OF PROTECTIVENESS

The remedies at Fuel Farms 1, 2, 3, and 4 and Building 357 currently protect human health and the environment because: 1) based on compliance/groundwater monitoring, the dissolved-phase petroleum and chlorinated volatile organic compound (VOC) plumes are characterized and delineated; 2) natural attenuation is occurring in the subsurface; and/or 3) existing LUCs prevent exposure to contaminants at concentrations above CULs. However, the following actions need to be taken to ensure protectiveness:

1. Re-evaluate and optimize the compliance/groundwater monitoring activities;
2. Revisit soil and groundwater CULs based on current standard assumptions and regulatory requirements;
3. Revisit site-specific LUCs and LUC boundaries based on updated/revised soil and groundwater CULs;
4. Revise the current decision document (NAVFAC, 2013a) to include establish/reference updated CULs, revised LUCs and LUC boundaries, and optimized monitoring approach;
5. Prepare a LUC Instruction to ensure LUC maintenance is performed by NAS Whidbey Island personnel;
6. Begin a vulnerability assessment of the remedies to climate change impacts at Fuel Farms 1 and 2 in support of a future adaptation plan for NAS Whidbey Island; and
7. Conduct an additional sampling event at Building 357 to determine current concentrations of dissolved-phase components and if requesting a NFA determination from Ecology is appropriate.

In addition to these actions, the current remedies will continue, including annual LUC inspections per the *Final Land Use Control Implementation Plan, Naval Air Station Whidbey Island, Oak Harbor, Washington* (Battelle, 2017); free product recovery efforts, particularly at Fuel Farm 3 to enhance natural attenuation; compliance/groundwater monitoring of the nature and extent of dissolved-phase contamination in the subsurface; an evaluation of natural attenuation at Fuel Farms 1, 2, and 3; and periodic reviews in the form of a FYR report per WAC 173-340-420(3).

10.0 REFERENCES

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APPENDIX A

Monitoring Data Summaries

FUEL FARM 1

Fuel Farm 1 - Groundwater Elevations and Water Quality Parameters
3rd FYR for Petroleum Sites, 2012 - 2017
Naval Air Station Whidbey Island, Oak Harbor, WA

Well ID (MW-)	Sample Date	Depth to water (ft)	TOC Elevation (msl)	Groundwater Elevation (ft msl)	Temperature (C)	pH	Redox (mV)	Conductivity (ms/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (%)
201	07/24/12	25.55	43.59	18.04	15.50	6.50	134	0.704	0.00	1.78	0.00
201	10/16/12	27.28	43.59	16.31	12.77	7.06	157	0.733	1.10	0.89	0.00
201	01/15/13	25.75	43.59	17.84	10.60	7.12	154	0.398	0.00	0.54	0.02
201	04/03/13	23.88	43.59	19.71	14.57	6.15	197	1.190	0.30	2.61	0.06
202	10/16/12	19.85	NA	NA	12.29	6.85	-99	1.180	1.80	0.00	0.10
202	09/11/13	19.53	NA	NA	18.52	7.41	-76	0.946	0.00	0.00	0.03
202	12/02/14	19.03	NA	NA	10.36	6.72	-56	1.050	1.57	0.61	0.05
202	07/11/16	18.73	NA	NA	15.28	6.96	-50	0.770	1.40	0.00	0.04
301	07/24/12	17.43	30.62	13.19	15.43	6.99	-80	1.840	0.10	0.00	0.10
301	09/16/13	18.21	30.62	12.41	14.55	6.85	-128	1.780	5.70	0.48	0.09
301	12/03/14	17.64	30.62	12.98	8.71	6.66	-79	1.890	0.97	0.00	0.09
301	07/14/16	17.81	30.62	12.81	13.98	6.96	-106	2.250	0.00	0.51	0.11
303	10/15/12	20.70	32.19	11.49	12.07	7.06	-118	1.820	5.20	0.00	0.10
303	09/16/13	20.75	32.19	11.44	14.36	7.62	-112	1.660	0.00	0.00	0.05
303	12/02/14	20.55	32.19	11.64	8.08	6.89	-92	1.760	1.12	0.00	0.09
303	07/13/16	20.25	32.19	11.94	15.41	6.71	-108	1.790	0.00	0.00	0.09
304	10/15/12	20.81	28.72	7.91	12.43	6.85	-61	0.942	19.40	0.00	0.00
304	09/17/13	20.81	28.72	7.91	11.97	7.24	-26	0.661	1.40	0.00	0.02
304	12/03/14	20.21	28.72	8.51	9.49	6.78	-7	0.626	8.00	0.00	0.03
304	07/13/16	20.58	28.72	8.14	15.13	6.61	-63	0.888	7.80	0.00	0.04
305	07/24/12	19.42	30.30	10.88	14.89	6.86	-50	1.020	3.20	0.12	0.00
305	09/16/13	19.93	30.30	10.37	13.95	7.42	-71	0.918	2.30	0.00	0.02
305	12/02/14	19.75	30.30	10.55	9.12	6.82	-42	0.907	18.00	0.00	0.04
305	07/13/16	19.73	30.30	10.57	16.04	6.58	-67	1.180	2.80	0.00	0.06
306	10/17/12	19.99	39.25	19.26	11.87	6.78	-88	0.999	14.20	0.00	0.00
306	09/16/13	19.93	39.25	19.32	14.34	6.52	-105	0.755	4.40	0.56	0.04
306	12/02/14	19.67	39.25	19.58	10.56	6.73	-67	0.838	2.81	0.00	0.04
306	07/14/16	18.83	39.25	20.42	14.38	6.86	-86	1.030	0.00	0.39	0.05
307	07/17/12	11.88	50.89	39.09	13.43	6.59	60	0.563	2.50	2.25	0.00
307	10/17/12	14.12	50.89	36.77	12.69	6.81	117	0.596	29.30	2.44	0.00
307	01/15/13	10.04	50.89	40.85	10.10	7.08	167	0.318	0.40	4.40	0.10
307	04/03/13	10.89	50.89	40.00	11.40	6.01	139	0.954	2.90	9.94	0.05
308	07/17/12	12.50	40.28	27.78	13.80	6.84	91	0.495	0.00	8.87	0.00
308	10/17/12	15.99	40.28	24.29	13.61	7.32	102	0.871	10.70	0.00	0.00
308	01/15/13	11.38	40.28	28.90	11.68	6.98	184	0.282	0.00	3.25	0.01
308	04/03/13	11.77	40.28	28.51	12.25	6.01	197	0.905	0.60	2.91	0.04
311	07/17/12	24.40	43.28	18.88	15.25	6.61	-69	0.990	7.60	0.00	0.00
311	09/11/13	26.66	43.28	16.62	20.78	7.51	-94	0.781	0.00	0.00	0.02
311	12/02/14	27.40	43.28	15.88				product present			

Fuel Farm 1 - Groundwater Elevations and Water Quality Parameters
3rd FYR for Petroleum Sites, 2012 - 2017
Naval Air Station Whidbey Island, Oak Harbor, WA

Well ID (MW-)	Sample Date	Depth to water (ft)	TOC Elevation (msl)	Groundwater Elevation (ft msl)	Temperature (C)	pH	Redox (mV)	Conductivity (ms/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (%)
311	10/26/15	27.89	43.28	15.39				product present			
311	07/11/16	25.77	43.28	17.51				product present			
311	11/14/16	27.06	43.28	16.22				product present			
312	07/17/12	24.25	47.60	23.35	15.35	6.70	92	0.766	4.40	3.78	0.00
312	10/12/12	26.93	47.60	20.67	11.51	6.92	115	0.857	5.00	4.77	0.00
312	01/14/13	24.32	47.60	23.28	8.36	5.44	152	0.788	1.70	2.78	0.04
312	04/08/13	21.73	47.60	25.87	11.22	6.73	131	0.482	1.10	1.53	0.02
313	07/23/12	28.85	46.09	17.24	16.03	7.15	-102	0.992	54.30	0.18	0.00
313	12/13/12	30.94	46.09	15.15				product present			
313	01/14/13	30.38	46.09	15.71	10.24	6.66	-42	0.598	4.70	2.21	0.03
313	04/03/13	25.68	46.09	20.41	15.48	6.83	-32	0.578	1.40	1.08	0.03
313	09/12/13	32.22	46.09	13.87	16.68	6.93	-100	0.764	2.60	2.06	0.04
313	12/01/14	31.05	46.09	15.04	9.27	7.18	-70	0.704	21.00	2.25	0.03
313	07/12/16	29.33	46.09	16.76	19.54	6.60	-59	1.090	0.00	0.17	0.05
314	07/23/12	35.43	50.54	15.11	13.30	6.19	211	0.900	1.00	7.73	0.00
314	10/15/12	38.93	50.54	11.61	12.06	7.43	152	0.873	6.20	11.01	0.00
314	01/14/13	39.09	50.54	11.45	9.07	7.09	139	0.483	18.80	3.14	0.02
314	04/03/13	30.25	50.54	20.29	16.69	7.17	116	0.576	2.20	1.33	0.03
315	07/16/12	30.42	46.22	15.80	16.45	7.15	-24	5.130	0.50	0.59	0.30
315	10/12/12	32.12	46.22	14.10	14.68	7.35	-130	1.080	3.70	0.00	0.00
315	01/14/13	32.08	46.22	14.14	18.22	5.96	-129	2.710	35.30	0.16	0.14
315	04/03/13	28.50	46.22	17.72	13.12	7.15	35	0.976	6.30	3.62	0.05
315	09/16/13	32.24	46.22	13.98	15.09	7.00	-141	0.991	11.80	1.22	0.05
315	10/26/15	33.01	46.22	13.21	13.56	7.59	0	0.634	27.60	0.93	0.03
315	12/01/15	32.70	46.22	13.52	9.86	7.18	96	0.990	20.00	3.80	0.05
315	01/04/16	24.22	46.22	22.00	10.30	7.02	63	0.999	11.70	5.06	0.05
315	04/18/16	28.98	46.22	17.24	20.44	7.59	-17	0.998	0.00	1.34	0.05
315	07/12/16	31.52	46.22	14.70	21.34	6.92	-92	1.430	47.90	0.35	0.07
317	07/24/12	28.10	42.42	14.32	12.44	7.00	-106	0.970	1.10	2.29	0.00
317	10/16/12	29.61	42.42	12.81	12.27	7.22	-142	0.930	9.90	0.00	0.00
317	01/15/13	28.89	42.42	13.53	9.31	7.55	-145	0.606	0.00	0.00	0.03
317	04/04/13	26.30	42.42	16.12	11.00	7.02	54	0.974	2.00	3.99	0.04
318	10/15/12	21.80	43.64	21.84	12.16	7.17	-143	1.280	7.50	0.00	0.10
318	09/12/13	21.75	43.64	21.89	14.07	7.08	-181	1.190	0.00	0.72	0.06
318	12/01/14	20.13	43.64	23.51	10.02	6.32	-126	1.130	0.00	0.00	0.06
318	07/11/16	20.31	43.64	23.33	13.54	6.71	-92	0.684	4.10	0.27	0.03
319	07/17/12	19.75	44.38	24.63	14.33	6.54	-94	1.190	4.30	0.00	0.10
319	09/12/13	21.94	44.38	22.44	12.73	7.39	-79	1.400	3.20	0.00	0.04
319	12/01/14	20.61	44.38	23.77	8.42	5.61	-63	1.250	0.00	0.34	0.06

Fuel Farm 1 - Groundwater Elevations and Water Quality Parameters
3rd FYR for Petroleum Sites, 2012 - 2017
Naval Air Station Whidbey Island, Oak Harbor, WA

Well ID	Sample Date	Depth to water	TOC Elevation	Groundwater Elevation	Temperature	pH	Redox	Conductivity	Turbidity	DO	Salinity
(MW-)		(ft)	(msl)	(ft msl)	(C)		(mV)	(ms/cm)	(NTU)	(mg/L)	(%)
319	07/11/16	20.75	44.38	23.63	product present						
320	10/15/12	23.90	45.96	22.06	12.13	6.92	-93	1.140	12.00	0.00	0.10
320	09/11/13	23.84	45.96	22.12	15.86	6.94	-145	1.040	0.00	0.49	0.05
320	12/01/14	23.86	45.96	22.10	8.56	5.93	-83	1.040	0.00	1.57	0.05
320	07/11/16	23.22	45.96	22.74	13.22	7.04	-82	0.949	0.60	0.23	0.05
321	07/17/12	33.42	48.42	15.00	13.86	6.57	117	0.107	5.70	6.20	0.00
321	10/15/12	36.28	48.42	12.14	12.11	6.82	156	0.960	0.60	5.86	0.00
321	01/14/13	35.83	48.42	9.59	9.46	5.91	150	2.340	20.80	5.40	0.12
321	04/08/13	31.68	48.42	16.74	15.45	7.00	-66	0.884	26.00	1.40	0.04
321	09/12/13	36.15	48.42	12.27	12.79	6.86	144	0.884	10.90	5.51	0.04
321	12/01/14	36.53	48.42	11.89	9.82	6.84	34	0.883	19.00	2.12	0.04
321	10/26/15	37.19	48.42	11.23	13.52	7.17	-90	0.966	77.30	1.00	0.05
321	01/04/16	25.62	48.42	22.80	9.87	7.20	2	1.000	19.80	5.22	0.05
321	04/18/16	31.33	48.42	17.09	18.63	7.57	-90	0.832	7.00	0.05	0.04
321	07/12/16	33.56	48.42	14.86	17.97	7.29	-104	1.210	6.30	2.21	0.06
321	11/14/16	36.82	48.42	11.60	13.95	6.31	34	0.830	0.00	9.40	0.04
321	01/10/17	36.80	48.42	11.62	10.19	6.49	74	0.875	14.10	1.85	0.04
322	10/15/12	24.08	36.94	12.86	13.82	7.14	-113	0.138	39.10	0.00	0.10
322	09/16/13	24.27	36.94	12.67	14.16	6.87	-150	1.220	4.80	0.75	0.06
322	12/01/14	24.23	36.94	12.71	13.13	6.10	-87	1.130	0.00	5.87	0.06
322	07/12/16	23.39	36.94	13.55	18.10	6.97	-128	1.460	216.00	0.61	0.07
323	07/24/12	19.60	33.48	13.88	12.18	6.88	-85	1.230	0.30	0.00	0.10
323	10/15/12	21.00	33.48	12.48	12.07	7.11	-115	1.220	10.60	0.00	0.10
323	01/16/13	19.91	33.48	13.57	9.33	7.27	-109	0.840	9.70	0.00	0.04
323	04/08/13	18.71	33.48	14.77	11.54	6.97	-74	1.160	16.40	0.52	0.06
323	09/16/13	20.82	33.48	12.66	13.98	7.57	-88	1.090	1.60	0.00	0.03
323	12/02/14	20.83	33.48	12.65	9.39	6.90	-71	1.130	3.09	0.00	0.06
323	07/13/16	20.32	33.48	13.16	15.19	6.82	-105	1.430	2.60	0.00	0.07
324	10/16/12	24.06	38.64	14.58	12.87	7.02	-79	1.250	10.70	0.00	0.10
324	09/16/13	24.03	38.64	14.61	13.66	7.37	-81	1.150	0.80	0.00	0.03
324	12/02/14	24.03	38.64	14.61	9.60	6.78	-59	1.070	2.00	0.00	0.05
324	07/13/16	23.34	38.64	15.30	14.59	6.87	-93	1.460	1.30	0.00	0.07
325	07/26/12	16.35	38.64	22.29	13.44	6.58	33	0.779	1.40	0.00	0.00
325	10/17/12	17.65	38.64	20.99	11.28	6.91	-97	0.909	4.00	0.00	0.00
325	01/16/13	14.68	38.64	23.96	9.94	7.18	140	0.362	1.00	6.44	0.02
325	04/08/13	13.99	38.64	24.65	11.24	6.82	104	0.467	7.50	3.06	0.02
326	10/17/12	16.97	28.55	11.58	11.38	6.83	-78	1.120	7.80	0.00	0.00
326	09/16/13	16.82	28.55	11.73	13.27	7.51	-70	1.010	0.00	0.00	0.03
326	12/02/14	15.73	28.55	12.82	7.55	6.65	-45	1.070	1.96	0.00	0.05

Well ID (MW-)	Sample Date	Depth to water (ft)	TOC Elevation (msl)	Groundwater Elevation (ft msl)	Temperature (C)	pH	Redox (mV)	Conductivity (ms/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (%)
326	07/14/16	16.04	28.55	12.51	15.10	6.85	-86	1.380	0.00	0.00	0.07
327	07/17/12	10.90	18.93	8.13	13.79	6.40	76	0.920	4.50	0.09	0.00
327	10/17/12	12.26	18.93	6.67	12.18	7.04	-20	0.001	3.50	0.00	0.00
327	01/16/13	9.88	18.93	9.05	9.68	7.22	63	0.615	0.60	2.39	0.03
327	04/08/13	9.20	18.93	9.73	11.37	6.87	206	0.769	3.50	2.20	0.04
328	07/17/12	14.14	37.57	23.43	14.35	7.00	-156	0.689	11.80	0.00	0.00
328	10/12/12	16.70	37.57	20.87	12.40	6.81	-160	0.734	5.30	0.00	0.00
328	01/16/13	10.99	37.57	26.58	10.77	7.04	-123	0.363	6.30	0.00	0.02
328	04/08/13	10.92	37.57	26.65	11.71	6.68	-118	0.440	2.70	0.54	0.02
328	09/12/13	16.52	37.57	21.05	14.81	6.69	-122	0.536	0.00	0.78	0.03
328	12/01/14	13.83	37.57	23.74	9.48	5.60	-62	0.528	0.00	0.18	0.03
328	07/11/16	15.10	37.57	22.47	15.56	7.15	-76	0.456	21.80	0.00	0.02
329	07/17/12	12.52	31.75	19.23	15.33	6.88	-175	0.785	0.00	0.00	0.00
329	10/12/12	15.06	31.75	16.69	12.18	7.00	-123	0.883	3.00	0.00	0.00
329	01/16/13	10.11	31.75	21.64	10.26	6.96	-99	0.421	2.20	0.00	0.02
329	04/08/13	9.73	31.75	22.02	11.54	6.74	-24	0.570	4.10	0.48	0.03
329	09/12/13	14.93	31.75	16.82	16.80	7.38	-87	0.552	0.00	0.00	0.01
329	12/02/14	12.68	31.75	19.07	9.79	6.80	-73	0.638	5.00	0.00	0.03
329	07/14/16	13.85	31.75	17.90	14.58	6.48	-83	0.802	0.00	0.39	0.04
330L	10/16/12	7.48	10.63	3.15	13.95	7.05	-153	0.998	13.00	0.00	0.00
330L	09/17/13	7.80	10.63	2.83	14.62	7.32	-107	0.587	3.40	0.00	0.01
330L	12/03/14	6.41	10.63	4.22	13.06	6.57	-108	0.489	1.49	0.23	0.02
330L	07/19/16	7.83	10.63	2.80				product present			
330U	10/17/12	10.96	22.05	11.09	13.30	6.99	109	0.694	18.30	2.82	0.00
330U	01/16/13	8.16	22.05	13.89	10.81	7.02	128	0.327	0.20	3.42	0.02
330U	04/09/13	7.56	22.05	14.49	10.66	6.56	196	0.399	3.10	6.73	0.02
330U	07/26/16	9.33	22.05	12.72	13.69	6.62	176	0.615	14.40	4.39	0.00
331	10/16/12	7.30	10.41	3.11	14.69	7.15	2	0.993	0.00	0.00	0.00
331	01/22/13	6.94	10.41	3.47	10.95	7.12	53	0.456	1.20	0.18	0.02
331	04/10/13	6.77	10.41	3.64	12.56	6.76	57	0.651	0.00	0.51	0.03
331	09/18/13	7.55	10.41	2.86	16.08	6.83	-15	0.634	0.00	0.36	0.03
331	12/03/14	6.43	10.41	3.98	16.32	6.77	15	0.638	0.00	0.00	0.03
331	07/16/16	7.43	10.41	2.98	14.83	6.68	-63	0.849	1.60	0.00	0.00
331	07/18/16	7.63	10.41	2.78	15.54	6.86	-34	0.828	1.80	0.00	0.04
332	07/25/12	5.20	10.41	5.21	17.69	7.12	-99	0.679	0.00	0.00	0.00
332	10/16/12	6.12	10.41	4.29	15.37	7.36	-25	0.738	0.00	0.00	0.00
332	01/22/13	5.57	10.41	4.84	10.35	7.56	-36	0.357	0.50	0.06	0.02
332	04/10/13	4.74	10.41	5.67	12.02	7.15	-18	0.455	0.00	0.54	0.02
332	09/17/13	5.08	10.41	5.33	18.14	8.00	-75	0.514	0.00	0.00	0.01

Well ID (MW-)	Sample Date	Depth to water (ft)	TOC Elevation (msl)	Groundwater Elevation (ft msl)	Temperature (C)	pH	Redox (mV)	Conductivity (ms/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (%)
332	12/02/13	4.72	10.41	5.69	12.97	6.98	-32	0.542	3.50	0.00	0.30
332	03/05/14	4.17	10.41	6.24	11.18	6.75	-100	0.502	7.80	0.33	0.02
332	06/04/14	5.51	10.41	4.90	18.68	7.60	-92	0.432	0.00	0.44	0.02
333	10/16/12	6.98	10.42	3.44	13.97	7.36	-230	0.163	0.00	0.00	0.10
333	09/17/13	7.72	10.42	2.70	15.38	7.83	-116	2.490	0.00	0.00	0.08
333	12/02/13	6.84	10.42	3.58	12.93	7.05	-262	2.000	69.00	0.53	0.10
333	03/05/14	5.48	10.42	4.94	11.98	7.30	-147	2.170	2.80	0.23	0.11
333	06/04/14	7.33	10.42	3.09	16.81	7.39	-87	2.440	0.00	0.38	0.13
333	07/18/16	7.96	10.42	2.46	16.27	7.05	-70	3.080	0.00	0.00	0.16
335	07/25/12	8.14	11.95	3.81	16.57	7.66	72	1.650	0.00	0.00	0.10
335	10/18/12	8.23	11.95	3.72	14.07	8.28	-116	1.590	0.00	0.00	0.10
335	01/22/13	8.21	11.95	3.74	10.34	8.36	61	1.490	0.00	0.67	0.07
335	04/09/13	7.31	11.95	4.64	11.57	7.86	24	1.480	1.40	0.69	0.07
337	07/16/12	7.10	10.50	3.40	18.04	7.08	-73	4.440	0.80	0.03	0.20
337	10/18/12	6.70	10.50	3.80	15.67	6.78	124	2.070	0.00	0.00	1.20
337	01/17/13	7.02	10.50	3.48	9.14	8.20	-32	6.400	0.00	2.94	0.34
337	04/09/13	6.32	10.50	4.18	11.66	7.14	46	3.210	1.70	3.63	0.17
337	09/18/13	6.96	10.50	3.54	18.94	7.15	-101	2.010	3.10	0.38	0.10
337	12/03/13	6.53	10.50	3.97	11.75	7.00	76	4.330	0.00	2.22	0.23
337	03/05/14	5.61	10.50	4.89	10.80	6.95	83	20.100	0.00	4.11	1.18
337	06/05/14	7.16	10.50	3.34	18.15	7.12	86	8.410	0.00	1.08	0.47
338	10/16/12	7.00	10.80	3.80	15.22	6.80	-160	9.780	10.70	0.00	0.50
338	09/17/13	7.21	10.80	3.59	15.96	6.62	-129	13.100	9.30	0.40	0.75
338	12/03/13	6.97	10.80	3.83	11.34	6.53	-56	1.570	0.80	0.00	0.08
338	03/05/14	5.71	10.80	5.09	12.35	7.06	-95	1.880	0.20	0.22	0.09
338	06/04/14	7.45	10.80	3.35	15.36	6.83	19	0.900	20.90	0.00	0.00
339	10/18/12	9.38	12.90	3.52	12.25	7.79	-311	2.080	3.70	0.00	0.10
339	09/17/13	9.24	12.90	3.66	13.35	6.99	-161	1.400	4.90	0.66	0.07
339	12/03/14	8.58	12.90	4.32	10.05	7.08	-95	1.310	13.00	0.00	0.06
339	07/19/16	9.53	12.90	3.37	14.11	7.42	-339	2.900	0.00	0.00	0.15
340	07/25/12	5.71	11.51	5.80	15.90	7.15	78	1.020	0.10	0.00	0.00
340	10/18/12	6.29	11.51	5.22	14.25	7.23	53	0.092	0.00	4.18	0.00
340	01/23/13	5.20	11.51	6.31	8.71	7.26	147	0.514	3.00	3.97	0.02
340	04/10/13	4.06	11.51	7.45	9.93	6.91	111	0.523	1.40	5.56	0.03
342	10/18/12	7.60	11.78	4.18	14.97	7.41	21	1.390	0.40	2.67	0.10
342	01/22/13	7.13	11.78	4.65	11.12	7.69	121	0.877	0.10	4.11	0.04
342	04/09/13	6.21	11.78	5.57	12.02	7.27	80	1.090	0.60	4.23	0.05
342	07/25/16	6.63	11.78	5.15	18.22	7.08	104	1.290	0.00	0.00	0.10
343	07/25/12	8.84	13.12	4.28	15.65	6.88	-153	1.340	0.70	0.00	0.10

Fuel Farm 1 - Groundwater Elevations and Water Quality Parameters
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Well ID (MW-)	Sample Date	Depth to water (ft)	TOC Elevation (msl)	Groundwater Elevation (ft msl)	Temperature (C)	pH	Redox (mV)	Conductivity (ms/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (%)
343	10/18/12	9.43	13.12	3.69	14.04	6.89	-178	1.460	2.00	0.00	0.10
343	01/23/13	9.04	13.12	4.08	10.42	7.18	-204	0.839	9.00	0.05	0.04
343	04/10/13	7.88	13.12	5.24	10.63	6.80	-80	0.960	4.40	0.54	0.05
343	09/17/13	9.47	13.12	3.65	15.43	6.74	-135	1.230	16.00	0.37	0.06
343	12/03/14	8.24	13.12	4.88	10.86	6.97	35	0.479	10.00	0.00	0.05
343	10/26/15	9.73	13.12	3.39	14.84	6.79	-96	1.370	20.50	0.04	0.07
343	01/04/16	5.90	13.12	7.22	9.37	7.11	63	1.050	0.90	2.48	0.05
343	04/18/16	7.94	13.12	5.18	18.85	7.15	-38	0.881	0.00	0.00	0.04
343	07/19/16	9.28	13.12	3.84	15.53	6.84	-201	1.920	0.00	0.19	0.10
343	11/14/16	8.69	13.12	4.43	16.62	7.44	-145	1.130	5.20	0.00	0.06
343	01/10/17	8.58	13.12	4.54	10.46	6.82	-99	0.980	12.00	0.00	0.05
344	10/18/12	7.40	10.98	3.58	13.93	6.99	-170	1.440	0.00	0.00	0.10
344	09/17/13	8.29	10.98	2.69	15.43	6.91	-184	1.220	0.00	0.35	0.06
344	12/03/13	7.45	10.98	3.53	11.08	6.83	-227	1.450	0.00	0.00	0.07
344	03/05/14	5.72	10.98	5.26	11.13	6.43	-131	1.160	17.50	0.44	0.06
344	06/04/14	7.94	10.98	3.04	13.09	6.86	-115	1.280	42.20	0.00	0.10
344	07/18/16	8.33	10.98	2.65	15.97	6.92	-134	1.440	0.00	0.00	0.07
501	07/16/12	8.20	10.00	1.80	15.71	7.24	-285	3.600	14.30	0.00	0.20
501	10/17/12	7.73	10.00	2.27	16.77	7.49	-64	3.280	0.00	0.00	0.20
501	01/17/13	7.64	10.00	2.36	12.19	7.50	-76	4.330	1.40	0.25	0.23
501	04/09/13	7.58	10.00	2.42	12.09	7.09	-58	4.490	3.30	0.67	0.24
501	09/19/13	7.71	10.00	2.29	16.42	7.11	-126	3.780	3.70	0.42	0.20
501	12/03/13	7.56	10.00	2.44	15.13	7.13	-131	4.600	0.00	0.47	0.24
501	03/05/14	6.99	10.00	3.01	12.65	6.84	-85	5.160	11.50	0.41	0.28
501	06/05/14	8.15	10.00	1.85	17.91	7.43	56	3.390	1.70	0.30	0.18
502	07/16/12	8.05	10.00	1.95	15.78	7.06	-352	24.700	2.50	0.00	1.50
502	10/17/12	7.50	10.00	2.50	15.61	7.20	-275	13.400	3.40	0.00	0.80
502	01/17/13	7.02	10.00	2.98	11.24	7.64	-351	20.400	0.00	0.11	1.20
502	04/09/13	7.42	10.00	2.58	12.02	7.19	-316	17.500	2.60	0.50	1.02
502	09/19/13	7.55	10.00	2.45	16.27	7.35	-303	9.420	0.00	0.33	0.53
502	12/03/14	6.34	10.00	3.66	13.06	7.17	-238	10.200	3.00	0.00	0.54
502	10/26/15	7.18	10.00	2.82	17.06	7.74	-162	1.930	0.00	0.14	0.10
502	01/04/16	7.05	10.00	2.95	12.49	7.16	-111	4.360	0.00	0.00	0.23
502	04/18/16	7.49	10.00	2.51	14.52	7.82	-105	8.090	0.00	0.00	0.45
502	07/19/16	7.60	10.00	2.40	17.36	6.91	-51	11.700	0.00	0.00	0.67
503	07/16/12	9.05	11.00	1.95	16.19	6.91	-287	29.600	0.90	0.00	1.80
503	10/17/12	7.91	11.00	3.09	16.34	7.22	30	56.500	0.00	0.21	3.70
503	01/17/13	7.57	11.00	3.43	8.21	7.87	-167	31.600	0.00	0.21	1.91
503	04/09/13	8.02	11.00	2.98	10.65	6.94	-107	33.000	3.00	1.00	2.02

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Well ID (MW-)	Sample Date	Depth to water (ft)	TOC Elevation (msl)	Groundwater Elevation (ft msl)	Temperature (C)	pH	Redox (mV)	Conductivity (ms/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (%)
601	07/16/12	8.31	10.50	2.19	15.37	6.99	-289	3.870	6.00	0.00	0.20
601	09/18/13	8.56	10.50	1.94	15.62	7.10	-385	14.900	0.00	0.29	0.86
601	12/03/13	7.35	10.50	3.15	10.14	7.08	-310	16.900	4.80	0.00	0.98
601	03/05/14	7.24	10.50	3.26	10.10	7.39	-201	2.070	0.20	0.30	0.10
601	06/05/14	8.02	10.50	2.48	18.01	7.39	-272	7.480	0.00	0.83	0.41
601	07/19/16	8.16	10.50	2.34	15.04	7.19	-331	14.500	0.00	0.82	0.83
602	07/16/12	7.29	10.80	3.51	14.09	7.10	-168	1.170	1.60	0.00	0.10
602	10/16/12	7.45	10.80	3.35	14.03	7.37	-142	1.350	16.60	0.00	0.10
602	01/22/13	7.31	10.80	3.49	9.30	7.51	-138	0.743	8.00	0.24	0.04
602	04/10/13	7.23	10.80	3.57	11.95	7.13	-123	0.926	4.00	0.55	0.05
602	09/18/13	8.86	10.80	1.94	14.91	7.19	-151	0.984	0.00	0.39	0.05
602	12/03/14	6.96	10.80	3.84	10.49	7.02	-100	1.080	0.48	0.05	0.05
602	07/18/16	8.00	10.80	2.80	15.00	7.17	-118	1.430	0.00	0.00	0.07
603	07/25/12	7.97	10.63	2.66	14.16	7.09	-125	3.140	0.00	0.00	0.20
603	10/16/12	8.05	10.63	2.58	14.13	6.99	-139	3.330	0.00	0.00	0.20
603	01/17/13	8.45	10.63	2.18	10.62	7.49	-152	2.870	72.30	0.00	0.15
603	04/10/13	6.34	10.63	4.29	10.78	6.89	-139	2.640	6.50	0.60	0.13
603	09/18/13	8.93	10.63	1.70	14.55	6.88	-136	2.800	0.00	0.36	0.14
603	12/03/14	7.34	10.63	3.29	11.45	7.06	-88	2.710	9.00	0.00	0.14
603	07/18/16	9.23	10.63	1.40	14.63	7.16	-96	3.500	0.00	0.00	0.18
604	07/17/12	10.80	10.44	9.64	13.09	7.14	-113	9.030	0.00	0.00	0.50
604	10/16/12	8.70	10.44	1.74	13.95	7.48	-142	9.860	0.00	0.00	0.50
604	01/17/13	8.47	10.44	1.97	10.11	7.49	-164	5.080	0.00	0.00	0.27
604	04/09/13	8.74	10.44	1.70	11.73	7.09	-143	5.080	0.30	0.56	0.27
604	09/18/13	9.56	10.44	0.88	14.13	7.09	-181	5.490	0.00	0.46	0.29
604	12/02/13	6.20	10.44	4.24	12.70	6.78	-112	8.260	8.10	0.00	0.45
604	03/05/14	4.49	10.44	5.95	10.28	7.38	-147	6.600	1.30	0.30	0.35
604	06/04/14	8.85	10.44	1.59	15.72	7.21	-112	6.420	5.60	0.00	0.30
604	07/18/16	10.10	10.44	0.34	14.13	7.67	-151	3.470	0.00	0.00	0.18

Notes:
NA=Not available; TOC elevation data for monitoring wells MW-306, MW-318, MW-319, MW-320, MW-328, and MW-329 were collected on December 14, 2017.

Fuel Farm 1 - Groundwater Analytical Results (DRO, GRO, and BTEX)
3rd FYR for Petroleum Sites, 2012 - 2017
Naval Air Station Whidbey Island, Oak Harbor, WA

Well ID (MW-)	Sample Date	DRO (µg/L)		GRO (µg/L)		Benzene (µg/L)		Ethylbenzene (µg/L)		Toluene (µg/L)		m,p-Xylene (µg/L)		o-Xylene (µg/L)	
Groundwater Cleanup Level Pathway 1		**800**		**700**		**N/A**		**N/A**		**N/A**		**N/A**		**N/A**	
Surface Water Cleanup Level Pathway 3		**N/A**		**N/A**		**43**		**86**		**5,000**		**332**		**332**	
Upper Wells															
201	07/24/12	100	U	250	U	0.15	J	0.2	U	0.2	U	0.4	U	0.2	U
201	10/16/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
201	01/15/13	160	UJ	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
201 (Dup)	01/15/13	150	UJ	250	U	0.2	UJ	0.2	U	0.2	U	0.4	U	0.2	U
201	04/03/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
202	10/16/12	320		**14,000**		**850**		**620**		22	J	**380**		14	J
202	09/11/13	210		**12,000**		**600**		**540**		18		270		12	
202 (Dup)	09/11/13	210		**12,000**		**690**		**640**		16		**340**		14	
202	12/02/14	200		**19,700**	D	**642**	D, B	**703**	D, B	20.3	B	266	D, B	17.3	B
202	07/11/16	146	UJ	**9,890**		**346**		**410**		11.9		165		10.7	
301	07/24/12	100	U	**24,000**		**2,600**		**220**		23	J	90	J	7.6	J
301	10/15/12	100	U	**17,000**		**3,800**		**280**		11		19		3.6	
301	09/16/13	58	J	**18,000**		**3,400**		**280**		20		98		7.5	J
301	12/03/14	60	J	**37,100**	D	**2,370**	D, B	**225**	D, B	20.0		103		10.3	
301	07/14/16	100	U	**14,100**		**1,940**		**274**		18.1		104		8.06	
303	09/05/13	77	J	**18,000**		**3,600**		**290**		9.5	J	20	J	10	U
303	12/02/14	170		**25,000**	D	**2,570**	D, B	**187**	D, B	10.2		20.3		2.82	
303	07/13/16	100	U	**11,400**		**1,980**		**99.3**		7.16		11.2		1.4	J
304	10/15/12	110		**2,200**		2.6		8.2		0.2	U	0.4	U	0.2	U
304	09/17/13	130		**2,000**		2.7		13		0.2	U	0.4	U	0.2	U
304	12/03/14	150		**38,840**		6.69	B	43.4		0.09	J	0.40	U	0.20	U
304	07/13/16	128		**1,780**		1.18		8.86		0.2	UJ	0.4	UJ	0.2	UJ
305	07/24/12	100	U	**4,300**	J	**120**		47		0.64		0.43		0.25	
305	09/16/13	56	J	**4,800**		**100**		26		0.52		0.34	J	0.4	U
305	12/02/14	100	U	**6,730**		**151**	D, B	20.7	B	0.51	J, B	0.40	U	0.20	U
305	07/13/16	100	U	**5,510**		**108**		42.5		0.69	J	4		2	U
306	10/17/12	100	U	**5,100**		10		**260**		0.44		0.78		0.11	J
306	09/16/13	140		**5,100**		11		**320**		1.0	U	2.0	U	1.0	U
306	12/02/14	100		**3,420**		5.12	B	40.5	B	0.47	J, B	0.72	J, B	0.22	J, B
306	07/14/16	100	U	**4,640**		8.69		**113**		0.5	J	4	U	2	U
307	07/17/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
307 (Dup)	07/17/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
307 (Dup)	10/15/12	100	U	**18,000**		**3,600**		**270**		12		21		3.9	
307	10/15/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
307	01/15/13	160	UJ	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
307	04/03/13	100	U	250	U	0.2		0.2	U	0.2	U	0.4		0.2	U
308	07/17/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
308	10/17/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
308	01/15/13	140	UJ	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
308	04/03/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
311	07/17/12	**1,800**		**9,600**		**270**		**1,300**		5.9	J	210		13	J
311	09/11/13	**4,300**		**11,000**		**75**		**1,500**		8.1		320		18	
312	07/17/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
312	10/12/12	100	U	250		0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
312	01/13/13	140	UJ	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
312	04/08/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
313	07/24/12	120		**9,700**	J	1.1	J	**220**		78		320		180	
313	01/15/13	380	UJ	**25,000**		15	J	**820**		1,000		**1,400**		**830**	
313	04/03/13	100	U	250	U	0.2	U	0.68		0.3		1.1		0.7	
313	09/12/13	87	J	**12,000**		5.4		**260**		210		**520**		310	

Fuel Farm 1 - Groundwater Analytical Results (DRO, GRO, and BTEX)
3rd FYR for Petroleum Sites, 2012 - 2017
Naval Air Station Whidbey Island, Oak Harbor, WA

Well ID (MW-)	**Sample Date**	**DRO (µg/L)**		**GRO (µg/L)**		**Benzene (µg/L)**		**Ethylbenzene (µg/L)**		**Toluene (µg/L)**		**m,p-Xylene (µg/L)**		**o-Xylene (µg/L)**	
Groundwater Cleanup Level Pathway 1		**800**		**700**		**N/A**		**N/A**		**N/A**		**N/A**		**N/A**	
Surface Water Cleanup Level Pathway 3		**N/A**		**N/A**		**43**		**86**		**5,000**		**332**		**332**	
313	12/02/14	180		**29,100**	D	12.3	B, J	**804**	D, B	675	D	**1,400**	D, B	**805**	D
313	07/12/16	100	U	**1,290**		0.17	J	2.3		0.37		6.45		2.32	
314	07/24/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
314	10/16/12	100	U	250	U	0.2	U	0.15	J	0.2	U	0.18	J	0.13	J
314	01/15/13	160	UJ	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.20	U
314	04/03/13	100	U	250	U	0.14	J	0.2	U	0.2	U	0.4	U	0.2	U
315	07/16/12	100	U	**1,200**		7.8		82		5.6		26		1.7	
315	10/12/12	100	U	**1,700**		22		**110**		1.6		5.4		0.28	
315	01/14/13	160	UJ	**1,700**		15		50		1.5		18		0.57	
315	04/03/13	100	U	250	U	0.2	U	0.33		0.2	U	0.4	U	0.2	U
315	09/16/13	100	U	290		0.12	J	0.77		0.2	U	0.85		0.2	U
315	12/02/14	100	U	669		3.29	B	2.28	B	0.39	J	0.40	U	0.07	J
315	10/26/15	100	U	**1,070**		19.4		13.4		0.81		0.40	U	0.20	U
315	01/04/16	100	U	100	U	0.20	U	0.20	U	0.20	U	0.40	U	0.20	U
315 (Dup)	01/04/16	100	U	100	U	0.20	U	0.20	U	0.20	U	0.40	U	0.20	U
315	04/18/16	100		28	J	0.20	U	0.20	U	0.06	J	0.77		0.12	J
315	07/12/16	248		**823**		0.78		1.49		0.07	J	1.09		0.07	J
317	07/24/12	100	U	250	U	4.1		1.4		0.2	U	3.1		0.2	U
317	10/16/12	100	U	250	U	8		14		0.2	U	11		0.2	U
317	01/15/13	160	UJ	280	U	6.5		22		0.1	J	22		0.2	U
317	04/04/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.17	J	0.2	U
318	10/15/12	100	U	**4,800**	J	**810**		4.3		8.6		6.8		0.15	J
318	09/12/13	61	J	**4,100**		**940**		3.7		8.4		7.4		0.2	
318	12/01/14	60	J	**7,090**		**944**	D, B	5.39	B	14.3	B	11.1	B	0.40	J, B
318 (Dup)	12/01/14	80	J	**6,560**		**838**	D, B	4.39	B	12.8	B	9.82	B	0.39	J, B
318	07/11/16	129	UJ	**2,360**		**175**		4.96		1.93	J	0.83	J	2	U
319	07/17/12	580		**5,400**		**790**		**340**		3.9		62		7	
319	09/12/13	**9,200**		**25,000**		**530**		**440**		35		310		20	
319 (Dup)	09/12/13	**2,100**		**24,000**		**7,400**		**710**		35		**440**		20	
319	12/01/14	**960**		**23,000**	D	**3,240**	H, D, B, J	**470**	H, D, B, J	50.0		245	H, D,	14.2	
320	10/15/12	140		**8,300**		34		**940**		5.1		11		5.2	
320	09/11/13	130		**8,000**		26		**710**		4.1		10		5.6	
320	12/01/14	150		**9,940**	D	27.0	B	**655**	D, B	3.75	B	6.69	B	4.13	B
320 (Dup)	12/01/14	170		**11,300**	D	26.9	B	**540**	D, B	3.75	B	6.59	B	4.25	B
320	07/11/16	169	UJ	**4,570**		24.3		**338**		2.22	J	1.92	J	2.13	
321	07/17/12	170		**2,700**		2.5		**230**		6.5		**360**		2	
321	10/16/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
321	01/14/13	140	UJ	250	U	0.2	U	0.13	J	0.2	U	0.22	J	0.2	U
321	04/08/13	160		**1,100**		1.9		78		3.6		92		0.88	
321	09/12/13	100	U	250	U	0.2	U	0.2	U	0.2		0.17	J	0.2	U
321	12/02/14	100	U	561		0.65	J, B	17.9	B, J	0.88		23.2	B	0.57	J
321	10/26/15	100	U	389		0.48		1.43		0.26		0.67		0.30	
321 (Dup)	10/26/15	100	U	335		0.51		1.49		0.28		0.86		0.33	
321	01/04/16	100	U	136		0.20	U	0.50		0.20	U	0.38		0.04	J
321	04/18/16	100	U	335		0.20	J	20.1		0.43		4.39		0.25	
321	07/01/16	100	U	**3,050**		1.38		**170**		4.89		94.7		0.2	U
321	11/14/16	100	U	30	J	0.15	J	0.06	J	0.2	U	0.05	J	0.04	J
321 (Dup)	11/14/16	100	U	25	J	0.13	J	0.05	J	0.2	U	0.05	J	0.04	J
321	01/10/17	100	U	34		0.1	J	0.2	U	0.2	U	0.4	U	0.2	U
321 (Dup)	01/10/17	100	U	37		0.09	J	0.2	U	0.2	U	0.4	U	0.2	U

Well ID (MW-)	**Sample Date**	**DRO (µg/L)**		**GRO (µg/L)**		**Benzene (µg/L)**		**Ethylbenzene (µg/L)**		**Toluene (µg/L)**		**m,p-Xylene (µg/L)**		**o-Xylene (µg/L)**	
Groundwater Cleanup Level Pathway 1		**800**		**700**		**N/A**		**N/A**		**N/A**		**N/A**		**N/A**	
Surface Water Cleanup Level Pathway 3		**N/A**		**N/A**		**43**		**86**		**5,000**		**332**		**332**	
322	10/15/12	100	U	**5,600**		**1,400**		3.3		1.7		3.2		1.3	
322	09/16/13	170		**3,900**		**1,400**		3.4	J	4.0	U	2.0	J	4.0	U
322	12/01/14	100	U	**5,900**		**947**	D, B	2.60	B	1.48	B	2.83	B	1.15	B
322	07/12/16	293		**3,600**	J	**837**		3.53	J	10	U	20	U	1.89	J
323	07/24/12	460		**2,000**		**260**		2.1		1.3		0.74		0.12	J
323 (Dup)	07/24/12	430		**1,900**		**200**		2.0		1.0		0.65		0.11	J
323	10/15/12	530		**1,700**		**260**		1.7		1.3		0.75		0.2	U
323	01/16/13	560	UJ	**2,100**		**550**		4	U	4	U	8	U	4	U
323 (Dup)	01/16/13	580	UJ	**2,100**		**620**		4	U	4	U	8	U	4	U
323	04/08/13	150		360		**1,100**		1.8		2.2		1.8		0.41	
323	09/16/13	100	U	**1,800**		**290**		2.8		1.4		1.2	J	1.0	U
323	12/02/14	217	D, B	2	B	**217**	D, B	1.72	B	1.27	B	0.95	J, B	0.20	U
323	07/13/16	100	U	**1,530**		**148**		1.38		0.91	J	0.63	J	1	U
324	10/16/12	**4,000**		**7,600**		**940**		**200**		3	J	66	J	3.4	J
324	09/16/13	**1,400**		**7,300**		**1,100**		**200**		2.4	J	13		3.0	J
324	12/02/14	**830**		**8,620**		**790**	D, B	66.3	B	1.52	B	1.90	B	1.38	B
324	07/13/16	662		**8,550**		**942**		**345**		6.15	J	90.6		20.6	
324 (Dup)	07/13/16	650		**9,360**		**970**		**377**		6.54	J	89.9		21	
325	07/26/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
325	10/17/12	100	U	410		0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
325	01/16/13	150	UJ	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
325	04/08/13	100	U	250	U	1.5		0.2	U	0.2	U	0.4	U	0.2	U
326	10/17/12	100	U	**12,000**		**1,400**		**560**		13		3		0.59	
326	09/16/13	66	J	**11,000**		**1,300**		**400**		12		3.2	J	4.0	U
326	12/02/14	150		**14,800**	D	**1,000**	D, B	**247**	D, B	10.8	B	2.30	B	0.48	J, B
326	07/14/16	100	U	**8,650**		**910**		**123**		9.72		1.95	J	2	U
327	07/17/12	100	U	140	J	0.2	U	0.35		0.2	U	0.4	U	0.2	U
327	10/17/12	100	U	500		0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
327	01/16/13	170	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
327	04/08/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
328	07/17/12	600		**6,800**		0.93	J	**480**		1.2	J	65	J	0.97	J
328	10/12/12	690		**6,000**	J	0.6	J	**210**		0.63	J	20	J	0.45	J
328	01/16/13	**1,200**		**7,000**		0.55		**260**		0.63		39		0.20	U
328	04/08/13	**830**		**1,700**		0.2	U	10		0.2	U	0.72		0.2	U
328	09/12/13	270	U	**6,300**		2.0	U	**350**		2.0	U	29		2.0	U
328	12/01/14	430		**12,500**	D	1.50	B	**395**	D, B	0.80	B	41.4	B	0.71	B
328	07/11/16	342		**6,630**		0.73	J	**211**		0.56	J	11.2		1	U
328 (Dup)	07/11/16	381		**6,720**		0.8	J	**230**		0.65	J	13.8		1	U
329	07/17/12	470		**1,300**		3		0.89		0.19	J	0.4	U	0.2	U
329	10/12/12	660		**2,200**		6.7		4.4		0.33		0.1	J	0.2	U
329	01/16/13	690		**1,300**		2.5		2.3		0.18	J	0.4	U	0.2	U
329	04/08/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
329	09/12/13	120		**2,000**		5.5		6.0		0.31		0.14	J	0.2	U
329	12/02/14	80	J	**3,090**		6.96	B	20.6	B	0.30	J, B	0.40	U	0.20	U
329	07/14/16	100	U	**1,980**		2.19		2.38		0.2	UJ	0.4	U	0.2	U
330U	07/26/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
330U	10/17/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
330U	01/16/13	160	UJ	250	U	0.2	U	0.13	J	0.2	U	0.4	U	0.2	U
330U	04/09/13	160	U	250	U	0.2	U	0.13	J	0.2	U	0.4	U	0.2	U
Lower Wells															
330L	10/16/12	**7,600**		**840**		0.16	J	0.21	J	0.15	J	0.4	UJ	0.23	J

Well ID (MW-)	Sample Date	DRO (µg/L)		GRO (µg/L)		Benzene (µg/L)		Ethylbenzene (µg/L)		Toluene (µg/L)		m,p-Xylene (µg/L)		o-Xylene (µg/L)	
Groundwater Cleanup Level Pathway 1		**800**		**700**		**N/A**		**N/A**		**N/A**		**N/A**		**N/A**	
Surface Water Cleanup Level Pathway 3		**N/A**		**N/A**		**43**		**86**		**5,000**		**332**		**332**	
330L	09/12/13	**1,000**	U	**1,200**		0.17	J	0.29		0.2		0.4	U	0.3	
330L	12/03/14	**1,500**		648		4.69	B	0.97	B	0.23	J	0.53	J, B	0.30	J
331	07/16/12	100	U	250	U	0.74		0.2	U	0.16	J	0.4	U	0.13	J
331	10/16/12	100	U	290	J	**44**		10	U	10	U	20	U	5.5	J
331(Dup)	10/16/2012	100	U	300	J	42		10	U	10	U	20	U	10	U
331	01/22/13	110		250	U	0.64		0.2	U	0.12	J	0.4	0.4	0.11	J
331	04/10/13	110		250	U	0.91		0.2	U	0.12	J	0.4	U	0.19	J
331	09/18/13	100	U	160	J	0.64		0.2	U	0.2	U	0.4	U	0.2	U
331	12/03/14	100	UJ	191		0.52	J	0.20	UJ	0.05	J	0.40	UJ	0.04	J
331	07/18/16	100	U	326		0.52		0.2	U	0.2	U	0.4	U	0.2	U
332	07/25/12	100	U	260		0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
332	10/16/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
332	01/22/13	100	U	280		0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
332	04/10/13	100	U	280		0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
333	10/16/12	450		250	U	0.41		0.1	J	0.2	U	0.4	U	0.2	U
333	09/19/13	340		250	U	0.25		0.2	U	0.2	U	0.4	U	0.2	U
333	12/02/13	330		90	J	0.3		0.2	U	0.2	U	0.4	U	0.2	U
333	03/05/14	350		140	J	0.34		0.2	U	0.2	U	0.4	U	0.2	U
333	06/04/14	190		250	U	0.24		0.2	U	0.2	U	0.4	U	0.2	U
333 (Dup)	06/04/14	180		250	U	0.25		0.2	U	0.2	U	0.4	U	0.2	U
335	07/25/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
335	10/18/12	100	U	250	U	0.2	U	0.71		0.2	U	0.4	U	0.2	U
335	01/22/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
335	04/09/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
337	07/16/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
337	10/18/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
337	01/17/13	130	UJ	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
337	04/08/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
338	10/16/12	100	U	250	U	0.1	J	0.2	U	0.2	U	0.4	U	0.2	U
338	09/17/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
338	12/03/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
338	03/05/14	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
338	06/04/14	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
339	10/18/12	780		**1,800**		0.31		26		0.12	J	0.4	U	0.2	U
339	09/17/13	350		**2,500**		1.4		**110**		0.4		0.8	U	0.4	U
339	12/03/14	**2,160**		**3,210**		1.00		73.0		0.33	J	0.08	J	0.20	U
339	07/19/16	140		**1,530**		0.11	J	0.19	J	0.2	U	0.4	U	0.2	U
340	07/25/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
340	10/18/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
340	01/23/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
340	04/10/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
340 (Dup)	04/10/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
342	07/26/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
342	10/18/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
342	01/22/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
342	04/09/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
343	07/25/12	550		250	U	0.15	J	0.2	U	0.2	U	0.4	U	0.2	U
343	10/18/12	**3,800**		250	U	0.19	J	0.2	U	0.21		0.4	U	0.2	U
343	01/23/13	**1,000**		250	U	0.18	J	0.2	U	0.2	U	0.4	U	0.2	U
343	04/10/13	240		250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
343	09/17/13	290		100	J	0.11	J	0.2	U	0.34		0.4	U	0.2	U

Fuel Farm 1 - Groundwater Analytical Results (DRO, GRO, and BTEX)
3rd FYR for Petroleum Sites, 2012 - 2017
Naval Air Station Whidbey Island, Oak Harbor, WA

Well ID (MW-)	Sample Date	DRO (µg/L)		GRO (µg/L)		Benzene (µg/L)		Ethylbenzene (µg/L)		Toluene (µg/L)		m,p-Xylene (µg/L)		o-Xylene (µg/L)	
Groundwater Cleanup Level Pathway 1		**800**		**700**		**N/A**		**N/A**		**N/A**		**N/A**		**N/A**	
Surface Water Cleanup Level Pathway 3		**N/A**		**N/A**		**43**		**86**		**5,000**		**332**		**332**	
343	12/03/14	370	J	100	U	0.20	U	0.20	U	0.20	U	0.40	U	0.20	U
343	10/26/15	200		107	J	0.23		0.20	U	0.20	U	0.40	U	0.20	U
343	01/04/16	50	J	100	U	0.20	U	0.20	U	0.20	U	0.40	U	0.20	U
343	04/18/16	100	U	100	U	0.20	U	0.20	U	0.20	U	0.40	J	0.07	J
343	07/19/16	69	J	100	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
343	11/14/16	384		45	J	0.08	J	0.2	U	0.1	J	0.4	U	0.05	J
343	01/01/17	164		81	J	0.15	J	0.2	U	0.2	U	0.4	U	0.05	J
344	10/18/12	390		250		0.2	U	0.1	J	0.2	U	0.4	U	0.2	U
344	09/17/13	470		250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
344	12/03/13	530		80	J	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
344 (Dup)	12/03/13	410		90	J	0.2	U	0.2	U	0.2	U	0.4	U	0.1	J
344	03/05/14	140		250	U	0.2	U	0.2	U	0.12	J	0.4	U	0.2	U
344	06/04/14	420		60	J	0.2	U	0.2	U	0.12	J	0.4	U	0.2	U
501	07/16/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
501	10/17/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
501	01/17/13	180	UJ	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
501	04/09/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
502	07/16/12	510		320		0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
502	10/17/12	240		340		0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
502 (Dup)	10/17/12	230		320		0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
502	01/17/13	440	UJ	280		0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
502	04/09/13	300		250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
503	07/16/12	260		250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
503	10/17/12	350		250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
503	01/17/13	160	UJ	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
503	04/09/13	190		250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
601	07/16/12	360		550		0.1	J	0.2	U	0.2	U	0.4	U	0.2	U
601 (Dup)	07/16/12	340													
601	09/18/13	91	J	460		0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
601	12/03/13	78	J	530		0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
601	03/05/14	200		600		0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
601 (Dup)	03/05/14	270		610		0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
601	06/05/14	130		600		0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
602	07/16/12	110		250	U	0.61		0.2	U	0.2	U	0.4	U	0.2	U
602	10/16/12	140		250	U	0.67		0.2	U	0.2	U	0.4	U	0.2	U
602	01/21/13	160		250	U	0.7		0.2	U	0.2	U	0.4	U	0.2	U
602	04/10/13	120		250	U	0.5		0.2	U	0.2	U	0.4	U	0.2	U
603	07/25/12	100	U	250	U	2.6		0.2	U	0.2	U	0.4	U	0.2	U
603	10/16/12	140		250	U	1.8		0.2	U	0.2	U	0.4	U	0.2	U
603	01/17/13	210	UJ	250	U	3.6		0.2	U	0.2	U	0.4	U	0.2	U
603	04/10/13	110		250	U	2.5		0.2	U	0.2	U	0.4	U	0.2	U
604	07/25/12	110		250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
604	10/16/12	130		250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
604	01/17/13	280	UJ	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
604	04/09/13	140		250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U

Notes:
Bold = Exceeds cleanup level
DRO = Diesel-Range Organics
GRO = Gasoline-Range Organics
(DUP) = Indicates sample is a duplicate collected and analyzed concurrently with the associated project sample.

Fuel Farm 1 - Groundwater Analytical Results (DRO, GRO, and BTEX)
3rd FYR for Petroleum Sites, 2012 - 2017
Naval Air Station Whidbey Island, Oak Harbor, WA

Well ID (MW-)	Sample Date	DRO (µg/L)	GRO (µg/L)	Benzene (µg/L)	Ethylbenzene (µg/L)	Toluene (µg/L)	m,p-Xylene (µg/L)	o-Xylene (µg/L)
Groundwater Cleanup Level Pathway 1		**800**	**700**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Surface Water Cleanup Level Pathway 3		**N/A**	**N/A**	**43**	**86**	**5,000**	**332**	**332**

U=The analyte is not detected. The analyte was reported as not detected by the laboratory or was qualified as not detected due to trace
J=The reported value is considered to be an estimate. The concentration is less than the quantitation limit, or the result was qualified as
UJ=The result was qualified as not detected at the indicated, estimated quantitatlion limit.
H- The holding time was exceeded.
D=The result is reported for a diluted analysis.
UM = The analyte is not detected. A chromatographic peak was present, but the laboratory determined the peak did not meet
B=The analyte is detected at a trace concentration in an assoicated method blank; the result for the sample is not significantly impacted

Fuel Farm 1 - Groundwater Analytical Results (VPHs and Chlorinated VOCs)
3rd FYR for Petroleum Sites, 2012 - 2017
Naval Air Station Whidbey Island, Oak Harbor, WA

		Volatile Petroleum Hydrocarbons (µg/L)							Chlorinated VOCs (µg/L)		
Well ID (MW-)	**Sample Date**	**C10-C12 Aliphatics**	**C10-C12 Aromatics**	**C12-C13 Aromatics**	**C5-C6 Aliphatics**	**C6-C8 Aliphatics**	**C8-C10 Aliphatics**	**C8-C10 Aromatics**	**1,1-Dichloroethene**	**Trichloroethene**	**Vinyl Chloride**
Cleanup Level Pathway 3 (µg/L)		**11**	**80,000**	**not specified**	**516**	**245**	**52**	**127,000**	**1.93**	**55.6**	**2.92**
331	09/12/13	NA	NA	NA	NA	NA	NA	NA	**3.6**	**66**	**70**
331 (Dup)	09/12/13	NA	NA	NA	NA	NA	NA	NA	**3.4**	**66**	**66**
331	12/03/14	NA	NA	NA	NA	NA	NA	NA	**2.14** J	**50.3** J	**52.9** J
331 (Dup)	12/03/14	NA	NA	NA	NA	NA	NA	NA	**2.23** J	**52.9** J	**27.5** J
331	07/18/16	NA	NA	NA	NA	NA	NA	NA	**1.95**	**37.1**	**39.8**
331 (Dup)	07/18/16	NA	NA	NA	NA	NA	NA	NA	**2.03**	**39.1**	**41.7**
332	09/17/13	50 U	50 U	50 U	50 U	210	50 U	50 U	0.20 U	0.13 J	0.20 U
332	12/02/13	50 U	50 U	50 U	50 U	200	50 U	50 U	0.20 U	0.26	0.20 U
332 (Dup)	12/02/13	50 U	50 U	50 U	50 U	210	50 U	50 U	0.20 U	0.22	0.20 U
332	03/05/14	50 U	50 U	50 U	50 U	210	50 U	50 U	0.20 U	0.20 U	0.20 UJ
332 (Dup)	03/05/14	50 U	50 U	50 U	50 U	240	50 U	50 U	0.20 U	0.20 U	0.20 UJ
332	06/04/14	50 U	50 U	50 U	50 U	220	50 U	50 U	0.20 U	0.14 J	0.20 U
332 (Dup)	06/04/14	50 U	50 U	50 U	50 U	210	50 U	50 U	0.20 U	0.15 J	0.20 UJ
337	09/18/13	50 U	50 U	50 U	50 U	50 U	50 U	50 U	NA	NA	NA
337	12/03/13	50 U	50 U	50 U	50 U	50 U	50 U	50 U	NA	NA	NA
337	03/05/14	50 U	50 U	50 U	50 U	50 U	50 U	50 U	NA	NA	NA
337	06/05/14	50 U	50 U	50 U	50 U	50 U	50 U	50 U	NA	NA	NA
501	09/19/13	50 U	50 U	50 U	50 U	50 U	50 U	50 U	NA	NA	NA
501	12/03/13	50 U	50 U	50 U	50 U	50 U	50 U	50 U	NA	NA	NA
501	03/04/14	50 U	50 U	50 U	50 U	50 U	50 U	50 U	NA	NA	NA
501	06/05/14	50 U	50 U	50 U	50 U	50 U	50 U	50 U	NA	NA	NA
502	09/19/13	50 U	50 U	50 U	50 U	220	50 U	50 U	NA	NA	NA
502 (Dup)	09/19/13	50 U	50 U	50 U	50 U	210	50 U	50 U	NA	NA	NA
502	12/03/14	50 U	50 U	50 U	50 U	90	50 U	50 U	NA	NA	NA
502 (Dup)	12/03/14	50 U	50 U	50 U	50 U	94	50 U	50 U	NA	NA	NA
502	10/26/15	50 UJ	50 U	50 U	50 UJ	**283**	50 UJ	50 U	NA	NA	NA
502 (Dup)	10/26/15	50 UJ	50 U	50 U	50 UJ	**279**	50 UJ	50 U	NA	NA	NA
502	01/04/16	50 UJ	50 U	50 U	50 U	**252**	50 UJ	50 UJ	NA	NA	NA
502 (Dup)	01/04/16	50 UJ	50 U	50 U	50 U	**251**	50 UJ	50 UJ	NA	NA	NA
502	04/18/16	50 UJ	50 U	50 U	50 U	159	50 U	50 U	NA	NA	NA
502 (Dup)	04/18/16	50 UJ	50 U	50 U	50 U	192	50 U	50 U	NA	NA	NA
502	07/18/16	50 UJ	50 U	50 U	50 U	180	50 U	50 U	NA	NA	NA
601	09/18/13	50 U	50 U	50 U	50 U	**250**	50 U	50 U	NA	NA	0.20 U
601	07/19/16	**105** J	85	50 U	50 U	**432**	50 U	50 U	NA	NA	50 U
601 (Dup)	07/19/16	**89** J	82	50 U	50 U	**411**	50 U	50 U	NA	NA	50 U
602	09/18/13	NA	NA	NA	NA	NA	NA	NA	NA	NA	**24**
602	12/03/14	NA	NA	NA	NA	NA	NA	NA	NA	NA	**36.5**
602	07/18/16	NA	NA	NA	NA	NA	NA	NA	NA	NA	**13.2**
603	09/18/13	NA	NA	NA	NA	NA	NA	NA	NA	NA	**7.7**
603	12/03/14	NA	NA	NA	NA	NA	NA	NA	NA	NA	**9.90**
603	07/18/16	NA	NA	NA	NA	NA	NA	NA	NA	NA	**4.05**
604	07/18/16	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.81

Notes:
NA= Not analyzed
Bold = Exceeds cleanup level
CVOCs=Chlorinated Volatile Organic Carbons
(DUP) = Indicates sample is a duplicate collected and analyzed concurrently with the associated project sample.

U=The analyte is not detected. The analyte was reported as not detected by the laboratory or was qualified as not detected due to trace contamination in an associated method blank.

J=The reported value is considered to be an estimate. The concentration is less than the quantitation limit, or the result was qualified as estimated by the validation firm.
UM = The analyte is not detected. A chromatographic peak was present, but the laboratory determined the peak did not meet identification criteria for the analyte.
UJ=The result was qualified as not detected at the indicated, estimated quantitatlion limit.

Fuel Farm 1 - Groundwater Analytical Results (PAHs)
3rd FYR for Petroleum Sites, 2012 - 2017
Naval Air Station Whidbey Island, Oak Harbor, WA

Well ID (MW-)	Sample Date	2-Methylnaphthalene (µg/L)	Acenaphthene (µg/L)	Acenaphthylene (µg/L)	Anthracene (µg/L)	Benz(a)anthracene (µg/L)	Benzo(a)pyrene (µg/L)	Benzo(b)fluoranthene (µg/L)	Benzo(g,h,i)perylene (µg/L)	Benzo(k)fluoranthene (µg/L)	Chrysene (µg/L)	Dibenz(a,h)anthracene (µg/L)	Fluoranthene (µg/L)	Fluorene (µg/L)	Indeno(1,2,3-cd)pyrene (µg/L)	Naphthalene (µg/L)	Phenanthrene (µg/L)	Pyrene (µg/L)
Surface Water Cleanup Level Pathway 3		4.46	40.4	26.3	8.36	0.0296	0.02	0.0296	0.02	0.0296	0.03	0.01	2.96	1.63	0.02	76.9	8.26	12.02
332	09/17/13	0.05	0.03	0.01 J	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.05	0.01 U	0.13	0.01 U	0.01 U
332	12/02/13	0.07	0.02	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.04	0.01 U	0.16	0.01 U	0.01 U
332 (Dup)	12/02/13	0.07	0.03	0.01 J	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.04	0.01 U	0.14	0.01 J	0.01 U
332	03/05/14	0.041 B	0.034	0.0040 J	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.054	0.010 U	0.091	0.010 U	0.010 U
332	06/04/14	0.010	0.018	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.030	0.010 U	0.035	0.010 U	0.010 U
333	09/17/13	**29**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
333	07/18/16	3.69	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
344	09/17/13	**26**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
344	07/18/16	**27.3**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
602	09/18/13	0.060	0.520	0.011 U	0.009 J	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	**0.011** U	0.055	0.160	0.011 U	0.01 J	0.011 U	0.032
602 (Dup)	09/18/13	0.046	0.450	0.011 U	0.007 J	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	**0.011** U	0.045	0.150	0.011 U	0.01 J	0.011 U	0.026
602	12/03/14	0.015	0.535	0.004 J	0.007 J	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.054	0.157	0.010 U	0.007 J	0.003 J	0.035
602 (Dup)	12/03/14	0.017	0.746	0.006 J	0.009 J	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.063	0.250	0.010 U	0.015	0.004 J	0.041
602	07/18/16	0.06 J	0.649	0.004 J	0.006 J	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.048	0.062	0.01 U	0.01 U	0.01 U	0.024
602 (Dup)	07/18/16	0.02	0.067	0.004 J	0.005 J	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.049	0.101	0.01 U	0.01 U	0.01 U	0.025
604	09/18/13	0.022	0.840	0.006 J	0.011	0.010 U	0.010 U	0.010 U	0.01 U	0.010 U	0.010 U	0.010 U	0.110	0.190	0.010 U	0.018	0.011	0.048
604	12/02/13	0.015	0.590	0.010 U	0.008 J	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.120	0.028	0.010 U	0.015	0.007 J	0.038
604	03/05/14	0.029 B	0.560	0.0048 J	0.0062 J	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.110	0.016	0.010 U	0.017	0.0032 J	0.046
604 (Dup)	03/05/14	0.031 B	0.560	0.0049 J	0.0068 J	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.110	0.016	0.010 U	0.016	0.0036 J	0.046
604	06/04/14	0.020	1.10	0.0060 J	0.0054 J	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.10	0.093	0.010 U	0.43	0.0120	0.043
604 (Dup)	06/04/14	0.020	0.99	0.0057 J	0.0052 J	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.096	0.088	0.010 U	0.44	0.0120	0.040

Notes:
NA= Not analyzed
Bold = Exceeds cleanup level
(DUP) = Indicates sample is a duplicate collected and analyzed concurrently with the associated project sample.
U=The analyte is not detected. The analyte was reported as not detected by the laboratory or was qualified as not detected due to trace contamination in an associated method blank.
J=The reported value is considered to be an estimate. The concentration is less than the quantitation limit, or the result was qualified as estimated by the validation firm.
B=The analyte is detected at a trace concentration in an assoicated method blank; the result for the sample is not significantly impacted as determined during data validation

FUEL FARM 2

Fuel Farm 2 - Groundwater Elevations and Water Quality Parameters
3rd FYR for Petroleum Sites, 2012 - 2017
Naval Air Station Whidbey Island, Oak Harbor, WA

Well ID (MW-)	Sample Date	Depth to water (ft)	TOC Elevation (msl)	Groundwater Elevation (ft msl)	Temperature (C)	pH	Redox (mV)	Conductivity (ms/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (%)
001	07/17/12	10.86	50.20	39.34	15.77	8.02	-180	1.160	11.70	0.00	0.10
001	10/10/12	14.92	50.20	35.28	13.42	8.40	-168	1.150	23.60	0.00	0.10
001	01/09/13	4.96	50.20	45.24	10.73	8.45	-194	0.783	119.00	0.13	0.04
001	04/02/13	5.93	50.20	44.27	11.68	7.85	-141	1.040	9.10	0.48	0.05
002	07/19/12	7.30	NA	NA	15.78	7.39	-14	1.590	0.00	0.76	0.10
002	10/10/12	11.10	NA	NA	12.67	7.81	52	1.530	0.00	0.15	0.10
002	01/08/13	2.94	NA	NA	9.02	8.16	176	0.846	2.10	4.18	0.04
002	04/02/13	3.83	NA	NA	12.45	6.58	112	3.450	0.80	3.28	0.18
301	07/23/12	6.80	61.09	54.29	13.60	7.26	17	0.990	0.90	0.00	0.00
301	10/11/12	9.35	61.09	51.74	12.09	7.36	94	0.940	3.10	0.00	0.00
301	01/10/13	3.10	61.09	57.99	8.28	7.97	134	0.474	0.00	0.51	0.02
301	04/02/13	5.18	61.09	55.91	11.93	6.23	166	1.920	0.50	0.82	0.10
302	07/23/12	36.45	60.36	23.91	12.53	8.76	62	0.190	6.10	1.17	0.10
302	10/11/12	37.76	60.36	22.60	13.28	8.84	-83	1.860	4.80	0.00	0.10
302	01/10/13	37.82	60.36	22.54	11.99	9.01	-97	1.800	4.10	0.49	0.09
302	04/02/13	36.23	60.36	24.13	12.78	8.24	147	1.800	3.40	4.81	0.09
303	07/23/12	55.95	61.07	5.12	14.45	8.57	-22	2.030	13.70	0.00	0.10
303	10/11/12	57.56	61.07	3.51	13.11	8.93	-98	1.980	34.10	0.00	0.10
303	01/09/13	55.12	61.07	5.95	7.58	9.18	-123	1.960	10.30	0.00	0.10
303	04/02/13	57.88	61.07	3.19	12.10	8.39	83	1.940	24.30	0.78	0.10
306	07/19/12	28.37	51.60	23.23	15.86	7.21	125	1.090	0.90	2.61	0.00
306	10/10/12	32.59	51.60	19.01	11.70	5.99	111	1.130	0.90	9.86	0.10
306	01/10/13	28.65	51.60	22.95	10.04	7.97	133	0.693	0.10	3.30	0.03
306	04/02/13	28.48	51.60	23.12	11.18	6.34	114	2.580	1.60	1.71	0.13
307	07/19/12	8.41	49.20	40.79	14.27	7.57	-95	1.050	0.40	0.00	0.00
307	10/10/12	12.87	49.20	36.33	13.25	7.69	-113	1.150	2.10	0.00	0.10
307	01/10/13	2.64	49.20	46.56	9.61	7.91	120	0.648	2.20	3.42	0.03
307	04/02/13	3.70	49.20	45.50	10.93	6.51	150	2.410	2.70	3.27	0.12
309	07/19/12	6.65	52.68	46.03	14.33	7.62	-167	1.480	0.90	0.00	0.10
309	10/10/12	9.24	52.68	43.44	12.93	7.96	-171	1.520	6.60	0.00	0.10
309	01/10/13	6.79	52.68	45.89	9.45	8.25	-124	0.951	0.70	0.00	0.05
309	04/02/13	5.75	52.68	46.93	12.25	6.77	-108	3.440	0.70	0.54	0.18
310	07/19/12	44.42	54.59	10.17	15.75	7.89	49	2.610	55.70	1.09	0.10
310	10/10/12	49.31	54.59	5.28	15.29	8.03	-33	2.530	76.90	0.00	0.10
310	01/09/13	24.90	54.59	29.69	9.87	8.07	59	2.070	71.10	1.40	0.11
310	04/02/13	26.21	54.59	28.38	12.67	7.60	51	2.170	126.00	0.50	0.11
311	07/19/12	14.63	56.27	41.64	15.63	8.06	-93	0.170	256.00	0.00	0.10
311	10/11/12	15.86	56.27	40.41	12.27	8.15	-33	1.720	307.00	0.00	0.10

Fuel Farm 2 - Groundwater Elevations and Water Quality Parameters
3rd FYR for Petroleum Sites, 2012 - 2017
Naval Air Station Whidbey Island, Oak Harbor, WA

Well ID (MW-)	Sample Date	Depth to water (ft)	TOC Elevation (msl)	Groundwater Elevation (ft msl)	Temperature (C)	pH	Redox (mV)	Conductivity (ms/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (%)
311	01/09/13	10.19	56.27	46.08	8.34	8.22	72	1.700	91.90	0.45	0.08
311	04/02/13	8.58	56.27	47.69	11.71	7.64	151	1.600	87.40	0.69	0.08
505	07/23/13	6.68	52.80	46.12	12.37	6.76	-118	1.380	67.30	0.00	0.10
505	09/11/13	Dry	52.80	NA	Dry						
505	06/04/14	4.06	52.80	48.74	11.62	6.47	-83	1.290	80.10	0.00	0.10
505	12/04/14	1.64	52.80	51.16	8.54	6.51	49	0.689	39.00	0.00	0.30
505	03/11/15	0.81	52.80	51.99	10.77	6.59	-32	0.755	7.40	0.00	0.04
505	06/01/15	4.76	52.80	48.04	12.82	7.59	-76	1.100	31.50	1.21	0.05
505	10/27/15	19.82	52.80	32.98	product present						
505	07/20/16	8.53	52.80	44.27	14.90	6.68	-148	1.220	19.60	0.00	0.06
506	07/23/12	14.59	51.40	36.81	12.00	7.26	-160	1.180	0.30	0.00	0.10
506	09/11/13	17.63	51.40	33.77	19.54	8.05	-129	0.884	0.00	0.00	0.02
506	12/04/14	12.72	51.40	38.68	10.49	7.03	-128	1.080	2.28	0.07	0.05
506	06/01/15	11.87	51.40	39.53	12.20	8.34	-107	1.070	1.60	1.87	0.05
506	10/27/15	19.82	51.40	31.58	product present						
506	07/20/16	15.76	51.40	35.64	product present						
506	11/14/16	18.13	51.40	33.27	product present						
507	07/23/12	9.26	49.41	41.15	12.47	6.74	-94	1.060	17.30	0.00	0.00
507	09/11/13	13.06	49.41	36.35	14.00	7.38	-72	0.895	3.60	0.00	0.02
507	12/04/14	6.48	49.41	42.93	10.87	6.69	17	0.696	6.00	0.00	0.03
507	03/11/15	0.60	49.41	48.81	10.16	7.11	243	0.656	1.20	0.00	0.03
507	06/01/15	7.15	49.41	42.26	13.81	6.68	0	0.717	4.10	0.00	0.03
507	10/27/15	14.27	49.41	35.14	14.40	6.86	-86	1.070	3.90	0.32	0.05
507	01/05/16	0.15	49.41	49.26	7.65	6.97	211	0.647	1.10	0.00	0.03
507	04/19/16	3.56	49.41	45.85	12.15	6.11	137	0.492	0.00	0.37	0.02
507	07/20/16	12.35	49.41	37.06	13.83	7.31	-144	0.772	0.00	0.00	0.04
507	11/14/16	13.30	49.41	36.11	14.78	7.36	-67	0.799	0.00	0.00	0.04
507	01/11/17	2.28	49.41	47.13	7.45	6.45	124	0.408	22.80	13.77	0.02
508	07/23/12	13.62	51.92	38.30	12.30	6.78	-125	1.540	10.40	0.00	0.00
508	09/11/13	16.35	51.92	35.57	16.61	6.91	-156	1.030	12.70	0.40	0.05
508	12/04/14	11.86	51.92	40.06	9.93	6.83	-114	1.150	9.00	0.00	0.05
508	03/11/15	3.64	51.92	48.28	10.96	6.91	-47	0.574	6.00	0.00	0.03
508	06/01/15	11.02	51.92	40.90	12.75	8.18	-97	1.080	4.20	1.76	0.05
508	10/27/15	17.33	51.92	34.59	14.12	6.74	-103	1.350	11.70	0.21	0.07
508	01/05/16	3.38	51.92	48.54	9.83	7.17	-109	0.474	12.30	0.21	0.02
508	04/19/16	6.15	51.92	45.77	12.71	7.67	-112	0.696	0.00	0.55	0.03
508	07/20/16	14.97	51.92	36.95	13.87	6.63	-152	1.010	0.00	0.00	0.05
508	11/14/16	16.69	51.92	35.23	13.24	8.09	-101	0.936	6.20	0.00	0.05

Fuel Farm 2 - Groundwater Elevations and Water Quality Parameters
3rd FYR for Petroleum Sites, 2012 - 2017
Naval Air Station Whidbey Island, Oak Harbor, WA

Well ID (MW-)	Sample Date	Depth to water (ft)	TOC Elevation (msl)	Groundwater Elevation (ft msl)	Temperature (C)	pH	Redox (mV)	Conductivity (ms/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (%)
508	01/10/17	6.09	51.92	45.83	9.65	7.11	-151	0.825	586.00	0.00	0.04
716	07/19/12	6.12	46.00	39.88	12.88	6.98	-132	0.966	0.30	0.00	0.00
717	10/10/12	16.68	52.00	35.32	12.74	6.93	-98	1.080	1.90	0.97	0.00
717	01/10/13	0.52	52.00	51.48	9.32	7.21	87	0.524	0.00	0.05	0.02
717	04/02/13	3.65	52.00	48.35	11.64	5.84	131	1.710	0.40	0.70	0.09
717	07/23/13	12.40	52.00	39.60	11.90	6.69	59	0.900	1.80	0.00	0.00
717	09/11/13	16.08	52.00	35.92	14.20	6.74	-54	0.961	0.00	0.67	0.05
717	12/04/14	10.19	52.00	41.81	10.21	6.91	-34	1.090	2.00	0.00	0.05
717	03/11/15	2.14	52.00	49.86	11.84	7.00	77	0.596	0.70	0.00	0.03
717	06/02/15	10.40	52.00	41.60	12.01	6.28	55	0.666	1.80	0.00	0.03
717	10/27/15	17.18	52.00	34.82	13.65	6.77	-78	1.300	0.00	0.00	0.06
717	01/05/16	1.91	52.00	50.09	9.90	6.94	30	0.486	0.00	0.00	0.02
717	04/19/16	4.99	52.00	47.01	15.42	6.96	13	0.577	0.00	0.06	0.03
717	07/20/16	14.12	52.00	37.88	13.76	6.74	-109	0.786	0.00	0.00	0.04
717	11/15/16	15.94	52.00	36.06	12.97	6.54	-55	0.866	1.80	0.00	0.04
717	01/11/17	4.30	52.00	47.70	10.57	6.19	81	0.664	0.00	0.00	0.03

Notes:
NA=Not available

Fuel Farm 2 - Groundwater Analytical Results
3rd FYR for Petroleum Sites, 2012 - 2017
Naval Air Station Whidbey Island, Oak Harbor, WA

Well ID	Sample Date	DRO		GRO		Benzene		Ethylbenzene		Toluene		m,p-Xylene		o-Xylene	
(MW-)		(µg/L)		(µg/L)		(µg/L)		(µg/L)		(µg/L)		(µg/L)		(µg/L)	
Groundwater Cleanup Level Pathway 1		**800**		**700**		**N/A**		**N/A**		**N/A**		**N/A**		**N/A**	
Surface Water Cleanup Level Pathway 3		**N/A**		**N/A**		**43**		**86**		**5,000**		**332**		**332**	
001	07/17/12	160		250	U	0.2	U	0.18	J	0.2	U	0.4	U	0.2	U
001	10/10/12	150		250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
001	01/09/13	190		250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
001 (Dup)	01/09/13	200		250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
001	04/02/13	180		250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
002	07/19/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
002	10/10/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
002	01/08/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
002	04/02/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
301	07/23/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
301	10/11/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
301	01/10/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
301	04/02/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
302	07/23/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
302 (Dup)	07/23/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
302	10/11/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
302	01/10/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
302	04/02/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
303	07/23/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
303	10/11/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
303	01/09/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
303	04/02/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
306	07/19/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
306	10/11/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
306	01/10/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
306	04/02/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
307	07/19/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
307	10/10/12	120		250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
307	01/10/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
307	04/02/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
309	07/19/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
309	10/10/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
309	01/10/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
309	04/02/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
310	07/19/12	100	U	250	U	0.16	J	0.2	U	0.13	U	0.4	U	0.2	U
310	10/10/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
310	01/19/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
310	04/02/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
310 (Dup)	04/02/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
311	07/19/12	100	U	250	U	0.13	J	0.2	U	0.11	J	0.4	U	0.2	U
311	10/11/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
311 (Dup)	10/11/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U

Fuel Farm 2 - Groundwater Analytical Results
3rd FYR for Petroleum Sites, 2012 - 2017
Naval Air Station Whidbey Island, Oak Harbor, WA

Well ID (MW-)	Sample Date	DRO (µg/L)		GRO (µg/L)		Benzene (µg/L)		Ethylbenzene (µg/L)		Toluene (µg/L)		m,p-Xylene (µg/L)		o-Xylene (µg/L)	
Groundwater Cleanup Level Pathway 1		**800**		**700**		**N/A**		**N/A**		**N/A**		**N/A**		**N/A**	
Surface Water Cleanup Level Pathway 3		**N/A**		**N/A**		**43**		**86**		**5,000**		**332**		**332**	
311	01/09/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
311	04/02/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
505	07/23/12	**1,700**		120	J	0.39	J	4.6		0.2	U	4.2		0.7	J
505 (Dup)	07/23/12	**20,000**													
505	06/04/14	**1,800**	J	250	U	0.32		1.3		0.2	U	0.22	J	0.14	J
505 (Dup)	06/04/14	**1,800**		250	U	0.27		0.35		0.2	U	0.4	U	0.2	U
505	12/04/14	280		100	U	0.20	U	0.20	U	0.20	U	0.40	U	0.04	J
505 (Dup)	12/04/14	510		100	U	0.20	U	0.20	U	0.20	U	0.40	U	0.20	U
505	03/11/15	120		100	U	0.06	J	0.07	J	0.20	U	0.40	U	0.20	U
505	06/01/15	**2,260**		67	J	0.28		1.49		0.20	U	0.19	J	0.34	
505 (Dup)	06/01/15	**1,850**		81.5	J	0.30		1.95		0.20	U	0.23	J	0.45	
505	07/20/16	**1,990**		197		0.3		4.59		0.05	J	0.4	U	0.22	
506	07/23/12	300		250	U	0.35		1.3		0.2	U	0.4	U	0.14	J
506	09/11/13	280		90	J	1.5		1.6		0.2	U	0.4	U	0.2	U
506	12/04/14	**40,900**	D	100	U	0.55	J, B	8.42	B	0.06	J	2.47	B	1.71	
506	06/01/15	710		140		0.97		4.46		0.20	U	1.24		1.07	
507	07/23/12	450		250	U	0.24		0.41		0.15	J	0.4	U	0.2	U
507	09/11/13	220		250	U	0.18	J	0.22		0.2	U	0.4	U	0.2	U
507	12/04/14	370		100	U	0.20	U	0.20	U	0.20	U	0.40	U	0.20	U
507	03/11/15	100	U	100	U	0.16	J	0.20	U	0.20	U	0.40	U	0.20	U
507	06/01/15	100	U	100	U	0.20	U	0.20	U	0.20	U	0.40	U	0.20	U
507	10/27/15	170		17	J	0.31		0.06	J	0.20	U	0.40	U	0.20	U
507	01/05/16	100	U	100	U	0.07	J	0.20	U	0.20	U	0.40	U	0.20	U
507	04/19/16	100	U	100	U	0.20	U	0.20	U	0.20	U	0.29	J	0.05	J
507	07/20/16	49	J	100	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
507	11/14/16	96	J	100	U	0.11	J	0.2	U	0.2	U	0.4	U	0.2	U
507	01/01/17	100	U	100	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
508	07/23/12	490		250	U	0.26		2.7		0.2	U	0.89		0.52	
508	09/11/13	510		250	U	0.27		0.41		0.2	U	0.1	J	0.2	U
508 (Dup)	09/11/13	530		250	U	0.29		0.41		0.2	U	0.11	J	0.2	U
508	12/04/14	**2,100**		39	J	0.20	U	3.71		0.20	U	0.74	J	0.20	U
508	03/11/15	170		100	U	0.20	U	0.34	J	0.20	U	0.40	U	0.20	U
508 (Dup)	03/11/15	190		100	U	0.03	J	0.32	J	0.20	U	0.40	U	0.20	U
508	06/01/15	**920**		86.1	J	0.20	U	5.73		0.20	U	1.95		0.20	U
508	10/27/15	500		48.1	J	0.13	J	0.48		0.20	U	0.40	U	0.20	U
508 (Dup)	10/27/15	380		60.2	J	0.15	J	0.40		0.20	U	0.40	U	0.20	U
508	01/05/16	190		100	U	0.20	U	0.22		0.20	U	0.40	U	0.20	U
508 (Dup)	01/05/16	170		100	U	0.20	U	0.21		0.20	U	0.40	U	0.20	U
508	04/19/16	180		100	U	0.03	J	0.75		0.20	U	0.40	U	0.20	U
508 (Dup)	04/19/16	190		100	U	0.04	J	0.75		0.20	U	0.40	U	0.20	U
508	07/20/16	466		35.7	J	0.16	J	0.27		0.2	U	0.4	U	0.2	U
508 (Dup)	07/20/16	480		35.5	J	0.15	J	0.28		0.2	U	0.4	U	0.2	U

Fuel Farm 2 - Groundwater Analytical Results
3rd FYR for Petroleum Sites, 2012 - 2017
Naval Air Station Whidbey Island, Oak Harbor, WA

Well ID (MW-)	Sample Date	DRO (µg/L)		GRO (µg/L)		Benzene (µg/L)		Ethylbenzene (µg/L)		Toluene (µg/L)		m,p-Xylene (µg/L)		o-Xylene (µg/L)	
Groundwater Cleanup Level Pathway 1		**800**		**700**		**N/A**		**N/A**		**N/A**		**N/A**		**N/A**	
Surface Water Cleanup Level Pathway 3		**N/A**		**N/A**		**43**		**86**		**5,000**		**332**		**332**	
508	11/14/16	339		18	J	0.13	J	0.12	J	0.05	J	0.4	U	0.2	U
508 (Dup)	11/14/16	263		17.6	J	0.14	J	0.14	J	0.05	J	0.4	U	0.2	U
508	01/10/17	268		17.3	J	0.18	J	0.27		0.2	U	0.4	U	0.2	U
716	07/19/12	220		250	U	0.15	J	0.2	U	0.2	U	0.4	U	0.2	U
717	07/23/12	260		250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
717	10/10/12	520		250	U	1.9		0.2	U	0.2	U	0.4	U	0.2	U
717	01/10/13	**870**		250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
717	04/02/13	590		250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
717	09/11/13	100	U	250	U	1.7		0.2	U	0.2	U	0.4	U	0.2	U
717	12/04/14	520		100	U	0.47	J	0.20	U	0.20	U	0.40	U	0.07	J
717	03/11/15	100	U	100	U	0.20	U	0.20	U	0.20	U	0.40	U	0.20	U
717	06/02/15	100	U	100	U	0.20	U	0.20	U	0.20	U	0.40	U	0.20	U
717	10/27/15	100	U	250	U	0.97		0.20	U	0.20	U	0.40	U	0.20	U
717	01/05/16	100	U	100	U	0.20	U	0.20	U	0.20	U	0.40	U	0.20	U
717	04/19/16	100	U	100	U	0.20	U	0.20	U	0.20	U	0.40	U	0.20	U
717	07/01/16	100	U	100	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
717	11/15/16	100	U	100	U	0.03	J	0.2	U	0.2	U	0.4	U	0.2	U
717	01/11/17	100	U	100	U	0.2	U	0.2		0.2	U	0.4	U	0.2	U

Notes:

Bold = Exceeds cleanup level

DRO = Diesel-Range Organics

GRO = Gasoline-Range Organics

(DUP) = Indicates sample is a duplicate collected and analyzed concurrently with the associated project sample.

U=The analyte is not detected. The analyte was reported as not detected by the laboratory or was qualified as not detected due to trace contamination in an associated method blank.

J=The reported value is considered to be an estimate. The concentration is less than the quantitation limit, or the result was qualified as estimated by the validation firm.

D=The result is reported for a diluted analysis.

UM = The analyte is not detected. A chromatographic peak was present, but the laboratory determined the peak did not meet identification criteria for the analyte.

B=The analyte is detected at a trace concentration in an assoicated method blank; the result for the sample is not significantly impacted as determined during data validation

FUEL FARM 3

Fuel Farm 3 - Groundwater Elevations and Water Quality Parameters
3rd FYR for Petroleum Sites, 2012 - 2017
Naval Air Station Whidbey Island, Oak Harbor, WA

Well ID (MW-)	Sample Date	Depth to water (ft)	TOC Elevation (msl)	Groundwater Elevation (ft msl)	Temperature (C)	pH	Redox (mV)	Conductivity (ms/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (%)
001	09/05/13	30.47	38.21	-42.26	17.85	7.17	-108	0.785	59.30	0.66	0.04
001	12/09/14	30.17	38.21	8.04	15.15	6.85	-94	0.751	23.00	0.19	0.04
001	07/21/16	30.39	38.21	7.82	17.74	7.01	-152	0.712	4.20	0.00	0.03
002	09/09/13	12.73	20.22	7.49	17.62	7.60	-187	0.685	23.60	0.45	0.03
002	12/04/13	12.67	20.22	7.55	10.73	7.83	-204	0.496	205.00	0.56	0.02
002	03/03/14	12.08	20.22	8.14	13.38	7.15	-185	0.665	7.10	0.46	0.03
002	06/02/14	12.40	20.22	7.82	15.84	8.04	-131	0.996	30.50	0.00	0.00
003	09/03/13	26.79	33.76	6.97	16.88	7.32	-97	1.010	14.40	0.41	0.05
003	12/09/14	26.57	33.76	7.19	12.59	6.91	-114	1.110	1.35	0.54	0.05
003	07/27/16	26.73	33.76	7.03	15.38	6.58	-151	1.110	0.00	0.00	0.05
302	09/04/13	35.18	47.86	12.68	17.81	7.58	66	0.817	18.70	0.84	0.04
302	12/05/13	34.90	47.86	12.96	14.87	7.66	16	0.841	6.20	0.00	0.04
302	03/04/14	35.38	47.86	12.48	14.92	7.40	-52	0.774	14.20	0.37	0.04
302	06/03/14	34.54	47.86	13.32	17.33	7.98	108	0.930	48.10	0.00	0.00
303	09/05/13	39.29	46.85	7.56	16.32	6.29	-101	0.677	53.30	1.05	0.03
303	12/09/14	39.07	46.85	7.78	no sample collected						
303	10/26/15	39.88	46.85	6.97	product present						
303	07/25/16	39.42	46.85	7.43	product present						
303	11/16/16	39.45	46.85	7.40	product present						
305	09/03/13	45.58	53.05	7.47	17.15	6.55	-126	1.090	19.30	0.43	0.05
305	12/11/14	45.26	53.05	7.79	15.10	6.68	-90	1.080	16.00	0.00	0.06
305	07/25/16	45.48	53.05	7.57	18.44	7.38	-153	1.200	6.20	0.00	0.06
311	09/09/13	29.78	37.67	7.89	15.94	6.53	187	0.231	18.30	5.30	0.01
311	12/03/13	29.67	37.67	8.00	11.72	6.59	143	0.215	0.00	2.02	0.01
311	03/03/14	29.06	37.67	8.61	14.54	6.05	124	0.202	0.00	5.75	0.01
311	06/02/14	29.29	37.67	8.38	15.14	6.18	309	0.332	15.40	1.23	0.00
334	09/03/13	43.13	50.57	7.44	17.15	6.39	-140	0.608	14.80	0.45	0.03
334	12/10/14	42.79	50.57	7.78	16.00	6.54	-88	0.626	3.00	0.36	0.03
334	07/25/16	43.02	50.57	7.55	18.55	7.05	-142	0.623	2.90	0.07	0.03
335	09/03/13	41.26	51.44	10.18	15.91	6.57	59	0.450	16.80	2.09	0.02
335	12/05/13	40.95	51.44	10.49	9.74	6.78	108	0.505	8.80	2.03	0.02
335	03/04/14	38.96	51.44	12.48	11.43	6.24	-19	0.445	11.80	1.60	0.02
335	06/03/14	40.59	51.44	10.85	15.34	6.82	129	0.595	8.50	0.00	0.00
350	09/05/13	23.23	30.84	7.61	11.75	7.22	-3	0.496	0.00	0.53	0.02
350	12/03/13	23.18	30.84	7.66	9.26	6.73	-4	0.542	2.10	0.00	0.03
350	03/03/14	22.61	30.84	8.23	11.01	7.12	-2	0.473	6.00	1.05	0.02
350	06/02/14	22.81	30.84	7.97	12.97	6.85	26	0.429	0.00	0.34	0.02
351	09/09/13	21.39	28.97	7.58	13.79	7.63	-79	0.931	1.70	0.00	0.02

Fuel Farm 3 - Groundwater Elevations and Water Quality Parameters
3rd FYR for Petroleum Sites, 2012 - 2017
Naval Air Station Whidbey Island, Oak Harbor, WA

Well ID (MW-)	Sample Date	Depth to water (ft)	TOC Elevation (msl)	Groundwater Elevation (ft msl)	Temperature (C)	pH	Redox (mV)	Conductivity (ms/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (%)
351	12/09/14	21.05	28.97	7.92	12.20	6.95	-88	1.050	0.25	0.00	0.05
351	07/27/16	21.35	28.97	7.62	13.99	7.09	-116	1.020	0.00	0.00	0.05
352	12/13/12	26.04	33.25	7.21	product present						
352	12/15/14	25.62	33.25	7.63	product present						
352	10/26/15	26.72	33.25	6.53	product present						
352	11/16/16	26.02	33.25	7.23	product present						
353	12/13/12	27.53	34.62	7.09	product present						
353	12/15/14	27.03	34.62	7.59	product present						
353	10/26/15	28.07	34.62	6.55	product present						
353	11/16/16	27.59	34.62	7.03	product present						
354	09/03/13	32.79	39.96	7.17	18.08	7.01	45	0.641	0.00	0.52	0.03
354	12/04/13	32.70	39.96	7.26	14.68	6.57	-23	0.570	59.40	0.46	0.03
354	03/03/14	32.21	39.96	7.75	15.83	6.40	6	0.681	0.00	0.99	0.03
354	06/02/14	32.43	39.96	7.53	16.64	6.69	51	0.900	66.20	0.00	0.00
355	09/03/13	39.93	43.13	3.20	18.60	7.12	-33	0.742	0.00	0.84	0.04
355	12/04/13	39.88	43.13	3.25	16.24	6.71	-83	0.649	28.40	0.43	0.03
355	03/03/14	39.31	43.13	3.82	17.87	6.63	-95	0.783	3.10	0.40	0.04
355	06/02/14	39.59	43.13	3.54	17.40	6.88	-29	1.010	6.10	0.00	0.00
356	09/03/13	34.45	41.82	7.37	17.50	7.13	-77	0.585	0.00	0.62	0.30
356	12/04/13	34.34	41.82	7.48	14.21	6.80	-119	0.519	83.70	0.39	0.03
356	03/03/14	33.73	41.82	8.09	13.97	6.74	-124	0.532	0.00	0.41	0.03
356	06/03/14	34.07	41.82	7.75	15.19	6.84	-64	0.700	48.70	0.00	0.00
356	07/25/16	34.35	41.82	7.47	18.47	7.28	-125	0.526	26.40	0.84	0.03
357	12/15/14	34.36	42.30	7.94	product present						
357	10/26/15	35.74	42.30	6.56	product present						
357	11/16/16	35.02	42.30	7.28	product present						
358	09/04/13	30.00	37.50	7.50	16.13	8.01	-194	0.691	5.30	0.42	0.03
358	12/10/14	29.64	37.50	7.86	15.72	7.14	-120	0.700	7.18	1.70	0.03
358	07/26/16	29.88	37.50	7.62	product present						
359	09/04/13	33.35	40.87	7.52	16.82	7.73	-180	0.414	0.00	0.42	0.02
359	12/08/14	33.06	40.87	7.81	17.03	7.09	-110	0.478	7.00	0.00	0.02
359	07/26/16	33.29	40.87	7.58	18.51	7.45	-175	0.533	15.30	0.24	0.03
360	09/04/13	38.82	46.39	7.57	19.73	7.55	-144	0.656	78.80	0.43	0.03
360	12/08/14	38.54	46.39	7.85	16.63	6.96	-106	0.695	13.00	0.63	0.03
360	07/21/16	38.76	46.39	7.63	18.74	7.63	-159	0.695	35.80	0.74	0.03
361	09/04/13	37.07	50.48	13.41	18.61	8.11	10	0.927	92.90	0.65	0.05
361	12/05/13	37.22	50.48	13.26	15.42	7.49	27	0.773	104.00	2.48	0.04
361	03/04/14	36.86	50.48	13.62	16.07	7.21	-25	0.907	105.00	0.48	0.05

Fuel Farm 3 - Groundwater Elevations and Water Quality Parameters
3rd FYR for Petroleum Sites, 2012 - 2017
Naval Air Station Whidbey Island, Oak Harbor, WA

Well ID	Sample Date	Depth to water	TOC Elevation	Groundwater Elevation	Temperature	pH	Redox	Conductivity	Turbidity	DO	Salinity
(MW-)		(ft)	(msl)	(ft msl)	(C)		(mV)	(ms/cm)	(NTU)	(mg/L)	(%)
361	06/03/14	36.69	50.48	13.79	18.29	7.83	62	1.040	54.20	0.00	0.00
363	09/09/13	22.12	39.56	17.44	14.94	7.48	90	0.480	1.30	0.00	0.01
363	12/02/13	22.22	39.56	17.34	12.33	6.78	155	0.571	1.70	0.00	0.30
363	03/04/14	22.16	39.56	17.40	11.36	7.36	72	0.608	2.30	2.94	0.03
363	06/02/14	22.01	39.56	17.55	16.08	7.21	122	0.616	1.90	0.49	0.03
364	09/09/13	19.41	27.68	8.27	16.81	7.76	-13	0.640	0.20	0.00	0.02
364	12/04/13	20.44	27.68	7.24	7.12	7.10	1	0.779	1.00	0.00	0.04
364	03/03/14	19.96	27.68	7.72	12.85	7.48	-5	0.693	2.60	0.59	0.03
364	06/03/14	20.22	27.68	7.46	12.62	7.40	4	0.796	0.00	0.38	0.04
365	09/09/13	15.92	23.21	7.29	15.42	6.99	-11	0.973	0.00	0.46	0.05
365	12/04/13	15.85	23.21	7.36	11.49	7.05	51	1.160	0.00	0.00	0.06
365	03/03/14	15.35	23.21	7.86	11.90	7.39	59	0.797	1.50	1.04	0.04
365	06/02/14	15.65	23.21	7.56	17.12	7.26	115	1.010	1.60	0.32	0.05
368	09/10/13	15.88	23.27	7.39	11.97	6.92	-22	1.190	1.00	0.82	0.06
368	12/05/13	14.95	23.27	8.32	6.79	6.98	-30	1.340	0.70	0.32	0.06
368	03/04/14	10.49	23.27	12.78	9.86	6.69	97	1.210	3.10	3.59	0.06
368	06/03/14	13.76	23.27	9.51	12.67	7.09	71	1.290	10.00	0.00	0.10
369	09/10/13	19.05	27.03	7.98	12.83	7.56	143	0.517	0.20	0.00	0.01
369	12/04/13	18.64	27.03	8.39	11.63	7.04	127	0.552	0.00	2.08	0.03
369	03/04/14	16.81	27.03	10.22	9.47	6.88	132	0.463	3.80	4.30	0.02
369	06/03/14	18.08	27.03	8.95	17.32	7.41	132	0.506	0.00	1.15	0.02
371	09/10/13	5.81	21.46	15.65	15.43	6.74	25	0.744	0.80	0.67	0.04
371	12/05/13	5.50	21.46	15.96	9.82	6.66	79	0.835	6.60	0.00	0.04
371	03/04/14	4.02	21.46	17.44	10.01	7.07	110	0.742	5.30	2.57	0.04
371	06/03/14	4.80	21.46	16.66	18.69	7.16	77	0.657	0.00	6.13	0.03
372	09/10/13	5.90	21.82	15.92	18.55	7.00	-72	0.655	0.00	0.54	0.03
372	12/09/14	4.22	21.82	17.60	15.08	6.92	37	0.593	4.78	0.00	0.03
372	10/26/15	5.88	21.82	15.94	17.05	6.87	70	0.601	0.00	0.00	0.03
372	01/04/16	3.75	21.82	18.07	11.39	6.82	80	0.565	0.00	0.25	0.03
372	04/19/16	4.30	21.82	17.52	17.25	7.22	54	0.612	0.00	0.03	0.03
372	07/27/16	6.08	21.82	15.74	18.09	6.78	37	0.606	1.60	0.00	0.03
372	11/15/16	5.00	21.82	16.82	16.58	6.76	57	0.581	4.50	0.00	0.03
372	01/11/17	4.14	21.82	17.68	11.05	6.34	133	0.195	1.70	4.06	0.01
501	09/04/13	35.44	43.03	7.59	16.88	6.68	-127	0.841	58.90	0.58	0.04
501	12/08/14	35.17	43.03	7.86	15.05	6.82	-75	0.794	15.00	0.00	0.04
501	07/21/16	35.43	43.03	7.60	18.04	7.17	-136	0.843	11.40	0.08	0.04
502	12/13/12	42.22	49.72	7.50	product present						
502	12/15/14	42.05	49.72	7.67	product present						

Fuel Farm 3 - Groundwater Elevations and Water Quality Parameters
3rd FYR for Petroleum Sites, 2012 - 2017
Naval Air Station Whidbey Island, Oak Harbor, WA

Well ID (MW-)	Sample Date	Depth to water (ft)	TOC Elevation (msl)	Groundwater Elevation (ft msl)	Temperature (C)	pH	Redox (mV)	Conductivity (ms/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (%)
502	10/26/15	42.72	49.72	7.00	product present						
502	11/16/16	42.53	49.72	7.19	product present						
503	09/09/13	24.93	32.34	7.41	15.99	6.68	-91	1.140	22.50	0.36	0.06
503	12/09/14	24.62	32.34	7.72	14.78	6.81	-35	1.020	0.00	0.00	0.05
503	07/26/16	24.85	32.34	7.49	17.06	6.69	-93	1.090	7.30	0.00	0.05
504	12/13/12	27.60	35.49	7.89	product present						
504	12/15/14	27.57	35.49	7.92	product present						
504	07/21/16	27.73	35.49	7.76	16.67	7.25	-124	0.682	2.50	0.14	0.03
505	12/13/12	25.72	32.34	6.62	product present						
505	12/15/14	25.01	32.34	7.33	product present						
505	10/26/15	26.35	32.34	5.99	product present						
505	11/16/16	26.25	32.34	6.09	product present						
506	09/04/13	31.62	39.10	7.48	18.33	6.42	-91	0.755	119.00	0.44	0.04
506	12/10/14	31.27	39.10	7.83	13.73	6.59	-55	0.798	45.90	0.00	0.04
506	07/26/16	31.54	39.10	7.56	18.94	7.19	-128	0.735	21.90	0.00	0.04
507	09/04/13	30.58	38.14	7.56	16.47	6.53	-120	1.190	14.50	0.57	0.06
507	12/10/14	30.29	38.14	7.85	12.97	6.62	-92	1.230	2.00	0.00	0.06
507	07/26/16	30.50	38.14	7.64	18.63	6.87	-146	1.140	24.20	0.50	0.06
701	09/09/13	16.98	27.89	10.91	17.14	8.04	-69	0.464	0.40	0.00	0.01
701	12/04/13	16.80	27.89	11.09	10.23	6.77	94	0.429	12.40	0.00	0.02
701	03/03/14	16.36	27.89	11.53	10.92	7.44	137	0.261	12.80	1.63	NA
701	06/02/14	16.61	27.89	11.28	15.73	7.22	106	0.434	4.60	0.86	0.02
702	09/10/13	14.31	22.07	7.76	15.24	9.01	81	0.144	0.20	0.00	0.00
702	12/04/13	14.25	22.07	7.82	12.52	8.32	75	0.166	0.00	2.89	0.01
702	03/04/14	13.61	22.07	8.46	10.73	8.78	116	0.164	0.50	5.42	0.01
702	06/03/14	13.92	22.07	8.15	14.31	8.84	73	0.166	0.00	3.63	0.01

Notes:
NA=Not available

Fuel Farm 3 - Groundwater Analytical Results
3rd FYR for Petroleum Sites, 2012 - 2017
Naval Air Station Whidbey Island, Oak Harbor, WA

Well ID	Sample Date	DRO		GRO		Benzene		Ethylbenzene		Toluene		m,p-Xylene		o-Xylene	
(MW-)		(µg/L)		(µg/L)		(µg/L)		(µg/L)		(µg/L)		(µg/L)		(µg/L)	
Groundwater Cleanup Level Pathway 1		**800**		**700**		**N/A**		**N/A**		**N/A**		**N/A**		**N/A**	
Surface Water Cleanup Level Pathway 3		**N/A**		**N/A**		**43**		**86**		**5,000**		**332**		**332**	
001	09/05/13	140		**7,900**		1.5		**460**		15		**2,000**		130	
001	12/09/14	90	J	**11,200**	HD J	4.00	U	**461**	DB	30.8	D	**1,680**	DB	40.1	D
001	07/21/16	68	J	**4,270**		1.89		**252**		38		**730**		27.4	
002	09/09/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
002	12/04/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
002	03/03/14	100	U	250	U	0.2	U	0.2	U	0.2	U	0.12	J	0.2	U
002	06/02/14	100	U	250	U	0.2	U	0.2	U	0.2	U	0.1	J	0.2	UJ
003	09/03/13	100	U	**1,700**		8.4		0.17	J	0.3		0.12	J	0.2	
003	12/09/14	100	U	**1,370**		7.8	B	0.20	U	0.29	J	0.40	U	0.19	J
003	07/27/16	100	U	**1,320**		8.82		0.11	J	0.27		0.4	U	0.22	
302	06/21/11	120	U	50	U	1.0	U	1.0	U	1.0	U	2.0	U	1.0	U
302	09/04/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
302	12/05/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
302	03/04/14	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
302	06/03/14	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	UJ
303	09/05/13	660		**12,000**		3.0		11		1.5		27		0.52	
305	09/03/13	96	J	**4,100**		**140**		31		1.4		7.4		0.87	
305 (Dup)	09/03/13	120		**4,100**		**130**		32		1.5		7.7		0.89	
305	12/11/14	410		**7,540**		**114**	DB	26.5	DB	1.49	D	9.72	DB	0.84	JD
305	07/25/16	176	UJ	**4,630**		**93.1**		17.9		0.93		3.85		0.63	
305 (Dup)	07/25/16	254	UJ	**4,570**		**95.5**		17.9		0.98		3.9		0.61	
311	09/09/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
311	12/03/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
311	03/03/14	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
311	06/02/14	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
334	09/03/13	100	U	**1,300**		1.3		5.4		0.62		16		0.36	
334	12/10/14	60	J	**1,290**		1.34	B	9.81	B	0.65	J	16.6	B	0.31	J
334	07/25/16	131	UJ	**1,140**		0.65		6.13		0.32		6.93		0.15	J
335	09/03/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
335	12/05/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
335 (Dup)	12/05/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U		
335	03/04/14	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
335	06/03/14	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	UJ
350	09/05/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.28	J	0.2	U
350	12/03/13	100	U	100	J	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
350	03/03/14	100	U	120	J	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
350	06/02/14	100	U	60	J	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
351	09/09/13	100	U	**1,100**		2.0		0.2	U	0.1	J	0.4	U	0.24	
351	12/09/14	80	J	**1,160**		1.48	B	0.28	JB	0.13	J	0.73	JB	0.17	J
351	07/27/16	100	U	**1,070**		1.16		0.2	U	0.2	U	0.4	U	0.12	J
354	09/03/13	100	U	430		0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
354	12/04/13	100	U	400		0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
354	03/03/14	100	U	400		0.2	U	0.2	U	0.2	U	0.4	U	0.2	U

Well ID (MW-)	Sample Date	DRO (µg/L)		GRO (µg/L)		Benzene (µg/L)		Ethylbenzene (µg/L)		Toluene (µg/L)		m,p-Xylene (µg/L)		o-Xylene (µg/L)	
Groundwater Cleanup Level Pathway 1		**800**		**700**		**N/A**		**N/A**		**N/A**		**N/A**		**N/A**	
Surface Water Cleanup Level Pathway 3		**N/A**		**N/A**		**43**		**86**		**5,000**		**332**		**332**	
354	06/02/14	100	U	500		0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
355	09/03/13	100	U	270		0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
355	12/04/13	100	U	440		0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
355	03/03/14	100	U	360		0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
355 (Dup)	03/03/14	100	U	240	J	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
355	06/02/14	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	UJ
356	09/03/13	100	U	**720**		0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
356	12/04/13	100	U	**710**		0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
356	03/03/14	100	U	**720**		0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
356	06/03/14	100	U	**840**		0.2	U	0.2	U	0.2	U	0.4	U	0.2	UJ
356	07/25/16	100	U	**820**		0.04	J	0.2	U	0.2	U	0.4	U	0.2	U
358	09/04/13	100	U	**2,600**		36		1.8		1.2		2.7		0.8	
358	12/10/14	140		**2,920**		5.93	B	2.49	B	0.53	J	34.3	B	0.93	
359	09/04/13	100	U	**2,800**		2.6		1.3		0.46		1.4		0.15	J
359	12/08/14	50	J	**3,130**		2.78	B	1.06	B	0.51	J	2.32	B	0.15	J
359	07/25/16	100	U	**2,420**		2.21		1.7		0.5		1.43		0.09	J
360	09/04/13	100		**4,700**		0.67		**110**		0.75		55		0.32	
360	12/08/14	70	J	**4,260**		0.75	B	66.6	B	0.78		9.60	B	0.20	U
360	07/21/16	79	J	**2,890**		0.46		45.6		0.6		2.94		0.2	U
361	09/04/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
361	12/05/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
361	03/04/14	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
361	06/03/14	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	UJ
363	09/09/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
363	12/03/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
363	03/04/14	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
363	06/02/14	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
364	09/09/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
364	12/04/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
364	03/03/14	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
364	06/03/14	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	UJ
365	09/09/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
365	12/04/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
365	03/03/14	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
365	06/02/14	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
368	09/10/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
368	12/05/13	43	J	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
368	03/04/14	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
368	06/03/14	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	UJ
369	09/10/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
369	12/04/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
369	03/04/14	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
369	06/03/14	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	UJ
371	09/10/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U

Well ID (MW-)	Sample Date	DRO (µg/L)		GRO (µg/L)		Benzene (µg/L)		Ethylbenzene (µg/L)		Toluene (µg/L)		m,p-Xylene (µg/L)		o-Xylene (µg/L)	
Groundwater Cleanup Level Pathway 1		**800**		**700**		**N/A**		**N/A**		**N/A**		**N/A**		**N/A**	
Surface Water Cleanup Level Pathway 3		**N/A**		**N/A**		**43**		**86**		**5,000**		**332**		**332**	
371	12/05/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
371	03/04/14	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
371	06/03/14	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	UJ
372	09/10/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
372	12/09/14	100	U	100	U	0.20	U	0.20	U	0.20	U	0.40	U	0.20	U
372	10/26/15	100	U	100	U	0.20	U	0.20	U	0.20	U	0.40	U	0.20	U
372 (Dup)	10/26/15	100	U	100	U	0.20	U	0.20	U	0.20	U	0.40	U	0.20	U
372	01/04/16	100	U	100	U	0.20	U	0.20	U	0.20	U	0.40	U	0.20	U
372 (Dup)	01/04/16	100	U	100	U	0.20	U	0.20	U	0.20	U	0.40	U	0.20	U
372	04/19/16	100	U	100	U	0.20	U	0.20	U	0.20	U	0.40	U	0.04	J
372 (Dup)	04/19/16	100	U	100	U	0.20	U	0.20	U	0.20	U	0.40	U	0.20	U
372	07/27/16	100	U	100	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
372	11/15/16	100	U	100	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
372 (Dup)	11/15/16	100	U	100	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
372	01/11/17	100	U	100	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
372 (Dup)	01/11/17	100	U	100		0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
501	09/04/13	220		**7,300**		1.1		**150**		1.8		**430**		6.8	
501 (Dup)	09/04/13	240		**7,600**		1.1		**160**		1.9		**450**		5.4	
501	12/08/14	180		**6,330**		2.00	U	**89.5**	DB	1.75	JD	294	DB	3.27	JD
501 (Dup)	12/08/14	320		**6,180**		0.97	B	68.2	B	1.69		271	DB	3.50	
501	07/21/16	293		**3,960**		0.92		**116**		2		**359**		5.69	
503	09/09/13	100	U	**1,600**		0.58		0.2	U	0.23		0.24	J	0.17	J
503	12/09/14	100	U	**1,920**		0.77	B	0.28	JB	0.33	J	0.92	JB	0.16	J
503	07/01/16	100	U	**1,600**		0.45		0.19	J	0.22		0.86		0.13	J
504	07/21/16	121		**4,310**		**120**		**262**		18		**1,210**		211	
506	09/04/13	200		**6,000**		8.6		15		2.6		35		2.1	
506	12/10/14	220		**7,970**		12.2	B	13.5	B	3.49		14.7	B	1.65	
506	07/26/16	259	UJ	**3,450**		4.24		5.54		1.59		5.66		0.73	
507	09/04/13	66	J	**2,800**		3.1		31		3.0		110		3.1	
507	12/10/14	170		**3,380**		6.27	B	37.6	B	3.26		128	B	2.15	
507	07/26/16	158	UJ	**3,120**		2.3		**137**		4.58		**396**		3.47	
701	09/09/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
701	12/04/13	100	U	420		0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
701	03/03/14	100	U	50	J	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
701	06/02/14	100	U	50	J	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
701 (Dup)	06/02/14	100	U	50	J	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
702	09/10/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
702	12/04/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
702	03/04/14	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
702	06/03/14	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	UJ

Notes:
Bold = Exceeds cleanup level

Well ID (MW-)	Sample Date	DRO (µg/L)	GRO (µg/L)	Benzene (µg/L)	Ethylbenzene (µg/L)	Toluene (µg/L)	m,p-Xylene (µg/L)	o-Xylene (µg/L)
Groundwater Cleanup Level Pathway 1		**800**	**700**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Surface Water Cleanup Level Pathway 3		**N/A**	**N/A**	**43**	**86**	**5,000**	**332**	**332**

DRO = Diesel-Range Organics

GRO = Gasoline-Range Organics

(DUP) = Indicates sample is a duplicate collected and analyzed concurrently with the associated project sample.

U=The analyte is not detected. The analyte was reported as not detected by the laboratory or was qualified as not detected due to trace contamination in an associated method blank.

J=The reported value is considered to be an estimate. The concentration is less than the quantitation limit, or the result was qualified as estimated by the validation firm.

UJ=The result was qualified as not detected at the indicated, estimated quantitatlion limit.

H- The holding time was exceeded.

D=The result is reported for a diluted analysis.

UM = The analyte is not detected. A chromatographic peak was present, but the laboratory determined the peak did not meet identification criteria for the analyte.

B=The analyte is detected at a trace concentration in an assoicated method blank; the result for the sample is not significantly impacted as determined during data validation

FUEL FARM 4

Fuel Farm 4 - Groundwater Elevations and Water Quality Parameters
3rd FYR for Petroleum Sites, 2012 - 2017
Naval Air Station Whidbey Island, Oak Harbor, WA

Well ID (MW-)	Sample Date	Depth to water (ft)	TOC Elevation (msl)	Groundwater Elevation (ft msl)	Temperature (C)	pH	Redox (mV)	Conductivity (ms/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (%)
101	07/18/12	45.80	59.74	13.94	15.16	7.89	-156	0.609	32.40	0.00	0.00
101	10/09/12	46.49	59.74	13.25	14.46	8.39	-160	0.674	55.10	0.51	0.00
101	01/07/13	45.57	59.74	14.17	13.25	8.28	-169	0.363	54.20	0.54	0.02
101	04/01/13	45.45	59.74	14.29	15.68	7.75	-106	0.482	21.80	1.22	0.02
102	07/18/12	21.09	60.93	39.84	14.01	7.05	-54	0.897	0.00	1.10	0.00
102	10/09/12	21.16	60.93	39.77	11.27	7.08	-113	0.923	0.00	0.00	0.00
102	01/07/13	20.86	60.93	40.07	9.54	7.32	-118	0.098	0.00	0.39	0.02
102	04/01/13	20.15	60.93	40.78	10.69	6.74	-38	0.711	2.70	1.18	0.03
103	07/18/12	11.95	NA	NA	11.20	6.11	160	34.600	0.30	0.00	0.00
103	10/09/12	11.96	NA	NA	11.25	6.75	123	0.457	0.00	0.00	0.00
103	01/08/13	11.72	NA	NA	8.60	6.62	207	0.235	1.50	0.60	0.01
103	04/01/13	11.80	NA	NA	9.10	5.91	192	0.299	1.60	1.41	0.01
104	07/18/12	21.10	NA	NA	11.90	7.21	73	1.090	5.20	0.35	0.00
104	10/09/12	21.01	NA	NA	10.96	7.50	70	0.930	1.20	0.00	0.00
104	01/08/13	11.68	NA	NA	8.90	7.92	177	0.500	5.50	0.67	0.02
104	04/01/13	20.40	NA	NA	9.64	7.14	171	0.621	13.30	1.13	0.03
107	07/18/12	23.00	NA	NA	15.52	7.22	4	0.721	12.10	0.00	0.00
107	10/09/12	23.03	NA	NA	13.96	7.55	3	0.798	26.20	0.00	0.00
107	01/07/13	22.55	NA	NA	11.71	7.49	-9	0.439	16.80	0.45	0.02
107	04/01/13	22.23	NA	NA	14.62	6.96	76	0.594	61.90	0.70	0.03
109	07/18/12	25.65	54.00	28.35	12.74	7.20	-94	0.638	2.70	1.52	0.00
109	09/10/13	25.85	54.00	28.15	14.39	7.26	-124	0.464	0.00	2.24	0.02
109	12/02/13	26.78	54.00	27.22	9.30	6.92	-102	0.460	3.90	0.00	0.20
109	03/04/14	25.29	54.00	28.71	9.43	6.87	-147	0.466	10.10	0.57	0.02
109	06/04/14	25.39	54.00	28.61	11.89	7.51	-79	0.471	0.10	1.16	0.02
109	10/27/15	26.86	54.00	27.14	product present						
109	01/05/16	25.39	54.00	28.61	product present						
109	04/18/16	25.34	54.00	28.66	product present						
109	07/27/16	28.79	54.00	25.21	product present						
109	11/15/16	26.25	54.00	27.75	product present						
110	07/18/12	23.26	NA	NA	14.34	7.11	78	0.418	22.00	9.98	0.00
110	10/09/12	23.40	NA	NA	13.44	7.38	96	0.472	86.40	8.97	0.00
110	01/07/13	23.28	NA	NA	12.30	7.27	183	0.268	19.30	8.48	0.01
110	04/01/13	23.13	NA	NA	13.36	6.88	356	0.359	19.50	13.78	0.02
113	07/18/12	25.86	70.75	44.89	12.12	7.28	77	0.611	3.10	7.65	0.00
113	10/09/12	26.48	70.75	44.27	11.58	7.32	86	0.678	5.80	7.14	0.00
113	01/07/13	25.54	70.75	45.24	10.67	7.26	147	0.356	0.00	7.36	0.02
113	04/01/13	24.86	70.75	45.89	10.15	6.99	322	0.498	2.10	10.75	0.02

Well ID (MW-)	Sample Date	Depth to water (ft)	TOC Elevation (msl)	Groundwater Elevation (ft msl)	Temperature (C)	pH	Redox (mV)	Conductivity (ms/cm)	Turbidity (NTU)	DO (mg/L)	Salinity (%)
113	12/04/14	2.76	70.75	67.99	9.57	6.93	-57	0.765	20.00	0.14	0.04
113	03/12/15	2.25	70.75	68.50	10.05	6.82	-65	0.681	6.00	0.08	0.03
114	07/18/12	26.18	50.90	24.72	13.48	7.12	-78	0.666	0.00	1.39	0.00
114	11/15/16	14.40	50.90	36.50	13.11	6.38	115	0.445	3.80	0.00	0.02
115	01/08/13	2.83	NA	NA	6.98	6.37	225	0.274	57.80	0.55	0.01
115	11/15/16	3.02	NA	NA	13.70	6.02	126	0.318	17.70	0.00	0.02
113 (491)	07/18/12	2.95	38.40	35.45	17.29	6.46	-111	0.875	1.10	0.00	0.00
113 (491)	09/10/13	4.08	38.40	34.32	20.76	7.07	-83	0.662	1.00	0.00	0.02
113 (491)	06/02/15	2.59	38.40	35.81	15.95	7.48	-83	0.620	2.70	1.09	0.03
113 (491)	07/27/16	3.51	38.40	34.89	21.24	6.83	-142	0.732	3.40	0.51	0.04
114 (491)	07/18/12	14.20	38.40	24.20	13.78	6.64	116	0.627	3.80	0.00	0.00
114 (491)	10/09/12	15.88	38.40	22.52	13.10	7.04	125	0.686	0.00	0.00	0.00
114 (491)	01/08/13	14.13	38.40	24.27	7.93	7.20	200	0.332	1.20	3.19	0.02
114 (491)	04/01/13	13.05	38.40	25.35	12.50	6.88	119	0.446	0.00	0.76	0.02
114 (491)	01/11/17	13.68	38.40	24.72	10.65	6.38	83	0.422	5.50	0.00	0.02
115 (491)	07/18/12	3.25	38.64	35.39	18.76	6.22	132	0.502	18.20	0.79	0.00
115 (491)	10/09/12	5.09	38.64	33.55	15.95	5.83	120	0.736	123.00	7.51	0.00
115 (491)	04/01/13	2.89	38.64	35.75	12.93	6.27	179	0.280	6.60	4.88	0.01
115 (491)	01/11/17	3.20	38.64	35.44	6.56	5.87	146	0.385	52.30	3.58	0.02

Notes:
NA=Not available

Fuel Farm 4 - Groundwater Analytical Results
3rd FYR for Petroleum Sites, 2012 - 2017
Naval Air Station Whidbey Island, Oak Harbor, WA

Well ID (MW-)	Sample Date	DRO (µg/L)		GRO (µg/L)		Benzene (µg/L)		Ethylbenzene (µg/L)		Toluene (µg/L)		m,p-Xylene (µg/L)		o-Xylene (µg/L)	
Groundwater Cleanup Level Pathway 1		800		700		N/A		N/A		N/A		N/A		N/A	
Surface Water Cleanup Level Pathway 3		N/A		N/A		43		86		5,000		20		20	
101	07/18/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
101	10/09/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
101	01/07/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
101	04/01/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
102	07/18/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
102 (Dup)	07/18/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
102	10/09/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
102	01/07/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
102	04/01/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
103	07/18/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
103	10/09/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
103	01/08/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
103	04/01/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
104	07/18/12	100	U	100	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
104	10/09/12	100	U	100	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
104 (Dup)	10/09/12	100	U	100	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
104	01/08/13	100	U	100	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
104	04/01/13	100	U	100	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
107	07/18/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
107	10/09/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
107	01/07/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
107	04/01/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
109	07/18/12	150		200	J	0.22		0.37		0.2	U	0.4	U	0.2	U
109 (Dup)	07/18/12	120													
109	09/10/13	260		240	J	0.2	U	0.77		0.2	U	0.4	U	0.2	U
109 (Dup)	09/10/13	210		270		0.2	U	0.81		0.2	U	0.4	U	0.2	U
109	12/02/13	160		270		0.15	J	3.0		0.2	U	1.0		0.14	J
109 (Dup)	12/02/13	200		310		0.13	J	2.1		0.2	U	0.69		0.1	J
109	03/04/14	140		350		0.18	J	1.2		0.2	U	0.55		0.2	U
109 (Dup)	03/04/14	150		370		0.15	J	0.84		0.2	U	0.35		0.2	U
109	06/04/14	150		350		0.11	J	0.75		0.2	U	0.40	U	0.2	U
109 (Dup)	06/04/14	**4,200**		370		0.12	J	0.67		0.2	U	0.4	U	0.2	U
110	07/18/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
110	10/09/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
110	01/07/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
110	04/01/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
113	07/18/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
113	10/09/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
113	01/07/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
113 (Dup)	01/07/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
113	04/01/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
114	07/18/12	230		270		0.12	J	8.2		0.2	U	2.8		0.65	
113 (491)	07/18/12	100	U	**1,000**		1.1		0.13	J	0.2	U	0.17	J	0.2	U

Fuel Farm 4 - Groundwater Analytical Results
3rd FYR for Petroleum Sites, 2012 - 2017
Naval Air Station Whidbey Island, Oak Harbor, WA

Well ID (MW-)	Sample Date	DRO (µg/L)		GRO (µg/L)		Benzene (µg/L)		Ethylbenzene (µg/L)		Toluene (µg/L)		m,p-Xylene (µg/L)		o-Xylene (µg/L)	
Groundwater Cleanup Level Pathway 1		800		700		N/A		N/A		N/A		N/A		N/A	
Surface Water Cleanup Level Pathway 3		N/A		N/A		43		86		5,000		20		20	
113 (491)	09/10/13	200		410		0.49		0.2	U	0.2	U	0.4	U	0.2	U
113 (491)	12/04/14	550		**858**		0.64	J, B	0.20	U	0.20	U	0.40	U	0.20	U
113 (491) (Dup)	12/04/14	**1,890**		**727**		0.71		0.20	U	0.20	U	0.40	U	0.20	U
113 (491)	03/12/15	100	U	**993**		0.35	J	0.20	U	0.20	U	0.40	U	0.20	U
113 (491) (Dup)	03/12/15	100	U	**728**	J	0.40	J	0.20	U	0.20	U	0.06	J	0.20	U
113 (491)	06/02/15	100	U	**882**		0.64		0.20	U	0.20	U	0.40	U	0.20	U
113 (491) (Dup)	06/02/15	100	U	**812**		0.69		0.20	U	0.20	U	0.40	U	0.20	U
113 (491)	07/27/16	100	U	**1,010**		3.12		0.2	U	0.2	U	0.4	U	0.2	U
113 (491) (Dup)	07/27/16	100	U	**963**		2.76		0.2	U	0.2	U	0.4	U	0.2	U
114 (491)	07/18/12	210		250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
114 (491)	10/09/12	100		250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
114 (491)	01/08/13	120		250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
114 (491)	04/01/13	190		250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
114 (491)	11/15/16	100	U	100	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
114 (491) (Dup)	11/15/16	100	U	100	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
114 (491)	01/11/17	100	U	100	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
114 (491) (Dup)	01/11/17	100	U	100	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
115 (491)	07/18/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
115 (491)	10/09/12	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
115 (491)	01/08/13	100		250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
115 (491)	04/01/13	100	U	250	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
115 (491)	11/15/16	100	U	100	U	0.2	U	0.2	U	0.2	U	0.4	U	0.2	U
115 (491)	01/11/17	100	U	100	U	0.2	U	0.2	U	0.2	U	0.6	J	0.2	U

Notes:

Bold = Exceeds cleanup level

DRO = Diesel-Range Organics

GRO = Gasoline-Range Organics

(DUP) = Indicates sample is a duplicate collected and analyzed concurrently with the associated project sample.

U=The analyte is not detected. The analyte was reported as not detected by the laboratory or was qualified as not detected due to trace contamination in an associated method blank.

J=The reported value is considered to be an estimate. The concentration is less than the quantitation limit, or the result was qualified as estimated by the validation firm.

UM = The analyte is not detected. A chromatographic peak was present, but the laboratory determined the peak did not meet identification criteria for the analyte.

B=The analyte is detected at a trace concentration in an assoicated method blank; the result for the sample is not significantly impacted as determined during data validation

APPENDIX B

LUC Inspection Checklists

NASWI
Oak Harbor, WA
Former Fuel Farm 1, Site 36

LAND USE CONTROLS (LUCs) INSPECTION CHECKLIST

DATE(S) (MM|DD|YY):
08/08/17; 08/09/17 (inspect well MW-343)

INSPECTOR(S):	COMPANY:
S. Moore and B. Gemler	Battelle

LAND USE CONTROLS:
- ENSURE THAT LAND USE REMAINS INDUSTRIAL WITH RESTRICTED RECREATIONAL LAND USE LIMITED TO THE UPPER AREA ALONG PAVED FOOTPATHS WITH TRAFFIC CONFINED TO SPECIFIC AREAS, SIGNS, AND BARRIER VEGETATION AND ALONG PAVED ATHLETIC AREAS
- NO USE OF GROUNDWATER FROM, OR DOWNGRADIENT OF, THE AREA EXCEPT FOR MONITORING AND REMEDIATION, EXCEPT AS APPROVED BY U.S. EPA AND ECOLOGY
- NO DOWNGRADIENT WELL DRILLING EXCEPT FOR MONITORING WELLS AND/OR REMEDIATION SYSTEM WELLS AUTHORIZED BY U.S. EPA AND ECOLOGY IN APPROVED PLANS
- PROTECT EXISTING MONITORING WELLS
- PREVENT GROUND DISTURBANCE OR CONSTRUCTION ACTIVITIES IN LOWER AREA
- PREVENT GROUND DISTURBANCE OR CONSTRUCTION ACTIVITIES AT DEPTHS GREATER THAN 15 FT BGS IN UPPER AREA
- MAINTAIN CONTROLLED ACCESS AND SECURITY FENCING FOR TANK 226 AND THE RESOURCE CONSERVATION AND RECOVERY ACT SATELLITE ACCUMULATION POINT

INSPECTION CHECKLIST

HAS SITE OR ADJACENT LAND USE CHANGED SINCE LAST INSPECTION? ☐ YES ☒ NO

INSPECTION PERFORMED? (CHECK ALL THAT APPLY) ☒ SITE WALK ☐ SECURITY CHECK ☐ INTERVIEW W/____ ☐ OTHER ____

FINDINGS:

IS THERE VISUAL EVIDENCE OF UNAUTHORIZED ON-SITE OR DOWNGRADIENT WELL INSTALLATION OR GROUNDWATER USE? ☐ YES ☒ NO

INSPECTION PERFORMED? (CHECK ALL THAT APPLY) ☒ SITE WALK ☐ SECURITY CHECK ☐ WELL INSPECTIONS ☐ INTERVIEW W/____ ☐ OTHER ____

FINDINGS: ☐ SEE WELL INSPECTION LOGS ☐ OTHER ____

HAVE ANY WELL CONSTRUCTION APPLICATIONS BEEN SUBMITTED TO OR APPROVED BY ISLAND COUNTY IN AREAS DOWNGRADIENT OF THE SITE? (ISLAND COUNTY CONTACT REQUIRED) ☐ YES ☒ NO

INSPECTION PERFORMED? (CHECK ALL THAT APPLY) ☐ SITE WALK ☐ SECURITY CHECK ☐ WELL INSPECTIONS ☐ INTERVIEW W/____ ☒ OTHER Island County Environmental Health

FINDINGS: ☐ SEE WELL INSPECTION LOGS ☒ OTHER See Appendix E

ARE ALL MONITORING WELLS IN GOOD CONDITION AND ACCESSIBLE? (REFER TO ROUTINE MONITORING WELL INSPECTION CHECKLISTS OR ANNUAL ON-SITE INSPECTIONS) ☐ YES ☒ NO

INSPECTION PERFORMED? (CHECK ALL THAT APPLY) ☒ SITE WALK ☐ SECURITY CHECK ☒ WELL INSPECTIONS ☐ INTERVIEW W/____ ☐ OTHER ____

FINDINGS: ☒ SEE WELL INSPECTION LOGS ☐ OTHER ____

IS THERE VISUAL OR ADMINISTRATIVE EVIDENCE OF EXCAVATION OR SOIL DISTURBANCE? IF SO, DETERMINE IF SITE APPROVAL PROCESS HAS BEEN FOLLOWED. ☐ YES ☒ NO

INSPECTION PERFORMED? (CHECK ALL THAT APPLY) ☒ SITE WALK ☐ SECURITY CHECK ☐ INTERVIEW W/____ ☐ OTHER ____

FINDINGS:

HAS ACCESS CONTROL BEEN MAINTAINED? (REFER TO SECURITY INCIDENT REPORTS) ☒ YES ☐ NO ☐ NA

IS SIGNAGE INTACT AND READABLE? ☐ YES ☒ NO ☐ NA

INSPECTION PERFORMED? (CHECK ALL THAT APPLY) ☒ SITE WALK ☐ SECURITY CHECK ☐ INTERVIEW W/____ ☐ OTHER ____

FINDINGS: No signage for site.

I CERTIFY THAT THE CONDITIONS OF THE AREA ON THE INSPECTION DATES(S) WERE AS REPORTED ABOVE.

INSPECTOR SIGNATURE:	DATE:
AMP	09/29/17

NASWI
Oak Harbor, WA
Former Fuel Farm 2, Site 35

LAND USE CONTROLS (LUCs) INSPECTION CHECKLIST

DATE(S) (MM|DD|YY):
08/07/17

INSPECTOR(S):	COMPANY:
S. Moore and B. Gemler	Battelle

LAND USE CONTROLS:
- ENSURE THAT SITE IS USED FOR NON-RESIDENTIAL PURPOSES ONLY
- NO USE OF GROUNDWATER FROM, OR DOWNGRADIENT OF, THE AREA EXCEPT FOR MONITORING AND REMEDIATION, EXCEPT AS APPROVED BY U.S. EPA AND ECOLOGY
- NO DOWNGRADIENT WELL DRILLING EXCEPT FOR MONITORING WELLS AND/OR REMEDIATION SYSTEM WELLS AUTHORIZED BY U.S. EPA AND ECOLOGY IN APPROVED PLANS
- PROTECT EXISTING MONITORING WELLS
- PREVENT GROUND DISTURBANCE OR CONSTRUCTION ACTIVITIES
- ENSURE SITE SIGNAGE INDICATING RESTRICTIONS ON SHELLFISH HARVESTING IS INTACT, SECURE AND READABLE

INSPECTION CHECKLIST

HAS SITE OR ADJACENT LAND USE CHANGED SINCE LAST INSPECTION? ☐ YES ☒ NO
INSPECTION PERFORMED? (CHECK ALL THAT APPLY) ☒ SITE WALK ☐ SECURITY CHECK ☐ INTERVIEW W/ ☐ OTHER
FINDINGS:

IS THERE VISUAL EVIDENCE OF UNAUTHORIZED ON-SITE OR DOWNGRADIENT WELL INSTALLATION OR GROUNDWATER USE? ☐ YES ☒ NO
INSPECTION PERFORMED? (CHECK ALL THAT APPLY) ☒ SITE WALK ☐ SECURITY CHECK ☐ WELL INSPECTIONS ☐ INTERVIEW W/ ☐ OTHER
FINDINGS: ☐ SEE WELL INSPECTION LOGS ☐ OTHER

HAVE ANY WELL CONSTRUCTION APPLICATIONS BEEN SUBMITTED TO OR APPROVED BY ISLAND COUNTY IN AREAS DOWNGRADIENT OF THE SITE? (ISLAND COUNTY CONTACT REQUIRED) ☐ YES ☒ NO
INSPECTION PERFORMED? (CHECK ALL THAT APPLY) ☐ SITE WALK ☐ SECURITY CHECK ☐ WELL INSPECTIONS ☐ INTERVIEW W/ ☒ OTHER Island County Environmental Health
FINDINGS: ☐ SEE WELL INSPECTION LOGS ☒ OTHER See Appendix E

ARE ALL MONITORING WELLS IN GOOD CONDITION AND ACCESSIBLE? (REFER TO ROUTINE MONITORING WELL INSPECTION CHECKLISTS OR ANNUAL ON-SITE INSPECTIONS) ☒ YES ☐ NO
INSPECTION PERFORMED? (CHECK ALL THAT APPLY) ☒ SITE WALK ☐ SECURITY CHECK ☒ WELL INSPECTIONS ☐ INTERVIEW W/ ☐ OTHER
FINDINGS: ☒ SEE WELL INSPECTION LOGS ☐ OTHER

IS THERE VISUAL OR ADMINISTRATIVE EVIDENCE OF EXCAVATION OR SOIL DISTURBANCE? IF SO, DETERMINE IF SITE APPROVAL PROCESS HAS BEEN FOLLOWED. ☐ YES ☒ NO
INSPECTION PERFORMED? (CHECK ALL THAT APPLY) ☒ SITE WALK ☐ SECURITY CHECK ☐ INTERVIEW W/ ☐ OTHER
FINDINGS:

HAS ACCESS CONTROL BEEN MAINTAINED? (REFER TO SECURITY INCIDENT REPORTS) ☒ YES ☐ NO ☐ NA
IS SIGNAGE INTACT AND READABLE? ☐ YES ☒ NO ☐ NA
INSPECTION PERFORMED? (CHECK ALL THAT APPLY) ☒ SITE WALK ☐ SECURITY CHECK ☐ INTERVIEW W/ ☐ OTHER
FINDINGS: No signage for site.

I CERTIFY THAT THE CONDITIONS OF THE AREA ON THE INSPECTION DATES(S) WERE AS REPORTED ABOVE.

INSPECTOR SIGNATURE:	DATE:
SMP	09/29/17

NASWI
Oak Harbor, WA
Former Fuel Farm 3, Site 13

LAND USE CONTROLS (LUCs) INSPECTION CHECKLIST

DATE(S) (MM|DD|YY):
08/10/17

INSPECTOR(S):
S. Moore and B. Gemler

COMPANY:
Battelle

LAND USE CONTROLS:
- ENSURE THAT LAND USE REMAINS INDUSTRIAL
- NO USE OF GROUNDWATER FROM, OR DOWNGRADIENT OF, THE AREA EXCEPT FOR MONITORING AND REMEDIATION, EXCEPT AS APPROVED BY U.S. EPA AND ECOLOGY
- NO DOWNGRADIENT WELL DRILLING EXCEPT FOR MONITORING WELLS AND/OR REMEDIATION SYSTEM WELLS AUTHORIZED BY U.S. EPA AND ECOLOGY IN APPROVED PLANS
- PROTECT EXISTING MONITORING WELLS
- PREVENT GROUND DISTURBANCE OR CONSTRUCTION ACTIVITIES

INSPECTION CHECKLIST

HAS SITE OR ADJACENT LAND USE CHANGED SINCE LAST INSPECTION? ☐ YES ☒ NO

INSPECTION PERFORMED? (CHECK ALL THAT APPLY)
☒ SITE WALK ☐ INTERVIEW W/____
☐ SECURITY CHECK ☐ OTHER ____

FINDINGS:

IS THERE VISUAL EVIDENCE OF UNAUTHORIZED ON-SITE OR DOWNGRADIENT WELL INSTALLATION OR GROUNDWATER USE? ☐ YES ☒ NO

INSPECTION PERFORMED? (CHECK ALL THAT APPLY)
☒ SITE WALK ☐ INTERVIEW W/____
☐ SECURITY CHECK ☐ OTHER ____
☐ WELL INSPECTIONS

FINDINGS:
☐ SEE WELL INSPECTION LOGS
☐ OTHER ____

HAVE ANY WELL CONSTRUCTION APPLICATIONS BEEN SUBMITTED TO OR APPROVED BY ISLAND COUNTY IN AREAS DOWNGRADIENT OF THE SITE? (ISLAND COUNTY CONTACT REQUIRED) ☐ YES ☒ NO

INSPECTION PERFORMED? (CHECK ALL THAT APPLY)
☐ SITE WALK ☐ INTERVIEW W/____
☐ SECURITY CHECK ☒ OTHER Island County Environmental Health
☐ WELL INSPECTIONS

FINDINGS:
☐ SEE WELL INSPECTION LOGS
☒ OTHER See Appendix E

ARE ALL WELLS IN GOOD CONDITION AND ACCESSIBLE? (REFER TO COMPLETED WELL INSPECTION CHECKLISTS OR ANNUAL ON-SITE INSPECTIONS) ☐ YES ☒ NO

INSPECTION PERFORMED? (CHECK ALL THAT APPLY)
☒ SITE WALK ☐ INTERVIEW W/____
☐ SECURITY CHECK ☐ OTHER ____
☒ WELL INSPECTIONS

FINDINGS:
☒ SEE WELL INSPECTION LOGS
☐ OTHER ____

IS THERE VISUAL OR ADMINISTRATIVE EVIDENCE OF EXCAVATION OR SOIL DISTURBANCE? IF SO, DETERMINE IF SITE APPROVAL PROCESS HAS BEEN FOLLOWED. ☐ YES ☒ NO

INSPECTION PERFORMED? (CHECK ALL THAT APPLY)
☒ SITE WALK ☐ INTERVIEW W/____
☐ SECURITY CHECK ☐ OTHER ____

FINDINGS:

HAS ACCESS CONTROL BEEN MAINTAINED? (REFER TO SECURITY INCIDENT REPORTS) ☒ YES ☐ NO ☐ NA
IS SIGNAGE INTACT AND READABLE? ☐ YES ☒ NO ☐ NA

INSPECTION PERFORMED? (CHECK ALL THAT APPLY)
☒ SITE WALK ☐ INTERVIEW W/____
☐ SECURITY CHECK ☐ OTHER ____

FINDINGS:
No signage south of Upper Area.

I CERTIFY THAT THE CONDITIONS OF THE AREA ON THE INSPECTION DATES(S) WERE AS REPORTED ABOVE.

INSPECTOR SIGNATURE: AMP

DATE:
09/29/17

NASWI
Oak Harbor, WA
Former Fuel Farm 4, Site 11

LAND USE CONTROLS (LUCs) INSPECTION CHECKLIST

DATE(S) (MM|DD|YY):
08/04/17

INSPECTOR(S): S. Moore and B. Gemler

COMPANY: Battelle

LAND USE CONTROLS:
- ENSURE THAT LAND USE REMAINS INDUSTRIAL
- NO USE OF GROUNDWATER FROM, OR DOWNGRADIENT OF, THE AREA EXCEPT FOR MONITORING AND REMEDIATION, EXCEPT AS APPROVED BY U.S. EPA AND ECOLOGY
- NO DOWNGRADIENT WELL DRILLING EXCEPT FOR MONITORING WELLS AND/OR REMEDIATION SYSTEM WELLS AUTHORIZED BY U.S. EPA AND ECOLOGY IN APPROVED PLANS
- PROTECT EXISTING MONITORING WELLS
- PREVENT GROUND DISTURBANCE OR CONSTRUCTION ACTIVITIES

INSPECTION CHECKLIST

HAS SITE OR ADJACENT LAND USE CHANGED SINCE LAST INSPECTION? [ ] YES [x] NO

INSPECTION PERFORMED? (CHECK ALL THAT APPLY)
[x] SITE WALK [ ] INTERVIEW W/______
[ ] SECURITY CHECK [ ] OTHER ______

FINDINGS:

IS THERE VISUAL EVIDENCE OF UNAUTHORIZED ON-SITE OR DOWNGRADIENT WELL INSTALLATION OR GROUNDWATER USE? [ ] YES [x] NO

INSPECTION PERFORMED? (CHECK ALL THAT APPLY)
[x] SITE WALK [ ] INTERVIEW W/______
[ ] SECURITY CHECK [ ] OTHER ______
[ ] WELL INSPECTIONS

FINDINGS:
[ ] SEE WELL INSPECTION LOGS
[ ] OTHER ______

HAVE ANY WELL CONSTRUCTION APPLICATIONS BEEN SUBMITTED TO OR APPROVED BY ISLAND COUNTY IN AREAS DOWNGRADIENT OF THE SITE? (ISLAND COUNTY CONTACT REQUIRED) [ ] YES [x] NO

INSPECTION PERFORMED? (CHECK ALL THAT APPLY)
[ ] SITE WALK [ ] INTERVIEW W/______
[ ] SECURITY CHECK [x] OTHER Island County Environmental Health
[ ] WELL INSPECTIONS

FINDINGS:
[ ] SEE WELL INSPECTION LOGS
[x] OTHER See Appendix E

ARE ALL MONITORING WELLS IN GOOD CONDITION AND ACCESSIBLE? (REFER TO ROUTINE MONITORING WELL INSPECTION CHECKLISTS OR ANNUAL ON-SITE INSPECTIONS) [ ] YES [x] NO

INSPECTION PERFORMED? (CHECK ALL THAT APPLY)
[x] SITE WALK [ ] INTERVIEW W/______
[ ] SECURITY CHECK [ ] OTHER ______
[x] WELL INSPECTIONS

FINDINGS:
[x] SEE WELL INSPECTION LOGS
[ ] OTHER ______

HAS ACCESS CONTROL BEEN MAINTAINED? (REFER TO SECURITY INCIDENT REPORTS) [x] YES [ ] NO [ ] NA

IS SIGNAGE INTACT AND READABLE? [ ] YES [x] NO [ ] NA

INSPECTION PERFORMED? (CHECK ALL THAT APPLY)
[x] SITE WALK [ ] INTERVIEW W/______
[ ] SECURITY CHECK [ ] OTHER ______

FINDINGS:
Virtually no signage.

I CERTIFY THAT THE CONDITIONS OF THE AREA ON THE INSPECTION DATES(S) WERE AS REPORTED ABOVE.

INSPECTOR SIGNATURE: AMP

DATE: 09/29/17

NASWI
Oak Harbor, WA
Site 42, Building 357

LAND USE CONTROLS (LUCs) INSPECTION CHECKLIST

DATE(S) (MM|DD|YY):
08/07/17

INSPECTOR(S):	COMPANY:
S. Moore and B. Gemler	Battelle

LAND USE CONTROLS:
- ENSURE THAT LAND USE REMAINS INDUSTRIAL
- NO USE OF GROUNDWATER FROM, OR DOWNGRADIENT OF, THE AREA EXCEPT FOR MONITORING AND REMEDIATION, EXCEPT AS APPROVED BY U.S. EPA AND ECOLOGY
- NO DOWNGRADIENT WELL DRILLING EXCEPT FOR MONITORING WELLS AND/OR REMEDIATION SYSTEM WELLS AUTHORIZED BY U.S. EPA AND ECOLOGY IN APPROVED PLANS
- PROTECT EXISTING MONITORING WELLS
- ENSURE THAT ALL DISTURBED OR EXCAVATED SOILS AT OR FROM THE AREA ARE PROPERLY CATEGORIZED AND DISPOSED OF, AND THAT WORKERS ARE PROTECTED DURING ANY SUCH DISTURBANCE OR EXCAVATION

INSPECTION CHECKLIST

HAS SITE OR ADJACENT LAND USE CHANGED SINCE LAST INSPECTION? ☐ YES ☒ NO

INSPECTION PERFORMED? (CHECK ALL THAT APPLY)
☒ SITE WALK ☐ INTERVIEW W/
☐ SECURITY CHECK ☐ OTHER

FINDINGS:

IS THERE VISUAL EVIDENCE OF UNAUTHORIZED ON-SITE OR DOWNGRADIENT WELL INSTALLATION OR GROUNDWATER USE? ☐ YES ☒ NO

INSPECTION PERFORMED? (CHECK ALL THAT APPLY)
☒ SITE WALK ☐ INTERVIEW W/
☐ SECURITY CHECK ☐ OTHER
☐ WELL INSPECTIONS

FINDINGS:
☐ SEE WELL INSPECTION LOGS
☐ OTHER

HAVE ANY WELL CONSTRUCTION APPLICATIONS BEEN SUBMITTED TO OR APPROVED BY ISLAND COUNTY IN AREAS DOWNGRADIENT OF THE SITE? (ISLAND COUNTY CONTACT REQUIRED) ☐ YES ☒ NO

INSPECTION PERFORMED? (CHECK ALL THAT APPLY)
☐ SITE WALK ☐ INTERVIEW W/
☐ SECURITY CHECK ☒ OTHER Island County Environmental Health
☐ WELL INSPECTIONS

FINDINGS:
☐ SEE WELL INSPECTION LOGS
☒ OTHER See Appendix E

ARE ALL MONITORING WELLS IN GOOD CONDITION AND ACCESSIBLE? (REFER TO ROUTINE MONITORING WELL INSPECTION CHECKLISTS OR ANNUAL ON-SITE INSPECTIONS) ☐ YES ☒ NO

INSPECTION PERFORMED? (CHECK ALL THAT APPLY)
☒ SITE WALK ☐ INTERVIEW W/
☐ SECURITY CHECK ☐ OTHER
☒ WELL INSPECTIONS

FINDINGS:
☒ SEE WELL INSPECTION LOGS
☐ OTHER

HAS ACCESS CONTROL BEEN MAINTAINED? (REFER TO SECURITY INCIDENT REPORTS) ☒ YES ☐ NO ☐ NA
IS SIGNAGE INTACT AND READABLE? ☐ YES ☒ NO ☐ NA

INSPECTION PERFORMED? (CHECK ALL THAT APPLY)
☒ SITE WALK ☐ INTERVIEW W/
☐ SECURITY CHECK ☐ OTHER

FINDINGS:
No signage for site.

I CERTIFY THAT THE CONDITIONS OF THE AREA ON THE INSPECTION DATES(S) WERE AS REPORTED ABOVE.

INSPECTOR SIGNATURE:	DATE:
AMP	09/29/17

APPENDIX C

Proof of Public Notice

CLASSIFIED ADVERTISING

PROOF/RECEIPT

Client:	227269	Battelle	Phone:	(614) 424-5622
Address:	505 King Ave.			Columbus, OH 43201
Ad #	754901	Requested By: BRYAN GEMLER	Fax:	
Sales Rep.:		Lanum, Laura	Phone:	(360) 394-8714
		legals@soundpublishing.com	Fax:	(360) 598-6800
Class.:	3030	Legal Notices		
Start Date:	04/29/2017	End Date: 04/29/2017	Nb. of Inserts:	1
PO #:	5 YR REV PETRO SITES			
Publications:	News Times/Record			
Paid Amount:	$175.34	Visa	Balance:	$0.00
Total Price:	$175.34			

PUBLIC NOTICE
U.S. NAVY
ANNOUNCES NOTICE
TO CONDUCT A
FIVE-YEAR REVIEW
OF ENVIRONMENTAL
CLEANUP ACTIONS
FOR PETROLEUM
SITES AT NAVAL AIR
STATION WHIDBEY
ISLAND, OAK HABOR,
WASHINGTON

This notice is to inform the public that the U.S. Navy will conduct a five-year review of previously implemented environmental cleanup actions for the petroleum sites at Naval Air Station Whidbey Island (NASWI) in Oak Harbor, Washington. Navy policy requires that, if a remedy results in hazardous substances, pollutants, or contaminants remaining on a site above levels that allow for unlimited use and unrestricted exposure, a review must be conducted no less than every five years after the initiation of the cleanup action to ensure that the remedy is functioning as planned and remains protective of human health and the environment. A five-year review is also intended to identify possible deficiencies and recommend any necessary corrective actions. This will be the third five-year review completed for the petroleum sites at NASWI. The previous five-year reviews were completed in January 2008 and September 2012. The five-year review for the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites at NASWI will occur in

2018.

Similar to the previous two five-year reviews, this third five-year review for the petroleum sites at NASWI will focus on five sites (i.e., Former Fuel Farm 1, Former Fuel Farm 2, Former Fuel Farm 3, Former Fuel Farm 4, and Building 357) that have undergone environmental investigation and/or remediation to address the potential impacts of contamination to human health and the environment. The cleanup action implemented for Former Fuel Farms 1, 2, 3, and 4 and Building 357 includes land use controls/institutional controls. For Former Fuel Farms 1, 2, 3, and 4, groundwater monitoring, natural attenuation, and/or free product recovery are also components and implemented as part of the cleanup action.

The Navy welcomes written comments from the community during the five-year review process; comments will be accepted until Wednesday, June 28, 2017. A Notice of Completion for the third five-year review for the petroleum sites at NASWI is anticipated to be published in March 2018.

For more information or to provide comments, please contact:

Ms. Leslie Yuenger
Naval Facilities Engineering Command
Northwest Public Affairs Officer
1101 Tautog Circle,
Suite 203
Silverdale, Washington 98315-1101
(360) 396-6387
leslie.yuenger@navy.mil

Legal No. WCW754901
Published: The Whidbey News Times, The South Whidbey Record.
April 29, 2017.

APPENDIX D

Interview Responses

INTERVIEW RECORD
2017 (FORMER) FUEL FARMS 1, 2, 3, AND 4 AND BUILDING 357
NAVAL AIR STATION WHIDBEY ISLAND (NASWI), OAK HARBOR, WASHINGTON
THIRD FIVE-YEAR REVIEW

Type 1 Interview – Navy Personnel

Individual Contacted: Kristeen Bennett
Title: Remedial Project Manager
Organization: NAVFAC NW
Contact Made by: email from Ms. Angela Paolucci dated 27 April 2017
Date: 27 July 2017

1. Please describe your degree of familiarity with the petroleum sites (i.e., Former Fuel Farms 1, 2, 3, and 4 and Building 357) at NASWI, the cleanup action plan/independent remedial action closure report for these sites, the implementation of the remedies at these sites, and the inspections and operation, maintenance, and monitoring (OMM) that has taken place since remedy implementation. Please also describe your involvement since September 2012.
   RESPONSE:
   Remedial Project Manager (RPM) for NASWI Petroleum Sites, including the Former Fuel Farm sites, since January 2016. Previous RPM was Phil Nenninger (from 2015-2016), Mark Wicklein (?-2015).

2. What is your overall impression of the on-going remedy implementation at the petroleum sites and its performance, especially since September 2012? Do you believe the remedies meet the intent of the cleanup action plan (CAP)/ independent remedial action closure report (IRACR) for these sites? Do you feel the remedies continue to be effective? Please indicate the basis for your assessment.
   RESPONSE:
   Overall, I believe the remedy is effective. Frequency of groundwater monitoring (GWM) is currently per the CAP/IRACR requirements; historically, the GWM was not per the CAP/IRACR requirements, as documented by the reporting frequency. Free product recovery (FPR) has not been conducted per the CAP/IRACR. Previous RPMs did not document the rationale for the frequency decrease. FPR will change to recommendations in CAP/IRACR in FY18.

3. To the best of your knowledge, are land use controls (LUCs), including institutional controls, being utilized at the petroleum sites consistent with the terms of the cleanup action plan/independent remedial action closure report? Please indicate the basis for your assessment.
   RESPONSE:
   LUC requirements are not clearly defined in CAP/IRACR or in the 2016 LUC Implementation Plan Addendum for Petroleum Sites. To my knowledge, no drinking water wells have been installed in proximity to any of the identified petroleum sites at NASWI.

4. To the best of your knowledge, has the on-going program of LUCs inspection, groundwater monitoring, and maintenance at the petroleum sites been sufficiently thorough and frequent to meet the goals of the cleanup action plan/independent remedial action closure report? Please indicate the basis for your assessment.
   RESPONSE:
   No. See responses to #2 and #3.

5. Since the second five-year review of the petroleum sites at NASWI (completed in September 2012), are you aware of any changes in land uses, ownership, access, or other site conditions that you feel may impact the protectiveness and/or effectiveness of the remedy detailed in the cleanup action plan/independent remedial action closure report?
   RESPONSE:
   No.

6. What measures have been taken to implement institutional controls required by the cleanup action plan/independent remedial action closure report?
   RESPONSE:
   Annual LUC Inspections, since 2016 per 2016 LUC Implementation Plan Addendum.

7. Are you aware of concerns from the community regarding implementation or overall environmental protectiveness of the selected remedy?
   RESPONSE:
   I have not explicitly received any concerns from the community regarding environmental protectiveness of the remedies chosen for the Petroleum sites.

8. Has there continued to be a regular on-site inspection and OMM presence since September 2012?
   RESPONSE:
   Yes.

9. Have there been any unexpected OMM difficulties since September 2012?
   RESPONSE:
   Not any that have damaged or compromised the overall remedy.

10. Have there been any substantial changes to inspection and OMM requirements or activities? If so, do you feel that these changes have impacted the protectiveness and/or effectiveness of the remedy detailed in the cleanup action plan/independent remedial action closure report?
    RESPONSE:
    See response to question #2.

11. Are you aware of any violations of the institutional control requirements at any of the petroleum sites that could impact the protectiveness and/or effectiveness of this component of the remedy (e.g., unauthorized use of groundwater)?
    RESPONSE:
    None, since I have taken over as RPM in 2016.

12. Do you have any other comments, concerns, or suggestions regarding the effectiveness of the remedies implemented to protect human health and the environment at the petroleum sites?
    RESPONSE:
    No.

INTERVIEW RECORD
2017 (FORMER) FUEL FARMS 1, 2, 3, AND 4 AND BUILDING 357
NAVAL AIR STATION WHIDBEY ISLAND (NASWI), OAK HARBOR, WASHINGTON
THIRD FIVE-YEAR REVIEW

Type 1 Interview – Navy Personnel

Individual Contacted: Philip Nenninger
Title: Former Remedial Project Manager
Organization: NAVFAC NW
Contact Made by: Angela Paolucci on April 27, 2017
Date: April 27, 2017

1. Please describe your degree of familiarity with the petroleum sites (i.e., Former Fuel Farms 1, 2, 3, and 4 and Building 357) at NASWI, the cleanup action plan/independent remedial action closure report for these sites, the implementation of the remedies at these sites, and the inspections and operation, maintenance, and monitoring (OMM) that has taken place since remedy implementation. Please also describe your involvement since September 2012.
RESPONSE: I have a high degree of knowledge with the above sites. I served as the responsible RPM from May 2015 - Spring 2016.

2. What is your overall impression of the on-going remedy implementation at the petroleum sites and its performance, especially since September 2012? Do you believe the remedies meet the intent of the cleanup action plan/independent remedial action closure report for these sites? Do you feel the remedies continue to be effective? Please indicate the basis for your assessment.
RESPONSE: I believe the remedies meet the intent of the CAP/RACR. The remedies are flexible enough to still be effective as site conditions alter. As the RPM, we were able to modify sampling and fuel recovery plans as needed.

3. To the best of your knowledge, are land use controls (LUCs), including institutional controls, being utilized at the petroleum sites consistent with the terms of the cleanup action plan/independent remedial action closure report? Please indicate the basis for your assessment.

RESPONSE: Yes. LUC appear to be effective. When projects are going on that could potentially impact the sites, base environmental personnel notify the environmental restoration program to insure there are no impacts.

4. To the best of your knowledge, has the on-going program of LUCs inspection, groundwater monitoring, and maintenance at the petroleum sites been sufficiently thorough and frequent to meet the goals of the cleanup action plan/independent remedial action closure report? Please indicate the basis for your assessment.
   RESPONSE: Yes, based on the annual monitoring reports.

5. Since the second five-year review of the petroleum sites at NASWI (completed in September 2012), are you aware of any changes in land uses, ownership, access, or other site conditions that you feel may impact the protectiveness and/or effectiveness of the remedy detailed in the cleanup action plan/independent remedial action closure report?
   RESPONSE: No.

6. What measures have been taken to implement institutional controls required by the cleanup action plan/independent remedial action closure report?
   RESPONSE: LUC plan has been active.

7. Are you aware of concerns from the community regarding implementation or overall environmental protectiveness of the selected remedy?
   RESPONSE: No.

8. Has there continued to be a regular on-site inspection and OMM presence since September 2012?
   RESPONSE: Yes.

9. Have there been any unexpected OMM difficulties since September 2012?
   RESPONSE: No.

10. Have there been any substantial changes to inspection and OMM requirements or activities? If so, do you feel that these changes have impacted the protectiveness and/or effectiveness of the remedy detailed in the cleanup action plan/independent remedial action closure report?
    RESPONSE: No impacts have affected protectiveness.

11. Are you aware of any violations of the institutional control requirements at any of the petroleum sites that could impact the protectiveness and/or effectiveness of this component of the remedy (e.g., unauthorized use of groundwater)?
    RESPONSE: No.

12. Do you have any other comments, concerns, or suggestions regarding the effectiveness of the remedies implemented to protect human health and the environment at the petroleum sites?
    RESPONSE: No.

INTERVIEW RECORD
2017 (FORMER) FUEL FARMS 1, 2, 3, AND 4 AND BUILDING 357
NAVAL AIR STATION WHIDBEY ISLAND (NASWI), OAK HARBOR, WASHINGTON
THIRD FIVE-YEAR REVIEW

Type 1 Interview – Navy Personnel

Individual Contacted: Leslie Yuenger
Title: NAVFAC NW Public Affairs Officer
Organization: NAVFAC NW
Contact Made by: Angela Paolucci
Date: 4/27/2017

1. Please describe your degree of familiarity with the petroleum sites (i.e., Former Fuel Farms 1, 2, 3, and 4 and Building 357) at NASWI, the cleanup action plan/independent remedial action closure report for these sites, the implementation of the remedies at these sites, and the inspections and operation, maintenance, and monitoring (OMM) that has taken place since remedy implementation. Please also describe your involvement since September 2012.
   RESPONSE:

   I am not familiar with this project. I have little to no involvement since 2012.

2. What is your overall impression of the on-going remedy implementation at the petroleum sites and its performance, especially since September 2012? Do you believe the remedies meet the intent of the cleanup action plan/independent remedial action closure report for these sites? Do you feel the remedies continue to be effective? Please indicate the basis for your assessment.
   RESPONSE:
   I believe that the on-going remedy is progressing as intended.

   Yes, I believe that the remedies are meeting the intent of the cleanup action, because I have not been informed otherwise.

   I believe the remedies continue to be effective, because I have not been informed otherwise.

3. To the best of your knowledge, are land use controls (LUCs), including institutional controls, being utilized at the petroleum sites consistent with the terms of the cleanup action plan/independent remedial action closure report? Please indicate the basis for your assessment.
   RESPONSE: Yes, because I have not been informed otherwise.

4. To the best of your knowledge, has the on-going program of LUCs inspection, groundwater monitoring, and maintenance at the petroleum sites been sufficiently thorough and frequent to meet the goals of the cleanup action plan/independent remedial action closure report? Please indicate the basis for your assessment.
   RESPONSE:

   Yes, because I have not been informed otherwise.

5. Since the second five-year review of the petroleum sites at NASWI (completed in September 2012), are you aware of any changes in land uses, ownership, access, or other site conditions that you feel may impact the protectiveness and/or effectiveness of the remedy detailed in the cleanup action plan/independent remedial action closure report?
   RESPONSE:

   I am not aware of any changes in LUC, ownership, access or other site conditions.

6. What measures have been taken to implement institutional controls required by the cleanup action plan/independent remedial action closure report?
   RESPONSE:

   I am unaware of the measures.

7. Are you aware of concerns from the community regarding implementation or overall environmental protectiveness of the selected remedy?
   RESPONSE:

   I have not been contacted by any members of the public or the media regarding the implementation or overall environmental protectiveness of the selected remedy.

8. Has there continued to be a regular on-site inspection and OMM presence since September 2012?
   RESPONSE:

   I assume that there has been a regular on-site inspection.

9. Have there been any unexpected OMM difficulties since September 2012?
   RESPONSE:

   I am unaware of any unexpected OMM difficulties.

10. Have there been any substantial changes to inspection and OMM requirements or activities? If so, do you feel that these changes have impacted the protectiveness and/or effectiveness of the remedy detailed in the cleanup action plan/independent remedial action closure report?
    RESPONSE:

    I am unaware of any substantial changes to inspection and OMM requirements.

11. Are you aware of any violations of the institutional control requirements at any of the petroleum sites that could impact the protectiveness and/or effectiveness of this component of the remedy (e.g., unauthorized use of groundwater)?
    RESPONSE:

    I am not aware of any violations of the institutional control requirements.

12. Do you have any other comments, concerns, or suggestions regarding the effectiveness of the remedies implemented to protect human health and the environment at the petroleum sites?
    RESPONSE:

    I have no further comments.

INTERVIEW RECORD
2017 (FORMER) FUEL FARMS 1, 2, 3, AND 4 AND BUILDING 357
NAVAL AIR STATION WHIDBEY ISLAND (NASWI), OAK HARBOR, WASHINGTON
THIRD FIVE-YEAR REVIEW

Type 2 Interview – Regulatory Agency Staff

Individual Contacted:	Ben Forson
Title:	Senior Environmental Engineer
Organization:	Washington State Department of Ecology
Contact Made by:	
Date:	July 27, 2017

1. Please describe your degree of familiarity with the petroleum sites (i.e., Former Fuel Farms 1, 2, 3, and 4 and Building 357) at NASWI, the cleanup action plan/independent remedial action closure report for these sites, the implementation of the remedies at these sites, and the inspections and operation, maintenance, and monitoring that has taken place since remedy implementation. Please also describe your involvement since September 2012.
   RESPONSE:

   I am familiar with the site in general and specifically, elements of both the original cleanup action plan and the revised plan that pertains to the petroleum sites. I was involved in the development of the 2013 revised cleanup action plan which followed the closure of the fuel farms, and has been involved in the implementation of both cleanup action plans. Since September 2012, I have been involved in the implementation of the revised cleanup action plan as well as the Long-Term Monitoring Plan and project work plans for the sites. My involvement has also included site visit and inspections when necessary, and review and comment of Groundwater Monitoring and Site Inspection reports

2. What is your overall impression of the on-going remedy implementation at the petroleum sites and its performance, especially since September 2012? Do you believe the remedies meet the intent of the cleanup action plan/independent remedial action closure report for these sites? Do you feel the remedies continue to be effective? Please indicate the basis for your assessment.
   RESPONSE:

   I believe the remedies meet the intent of the cleanup action plan and based on my review of monitoring and inspection results, I feel the overall effectiveness appear to be protective of human health and the environment.

3. To the best of your knowledge, are land use controls (LUCs), including institutional controls, being utilized at the petroleum sites consistent with the terms of the cleanup action plan/independent remedial action closure report? Please indicate the basis for your assessment.
   RESPONSE:

   To the best of my knowledge, land-use and institutional controls being utilized at the petroleum sites have been adhered to in a manner consistent with the terms of the cleanup action plan.

4. To the best of your knowledge, has the on-going program of LUCs inspection, groundwater monitoring, and maintenance at the petroleum sites been sufficiently thorough and frequent to meet the goals of the cleanup action plan/independent remedial action closure report? Please indicate the basis for your assessment.
   RESPONSE:

   Based on my review of periodic reports generated for the petroleum sites, it appears the on-going program of groundwater monitoring, land-use controls and maintenance inspections has been thorough and of adequate frequency to meet the goals of the cleanup action plan.

5. To the best of your knowledge, since September 2012, have there been any new scientific findings that relate to potential site risks and that might call into question the protectiveness and/or effectiveness of the remedies?
   RESPONSE:

   To the best of my knowledge, since September 2012 there has not been any new scientific information or findings that relate to potential risks that might call into question the protectiveness of the remedies for the petroleum site.

6. To the best of your knowledge, since September 2012, have there been any changes in site conditions that you feel may impact the protectiveness and/or effectiveness of the remedies detailed in the cleanup action plan/independent remedial action closure report?
   RESPONSE:

   No, I am not aware of any changes in site conditions that may impact the protectiveness of the remedies selected in the cleanup action plan since September 2012.

7. Since September 2012, have there been any complaints, violations, or other incidents related to the petroleum sites at NASWI that required a response by your office? If so, please provide details of the events and results of the responses.
   RESPONSE:

   No, I am not aware of any complaints, violations, or other incidents relating to the petroleum sites that required a response by Ecology since September 2012.

8. Are you aware of any community concerns regarding the on-going remedy implementation at the petroleum sites? If so, please give details.
   RESPONSE:

   No, I am not aware of any community concerns regarding implementation of the remedies at the petroleum sites.

9. Do you have any other comments, concerns, or suggestions regarding the effectiveness of the remedies implemented to protect human health and the environment at the petroleum sites? Do you have any suggestions for changes to how the selected remedies (including LUCs) are implemented? Do you have any suggestions for changes to how monitoring of the remedies (including natural attenuation) are conducted?
   RESPONSE:

   No other comments, concerns or suggestions regarding the effectiveness of the institutional controls implemented to protect human health and the environment at the petroleum sites. Results of long-term groundwater monitoring and site inspections to date indicate that all remedies are performing as expected