GROUNDWATER MONITORING REPORT
Fourth Quarter 2015

Department of Ecology VCP ID #: SW1479
Facility ID: 1794148; Cleanup Site ID: 5266

5603 North Waterfront Drive
Tacoma, Washington 98407

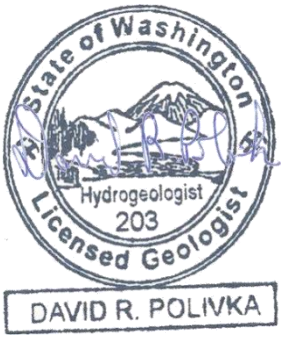
December 1, 2015

Prepared For:

Michael Marchetti
Breakwater Marina
5603 North Waterfront Drive
Tacoma, Washington 98407

K. Craig Klein, L.G.
Project Manager / Sr. Environmental Geologist

David R. Polivka, L.G., L.HG.
Sr. Hydrogeologist



Prepared by:

ECI | Environmental Consulting
PO Box 153
Fox Island, Washington 98333
Office: (253) 238-9270

ECI Project No.: 0483-06

Table of Contents

List of Attachments

Appendix A - Project Figures

- Figure 1 – Subject Site Location Map
- Figure 2 – Subject Site Topographic Map
- Figure 3 – Monitoring Well Locations & Analytical Results

Appendix B – Project Tables

- Table 3 - Historical Quarterly Groundwater Monitoring Results
- MTCA Method A Cleanup Levels for Groundwater

Appendix C - Analytical Results

- Laboratory Analytical Report
- Sample Chain of Custody

Appendix D - Sample Collection Forms

- Monitoring Well Sampling Log

1.0 INTRODUCTION

EcoCon, Inc. (ECI), at the request of Michael Marchetti of Breakwater Marina (owner), completed groundwater monitoring activities as part of an on-going remedial activity at the property located at 5603 North Waterfront Drive in Tacoma, Washington (the "Subject Site"). The Subject Site is currently an active commercial marina.

ECI has prepared this report to document site activities that include the collection and chemical analysis of groundwater samples from six groundwater monitoring wells (MW1-MW6) at the Subject Site (Appendix A, Figure 1). This groundwater monitoring was conducted in accordance with ECI's "*Groundwater Sampling and Analysis Plan*", approved by the Tacoma/Pierce County Health Department (TPCHD) and State of Washington Department of Ecology (Ecology) in July and August 2015, for the purpose of post-remediation compliance monitoring.

1.1 Property Description/Location

The Property (addressed as 5603 North Waterfront Drive, Tacoma, Washington) is a commercial marina located within Section 23, Township 21 North, and Range 02 East of the Willamette Meridian (Appendix A, Figures 1 & 2). According to the Pierce County Assessor records, the Property is identified as Pierce County Tax Parcel 8950100010, and consists of an irregular shaped lot that occupies 29.30 acres (1,276,308 square feet). The Site is located to the southeast of the Washington State Department of Transportation Pt. Defiance – Vashon Island ferry dock and the Tacoma Yacht Club (Appendix A, Figure 1). The Site is currently zoned as Municipal Area (City of Tacoma) and is a portion of the Metropolitan Parks District Point Defiance Park (Pierce County Assessor Website, 2013). This report is written exclusively for the Breakwater Marina, which includes the infrastructure (175 slips from 25 – 100 feet) associated with a marina. The current owner of the marina has confirmed that the site is located within the Metropolitan Park District.

The "Site" is defined by Ecology as the full lateral and vertical extent of contamination that has resulted from five former gasoline and diesel underground storage tanks (USTs) at the Property used to provide fuel for marina clients and customers. Based on information gathered to date, the Site had soil and/or groundwater contaminated with; gasoline-range organics (GRO), diesel-range organics (DRO); benzene, toluene, ethylbenzene, and/or total xylenes (BTEX); and lead.

1.2 Property Geology & Hydrogeology

The Site is located in the physiographic setting called the Puget Sound Lowlands, an elongate structural and topographic basin between the Olympic Peninsula (Olympic Mountains) and northern Willapa Hills on the west, and the Cascade subcontinent (Cascade Range) to the east. The area has been impacted by repeated glaciation and crustal deformation related to the Cascadia subduction zone. The present landscape largely results from those repeated cycles of glacial scouring and deposition and tectonic activity, subsequently modified by land sliding, stream erosion and deposition, and human activity.

The most recent glacier to override the area, during the Vashon Stade of the Fraser Glaciation, was marked by the advance and retreat of the Puget Lobe of the Cordilleran Ice Sheet in western Washington, and retreated from the area by approximately 13,650 years ago. This glacier was about 5,000 feet thick near Seattle and approximately 1,500 feet thick in the area of the Site, with its termination approximately 12 miles south of Olympia. This area is filled in with deep deposits of glacial debris which can reach thicknesses of at least 2000 feet in the Tacoma area. Bedrock beneath the thick glacial deposits in the Puget Sound Lowlands consists of oceanic crustal rocks.

According to the United States Geological Survey (USGS) 1:24000 Gig Harbor Quadrangle 7.5-minute Series Topographic Map, the Property is at an elevation of approximately 12 feet above mean sea level (msl) (Appendix A, Figure 2). A steep embankment is located southwest of the Property across South Waterfront Drive. The topography of the Property and vicinity generally slopes to the northeast.

The primary aquifers in the Puget Sound region are typically overlain by relatively impermeable glacial till deposits that are present at or near the ground surface. Within these till deposits are localized areas or lenses of water-bearing sands and gravels that may result in a shallow, perched water table. Lateral and vertical migration of shallow groundwater may be impeded by the relatively impermeable nature of the till and by the sometimes-discontinuous nature of the perched water-bearing sands and gravel. Perched and discontinuous zones of shallow groundwater may be seasonally or perennially present, depending on site-specific conditions.

Shallow groundwater flow directions can fluctuate but tend to follow the topography. They can also be affected by seasonal high water tables and variable soil characteristics. Groundwater migration pathways may also be influenced by man-made subsurface conditions created by soil excavation and filling, and underground utilities. These conditions may cause groundwater to migrate in different directions along those paths of least resistance.

Shallow groundwater beneath the Site was expected to flow to the northeast towards the Dalco Passage of the Puget Sound. However, the vicinity of the Site has been filled and a seawall constructed. As a result, the groundwater flow at the site appears to be variable and appears to be tidally influenced.

1.3 Background

Previous investigations at the Site have identified petroleum hydrocarbon contaminants in soil and groundwater adjacent to and beneath the locations of the former underground storage tanks (USTs) and product piping previously utilized for fueling services at the Site. Soil and groundwater samples collected during the investigations identified one or more of the following petroleum hydrocarbon contaminants at concentrations above the Model Toxics Control Act (MTCA) Method A Cleanup Levels (CULs): gasoline-range organics (GRO), diesel-range organics (DRO), and select volatile organic compounds benzene, toluene, ethylbenzene and xylenes (BTEX), and/or lead.

Focused Subsurface Investigation/Underground Storage Tank Assessment – November 2013

In November 2013, ECI directed the advancement of soil borings adjacent to the five USTs, as described in ECI's letter report entitled "*Focused Subsurface Investigation/Underground Storage Tank Assessment*", dated November 15, 2013. Thirteen borings were advanced as part of this focused subsurface investigation. Areas investigated included soils and groundwater adjacent to the five USTs. The depth of the borings ranged from eight to ten feet below ground surface (bgs) and the depth to groundwater ranged from five to six feet bgs.

Soil samples were collected from three to four feet bgs and from the groundwater interface. Groundwater and soil samples were analyzed for the site contaminants of concern (COC), identified as: GRO, DRO, and BTEX. Analytical results indicated only one of the groundwater samples contained DRO concentrations above the Ecology MTCA Method A groundwater CUL of 500 µg/L (*WAC 173-340-900: Table 720-1*) at 34,300 µg/L. That sample was groundwater sample B1-W collected from boring B1, located adjacent to the northwestern most UST at the Site. Based on the analytical results obtained from this investigation, ECI recommended further investigation in the area of that UST to further delineate groundwater contamination.

Supplemental Focused Subsurface Investigation – December 2013

In December 2013, ECI directed the advancement of additional soil borings at the Site, as described in ECI's letter report titled "*Supplemental Focused Subsurface Investigation*" (SFSI), dated January 13, 2014. Six borings were advanced as part of this SFSI. Areas investigated included soils and groundwater adjacent and to the northwest of the northwestern most UST. The depth of the borings reached ten feet bgs. The depth to groundwater ranged from eight to nine feet bgs.

Soil samples were collected from the groundwater interface. Groundwater samples collected from each boring were analyzed for DRO. Analytical results indicated concentrations of DRO below laboratory reporting limits in all six of the groundwater samples. Because the laboratory analysis did not detect concentrations of target analytes in groundwater, and the field screening of soil samples did not indicate the presence of contamination, the soil samples collected were not analyzed.

These results, and the results from the previous investigations, indicated a localized area of impacted groundwater adjacent to the northwestern most UST. This localized area appeared to be impacted with DRO above the applicable Ecology MTCA Method A CUL in groundwater (500 µg/L). Therefore, based on the analytical results obtained from the SFSI and previous investigations, ECI recommended further remedial actions at the Breakwater Marina Site.

UST Decommissioning and UST Site Assessment – December 2014

ECI completed the decommissioning and UST site assessment during the closure of the five USTs at the Subject Site in December 2014. The system consisted of one 8,000-gallon diesel UST, one 8,000-gallon gasoline UST, two 3,000-gallon gasoline USTs and one 3,000-gallon diesel UST.

Each UST was decommissioned by removal and transported off-site for cleaning and disposal. The Soil sampling conducted following the UST removal (site assessment) confirmed the presence of DRO, GRO, benzene, total xylenes, and lead exceeding applicable Ecology MTCA Method A Cleanup Levels.

Soil sample analytical results reported GRO in fifteen (15) samples, DRO in three (3) samples, benzene in two (2) samples, total xylenes in three (3) samples, and lead in one (1) of the samples at concentrations that exceed their applicable MTCA Method A soil cleanup levels. One groundwater grab sample was collected from the excavation following the removal of the USTs.

Analytical results of the groundwater sample reported the presence of DRO and lead at concentrations above laboratory reporting limits but below the MTCA Method A cleanup levels for DRO and lead in groundwater. None of the other analytes were identified above the laboratory reporting limits.

Interim Remedial Action – May 2015

During May 2015, ECI completed an interim remedial action to remediate the previously identified impacted soil and groundwater at the Subject Site. This interim action included excavation and off-site disposal of petroleum contaminated soil (PCS), pumping and off-site disposal of groundwater, and collection and analysis of soil and groundwater samples in multiple locations.

Confirmation samples collected during the remedial action confirmed that the COC concentrations in soil were below their respective MTCA Method A Cleanup Levels for unrestricted land use. Details regarding the interim remedial action are included in ECI's "*Remedial Excavation Report*", dated May 28, 2015.

Groundwater Sampling and Analysis Plan – April 2015

It was expected that the environmental quality of groundwater would be restored by virtue of source removal, therefore no additional active remediation was proposed for this media of concern. A groundwater sampling and analysis plan was established and submitted to Tacoma-Pierce County Health Department on April 9, 2015, detailing the proposed monitoring well locations and compliance sampling methodology. The plan was subsequently approved in an electronic correspondence dated July 20, 2015.

2.0 GROUNDWATER MONITORING

2.1 Regulatory Compliance

Regulatory compliance for this project is based on the Washington Administrative Code (WAC) 173-340 – Model Toxic Control Act (MTCA) - chapter 70.105D RCW and is regulated by Ecology. Ecology has established cleanup standards and requirements for the cleanup actions. The rules establishing these standards and requirements were developed by Ecology in consultation with the Science Advisory Board (established under the Act) and with representatives from local government, citizen, environmental, and business groups. The rules were first published in February 1991, with amendments in January 1996, February 2001, and October 2007.

The applicable ground water cleanup levels (CUL) for the contaminants of concern (COC) are guided by Ecology's MTCA-173-340: Table 720-1 Method A Cleanup Levels for Groundwater. The COCs for the Site were identified as GRO, DRO, BTEX, and lead, and are included for the purposes of compliance monitoring. Table 1 presents the COCs and their respective cleanup levels.

Table 1: Contaminants of Concern & Applicable Cleanup Levels – Groundwater

Primary Contaminant of Concern	Analytical Method	Groundwater Cleanup Levels (CUL) in µ/L
Gasoline range organics (GRO)	NWTPH-Gx	1,000 /800[1]
Diesel range organics (DRO)	NWTPH-Dx	500
Benzene	EPA Test Method 8260C	5
Toluene	EPA Test Method 8260C	1,000
Ethylbenzene	EPA Test Method 8260C	700
Xylenes	EPA Test Method 8260C	1,000
Total Lead	EPA Test Method 7010	15 µg/L

2.2 Sampling Activities

The activities conducted during this sampling event included the collection of representative groundwater samples from six groundwater monitoring wells along with collecting field measurements of groundwater elevations, pH, and temperature, specific conductivity, and field observations of water color and presence of odor or sheen.

[1] 1000 µg/L: Gasoline mixtures without benzene and the total of ethylbenzene, toluene and xylenes are less than 1% of the gasoline mixture. 800 µg/L: All other gasoline mixtures (MTCA Table 740-1).

The depth to groundwater was measured relative to the top of each monitoring well casing using an electric water level indicator / well sounder. The measurements were read from the north side of the well casing in each well. All of the monitoring wells were purged dry or purged until water parameters stabilized, and then allowed to recharge prior to the collection of groundwater samples. The locations of the monitoring wells are shown in Figure 3 of Appendix A.

2.2.1 Sample Collection

Groundwater samples were collected on November 12, 2015. Samples were collected in accordance with American Society of Testing and Materials (*ASTM) Guideline* D6771-02 "*Standard Practice for Low-Flow Purging and Sampling for Wells and Devices Used for Ground-Water Quality Investigations*". ECI field staff followed the procedures described below when collecting groundwater samples:

- The cap from the monitoring well was removed and the groundwater level was allowed to equilibrate to atmospheric pressure for a minimum of 20 minutes.
- The depth to groundwater in the monitoring well was measured relative to the top of the well casing using an electronic water-level meter.
- Each monitoring well was purged at a low-flow rate (100 to 300 milliliters per minute) using a peristaltic pump and dedicated polyethylene tubing.
- Temperature, pH, turbidity, and specific conductivity were monitored during purging using a water quality meter to determine when these parameters stabilized.

Samples were collected in new laboratory-provided analyte-specific sample containers and assigned a unique sample ID. The samples were placed in a climate controlled container and maintained at or below 4° Celsius until they were delivered to the laboratory under industry standard chain of custody protocol. Appendix D presents the sample collection forms that document the field observation.

2.2.2 Laboratory Analysis

Six groundwater samples were submitted to Libby Environmental, Inc. of Olympia, Washington for analysis of site specific COCs described in Table 1. The analytical results indicated that GRO, DRO and BTEX were not detected above the respective laboratory reporting limit, and lead was either not detected above the reporting limit or was detected at concentrations below the MTCA cleanup levels. A summary of the current sample analytical results is provided in Table 2 (below). Table 3, *Historical Groundwater Sample Results* in Appendix B presents the analytical results form both quarterly sampling events. The laboratory analytical report is included with this report in Appendix C.

Table 2: Summary of Groundwater Analytical Results

Sample ID	GRO (µg/L)	DRO (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (µg/L)	Total Lead (µg/L)
MW1	ND	ND	ND	ND	ND	ND	ND
MW2	ND	ND	ND	ND	ND	ND	ND
MW3	ND	ND	ND	ND	ND	ND	ND
MW4	ND	ND	ND	ND	ND	ND	ND
MW5	ND	ND	ND	ND	ND	ND	ND
MW6	ND	ND	ND	ND	ND	ND	ND
PQL	100	200	1	2	1	3	5
CUL	1000	500	5	1,000	700	1,000	15

ND: Not detected above the laboratory practical quantitation limit (PQL)
Model Toxic Control Act (MTCA) Method A Cleanup Limits (CUL's)

2.3 Data Quality

Groundwater samples collected on November 12, 2015 were submitted for analysis under industry standard chain-of-custody to Libby Environmental, Inc. All samples were prepared and/or analyzed within the required holding times and were properly preserved and cooled after collection. Method blanks were prepared and analyzed with the samples for all parameters. These applications were performed under Washington State Department of Ecology accreditation parameters. All appropriate Quality Assurance / Quality Control (QA/QC) method parameters have been applied. Libby Environmental, Inc. stated that there were no reportable sample analysis issues.

2.4 Groundwater Flow Direction

ECI environmental professionals measured the depth to groundwater in each of the monitoring wells in order to determine groundwater elevation and evaluate the current water table gradient. Groundwater levels for monitoring wells MW1 through MW6 were measured on November 12, 2015. The depth to groundwater ranged from 5.6 feet to 6.23 feet below the top of the monitoring well casings. The locations and elevations of the monitoring wells were professionally surveyed by Informed Land Survey of Tacoma, Washington. The calculated groundwater elevations ranged from 6.63 feet to 7.79 feet above mean sea level (amsl).

Table 3: Groundwater Elevation Data

Well ID	Top of Well Casing Elevation (feet amsl)	Depth to Water (feet amsl)	Groundwater Elevation (feet amsl)
MW1	13.30	5.60	7.70
MW2	13.53	5.93	7.60
MW3	12.86	6.23	6.63
MW4	13.64	5.85	7.79
MW5	12.98	5.28	7.70
MW6	12.82	5.40	7.42

NOTE: The surface elevation includes the distance from the top of the casing to ground surface.

Groundwater flow appears to be toward the north and northwest at an approximate gradient of 0.02 feet/foot (Appendix A, Figure 3). During the August 2015 sampling event the groundwater appeared to flow to the east-southeast. The difference in groundwater flow direction appears to be a result of tidal influence. During the August 2015 sampling event, the tide was rising (coming in) and the groundwater flow was moving with the tide toward the southeast. During the November 2015 sampling event, the tide was falling (going out) and the groundwater flow was moving with the tide to the north and northwest

3.0 CONCLUSIONS AND RECOMMENDATIONS

3.1 Conclusions

Six groundwater monitoring wells were installed at the Site in August 2015. On November 12, 2015, confirmation/compliance groundwater samples were collected from the six monitoring wells. The samples were collected to evaluate the post-remediation groundwater quality. Analytical results reported concentrations of all COCs below their respective laboratory method practical quantitation limits (PQLs) and/or applicable MTCA Method A Cleanup Levels for all samples analyzed.

The groundwater flow directions and gradients appear to be tidally influenced and depending on the tidal stage can flow from the east-southeast to the north and northwest. Based on the groundwater flow directions, it appears that ECI has sampled the ground water as it flows though the Site in both a northwest to southeast direction and the southeast to northwest direction.

Because no COCs have been detected above the PQLs (or cleanup levels in the case of lead) and the samples have been taken with groundwater flow through the Site in two directions, it is concluded that the remedial activities at the Site have been successful.

3.2 Recommendations

Based on the conclusions of this report, ECI recommends that a determination of "no further action" (NFA) be issued for the Site.

4.0 STANDARD LIMITATIONS

This report has been prepared to document the activities that occurred during quarterly groundwater monitoring and sampling activities at the site addressed at 5603 North Waterfront Drive, Tacoma, Washington. The findings and conclusions documented in this report have been prepared for the specific application to this project and have been developed in a manner consistent with the level of care and skill normally exercised by members of the environmental science profession currently practicing under similar conditions in the area. No warranty, expressed or implied, is made. This report is for the exclusive use of Breakwater Marina and/or its representatives.

If new information is developed in future site work (which may include excavations, additional borings, or other studies), ECI should be contacted to re-evaluate the interpretations in this report, and to provide amendments as required.

Appendix A

Project Figures

Figure 1: Subject Site Location Map
Figure 2: Subject Site Topographic Map
Figure 3: Monitoring Well Locatrion & Analytical Results

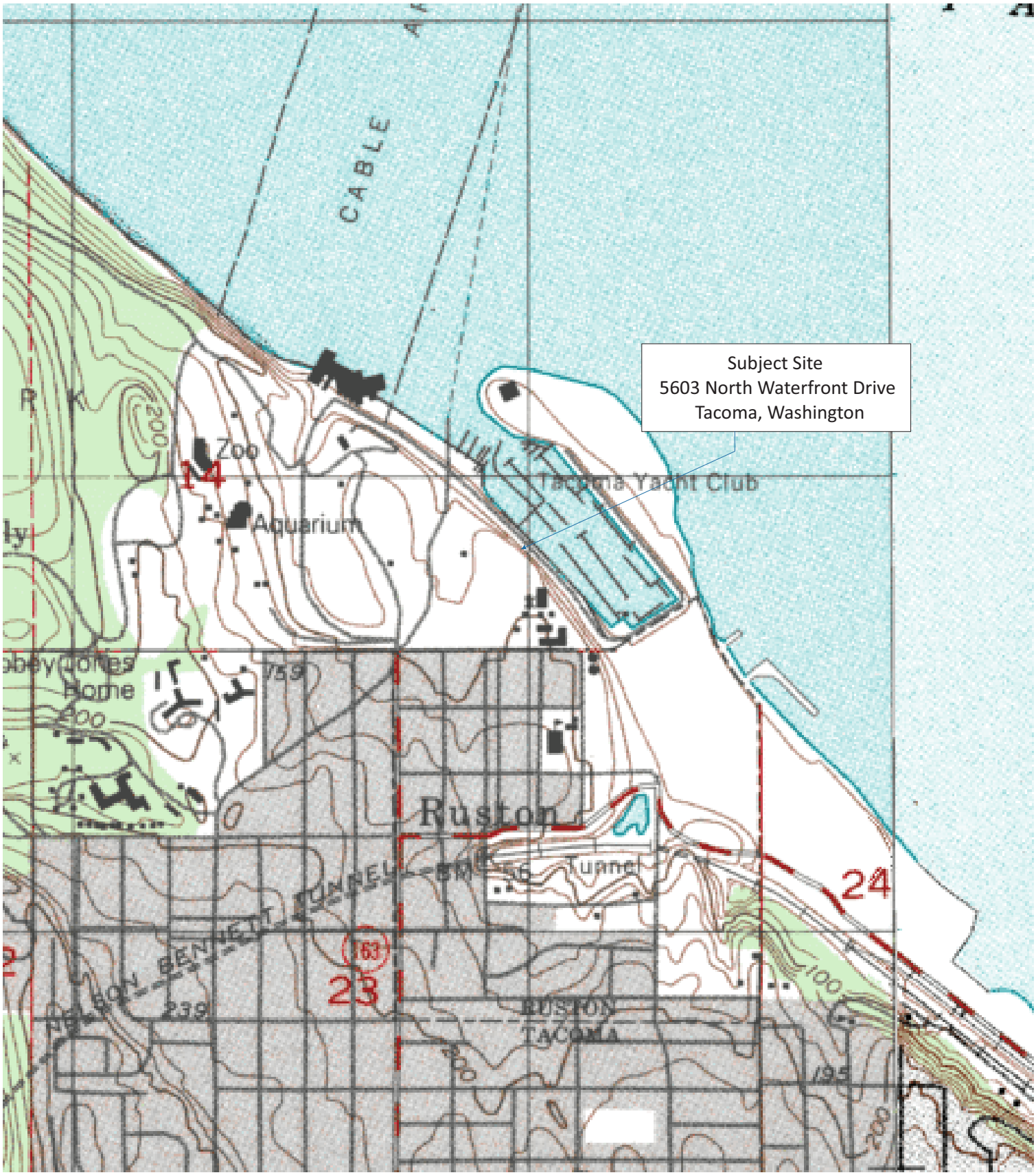
N
Not To Scale

Project Location Map
Groundwater Monitoring Project - 4th Quarter 2015
5603 North Waterfront Drive
Tacoma, Washington

Date:	November 19 ,2015
Completed By:	K. Spencer
Reviewed By.:	S. Spencer
Version:	ECI-003-090915
Project No.:	0483-06

Figure No.: 01
Sheet 01 of 03

ECI environmental services
www.ecocononline.com



N
Not To Scale

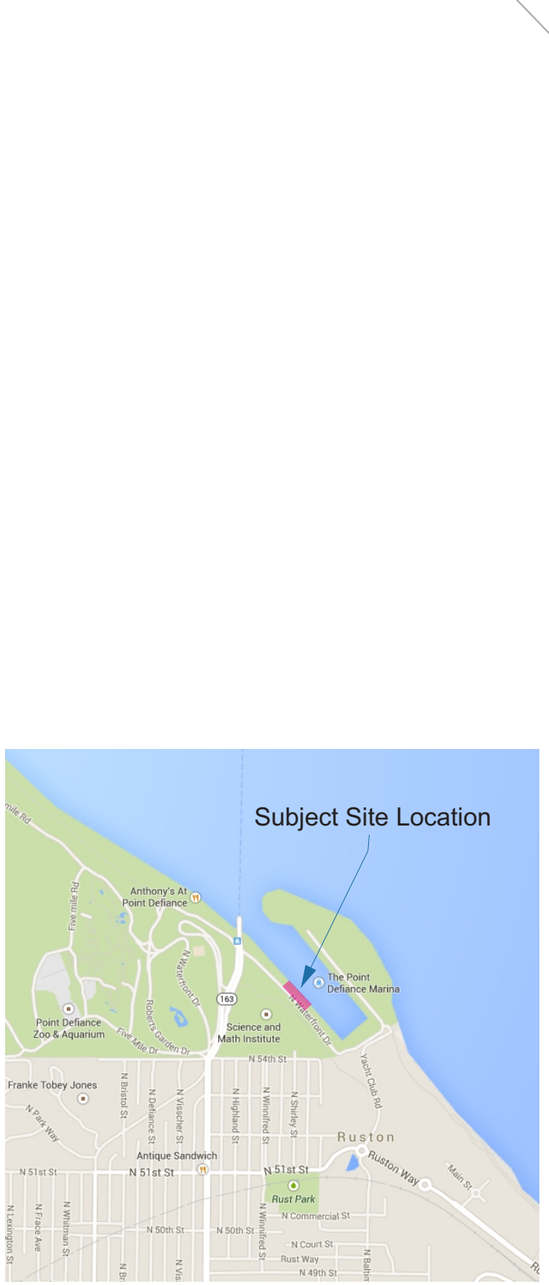
Site Topographic Map

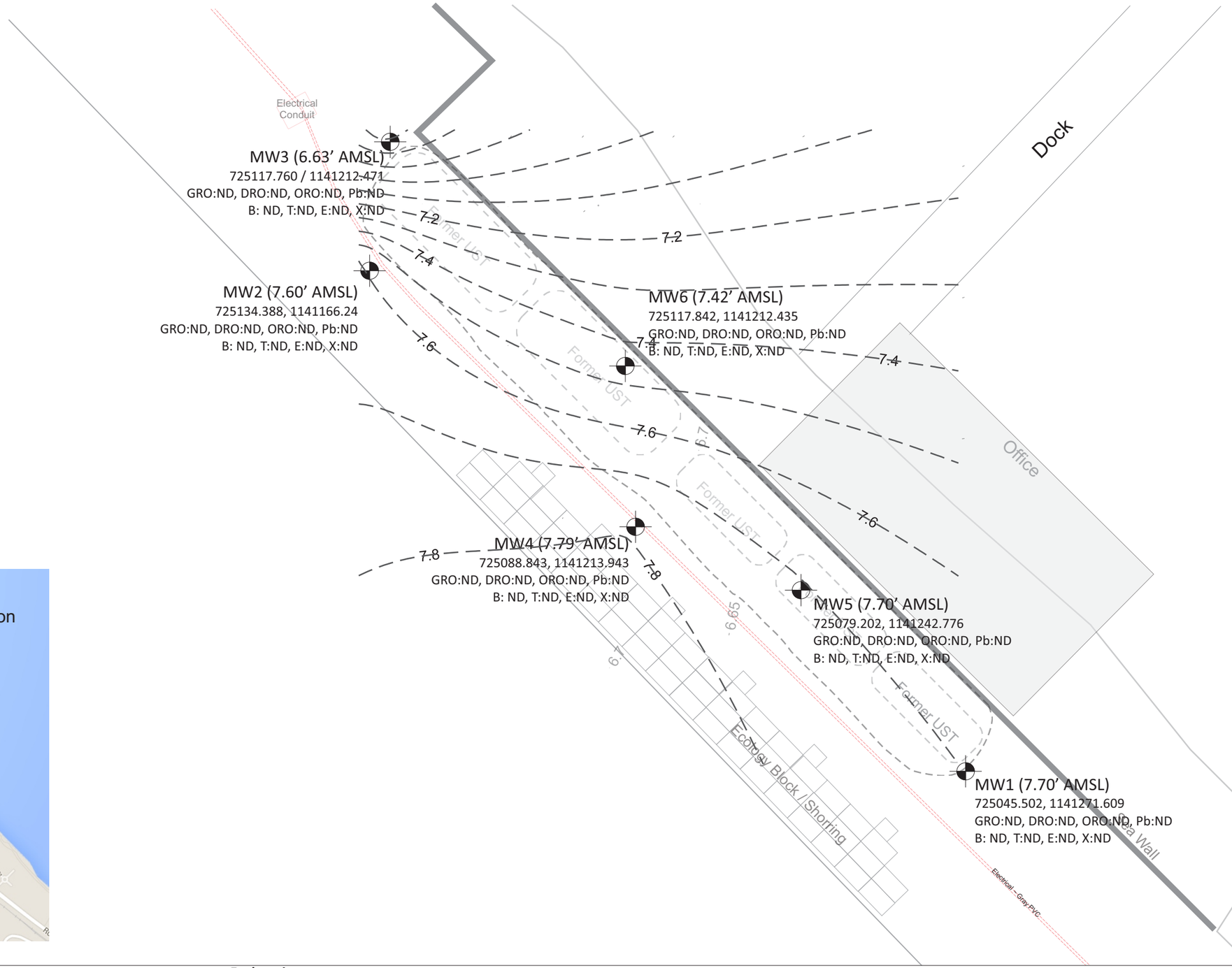
Groundwater Monitoring Project - 4th Quarter 2015
5603 North Waterfront Drive
Tacoma, Washington

Date:	November 19 ,2015
Completed By:	K. Spencer
Reviewed By.:	S. Spencer
Version:	ECI-003-090915
Project No.:	0483-06

Figure No.: 02
Sheet 02 of 03

ECI environmental services
www.ecocononline.com





N

0 15 30 60

Approximate Scale in Feet

Explanation

⌖	Groundwater Monitoring Wells
AMSL	Above Mean Sea Level
B,T,E,X	Benzene, Toluene, Ethylbenzene, Xylenes
GRO	Gasoline Range Organics
DRO	Diesel Range Organics
ORO	Oil Range Organics

Groundwater Monitoring Well Location Map & Sample Results

Groundwater Monitoring Project - 4th Quarter 2015
5603 North Waterfront Drive
Tacoma, Washington

Date:	November 24, 2015
Completed By:	K. Spencer
Reviewed By.:	S. Spencer
Version:	ECI-003-090915
Project No.:	0483-06

Figure No.: 03
Sheet 03 of 03

ECI environmental services
www.ecoconline.com

Appendix B

Project Tables

Table 3 - Historical Quarterly Groundwater Monitoring Results
Sample Chain of Custody

ECI environmental services
www.ecocononline.com
Anchorage | Tacoma | Portland

Table 3: Historical Groundwater Sampling Results

Groundwater Monitoring Project - 4th Quarter 2015
5603 North Waterfront Drive
Tacoma, Washington

November 23, 2015

Sample Identification Number	Sample Location		GW Depth (feet bgs)	Sample Date	NWTPH-Dx Ext.		NWTPH-Gx	8021B				200.8
					Diesel Range Organics (c10-c25)	Oil Range Organics (c25-c36)	Gasoline Range Organics (c3-c10)	Benzene	Toluene	Ethylbenzene	Xylenes	Lead
	Longitude	Latitude			µg/L							
MW1	47°18'14.56" N	122°30'43.33" W	6.60	8/24/2015	<50	<250	<100	<1	<1	<1	<3	**8.3**
			7.70	10/23/2014	<50	<250	<100	<1	<1	<1	<3	<1
MW2	47°18'15.41" N	122°30'44.89" W	6.88	8/24/2015	<50	<250	<100	<1	<1	<1	<3	**<1**
			7.60	10/23/2014	<50	<250	<100	<1	<1	<1	<3	<1
MW3	47°18'15.63" N	122°30'44.84" W	7.06	8/24/2015	<50	<250	<100	<1	<1	<1	<3	<1
			6.63	10/23/2014	<50	<250	<100	<1	<1	<1	<3	<1
MW4	47°18'14.97" N	122°30'44.19" W	6.74	8/24/2015	<50	<250	<100	<1	<1	<1	<3	**6**
			7.79	10/23/2014	<50	<250	<100	<1	<1	<1	<3	<1
MW5	47°18'14.89" N	122°30'43.76" W	6.61	8/24/2015	<50	<250	<100	<1	<1	<1	<3	**6**
			7.70	10/23/2014	<50	<250	<100	<1	<1	<1	<3	<1
MW6	47°18'15.26" N	122°30'44.22" W	6.72	8/24/2015	<50	<250	<100	<1	<1	<1	<3	**5.3**
			7.42	10/23/2014	<50	<250	<100	<1	<1	<1	<3	<1
Laboratory Minimum Method Reporting / Practical Quantitive Level (MRL)					50	250	100	1	1	1	3	1
Model Toxic Control Act - Method A Cleanup Levels For Groundwater					500	500	1000/800	5	1,000	700	1,000	15

Bold/Underlined: Analysis reported concentration exceeding Method Reporting Limits (MRL)
Bold / Shaded: Analysis reported concentration exceeding the MTCA Method A cleanup level
MTCA 2007 Method A Cleanup Levls for Groudwater - Table 720-1 - WAC 173-340 -900 Tables
Samples reported in micrograms per killigrams (µg/L)
bgs: below ground surface

Appendix C

Analytical Results

Laboratory Analytical Report
Chain of Custody

Libby Environmental, Inc.
4139 Libby Road NE • Olympia, WA 98506-2518

November 20, 2015

Craig Klein
ECI
P.O. Box 153
Fox Island, WA 98333

Dear Ms. Klein:

Please find enclosed the analytical data report for the Breakwater Marina Project located in Tacoma, Washington.

The results of the analyses are summarized in the attached tables. Applicable detection limits and QA/QC data are included. The sample(s) will be disposed of in 30 days unless we are contacted to arrange long term storage.

Libby Environmental, Inc. appreciates the opportunity to have provided analytical services for this project. If you have any further questions about the data report, please give me a call. It was a pleasure working with you on this project, and we are looking forward to the next opportunity to work together.

Sincerely,

Sherry L. Chilcutt
Senior Chemist
Libby Environmental, Inc.

Phone (360) 352-2110 • Fax (360) 352-4154 • libbyenv@aol.com

Libby Environmental, Inc.

Chain of Custody Record

www.LibbyEnvironmental.com

4139 Libby Road NE
Olympia, WA 98506
Ph: 360-352-2110
Fax: 360-352-4154

Client: ECI

Address:

City: State: Zip:

Phone: Fax:

Client Project #

Date: 11/13/15 Page: 1 of 1

Project Manager: Klein

Project Name: Breakwater Marina

Location: Pt. Defiance City, State: Tacoma

Collector: Mulvaig + Spencer Date of Collection: 11/12/15

Email: GMulvaig@ecocanonline.com

	Sample Number	Depth	Time	Sample Type	Container Type	VOC 8260	NWTPH-Gx	BTEX 8021	NWTPH-HCID	NWTPH-Dx	NWTPH-Dx/Dx	c PAH 8270	PAH 8270	Semi Vol 8270	PCB 8082	MTCA 5 Metals	RCRA 8 Metals	Total Lead		Field Notes
1	MW1		920	W			X	X		X							X			
2	MW2		1040														X			
3	MW3		1055																	
4	MW4		1015																	
5	MW5		1000																	
6	MW6		1025																	
7																				
8																				
9																				
10																				
11																				
12																				
13																				
14																				
15																				
16																				
17																				

Relinquished by:	Date / Time	Received by:	Date / Time
[signature]	11/13/15 1131	[signature]	11/13/15 1131
Relinquished by:	Date / Time	Received by:	Date / Time
Relinquished by:	Date / Time	Received by:	Date / Time

Sample Receipt

Good Condition?	Y	N	
Temp.			°C
Seals Intact?	Y	N	N/A
Total Number of Containers			

Remarks:

TAT: 24HR 48HR 5-DAY

Distribution: White - Lab, Yellow - File, Pink - Originator

Libby Environmental, Inc.

4139 Libby Road NE
Olympia, WA 98506
Phone: (360) 352-2110
FAX: (360) 352-4154
Email: libbyenv@aol.com

BREAKWATER MARINA PROJECT
ECI
Tacoma, Washington
Libby Project # L151113-3
Client Project # 0483-06

Analyses of Gasoline (NWTPH-Gx) & BTEX (EPA Method 8260C) in Water

Sample Number	Date Analyzed	Benzene (µg/l)	Toluene (µg/l)	Ethylbenzene (µg/l)	Xylenes (µg/l)	Gasoline (µg/l)	Surrogate Recovery (%)
Method Blank	11/14/15	nd	nd	nd	nd	nd	96
LCS	11/14/15	94%	92%				97
MW-1	11/14/15	nd	nd	nd	nd	nd	107
MW-2	11/14/15	nd	nd	nd	nd	nd	96
MW-2 Dup	11/14/15	nd	nd	nd	nd	nd	97
MW-3	11/14/15	nd	nd	nd	nd	nd	95
MW-4	11/14/15	nd	nd	nd	nd	nd	96
MW-5	11/14/15	nd	nd	nd	nd	nd	99
MW-6	11/14/15	nd	nd	nd	nd	nd	104
MW-2 MS	11/14/15	97%	129%				100
MW-2 MSD	11/14/15	82%	76%				92
Practical Quantitation Limit		1	2	1	3	100	

"nd" Indicates not detected at the listed detection limits.
"int" Indicates that interference prevents determination.

ACCEPTABLE RECOVERY LIMITS FOR SURROGATE (Toluene-d8): 65% TO 135%

ANALYSES PERFORMED BY: Sherry Chilcutt

Libby Environmental, Inc.

4139 Libby Road NE
Olympia, WA 98506
Phone: (360) 352-2110
FAX: (360) 352-4154
Email: libbyenv@aol.com

BREAKWATER MARINA PROJECT
ECI
Tacoma, Washington
Libby Project # L151113-3
Client Project # 0483-06

Analyses of Diesel & Oil (NWTPH-Dx/Dx Extended) in Water

Sample Number	Date Analyzed	Surrogate Recovery (%)	Diesel (µg/l)	Oil (µg/l)
Method Blank	11/13/15	106	nd	nd
Method Blank	11/16/15	73	nd	nd
MW-1	11/13/15	101	nd	nd
MW-2	11/13/15	109	nd	nd
MW-3	11/13/15	100	nd	nd
MW-4	11/16/15	72	nd	nd
MW-5	11/16/15	76	nd	nd
MW-5 Dup	11/16/15	81	nd	nd
MW-6	11/13/15	103	nd	nd
MW-6 Dup	11/13/15	105	nd	nd
Practical Quantitation Limit			200	400

"nd" Indicates not detected at the listed detection limits.
"int" Indicates that interference prevents determination.

ACCEPTABLE RECOVERY LIMITS FOR SURROGATE (2-F Biphenyl): 65% TO 135%

ANALYSES PERFORMED BY: Maria Friedrich

Libby Environmental, Inc.

4139 Libby Road NE
Olympia, WA 98506
Phone: (360) 352-2110
FAX: (360) 352-4154
Email: libbyenv@aol.com

BREAKWATER MARINA PROJECT
ECI
Tacoma, Washington
Libby Project # L151113-3
Client Project # 0483-06

Analyses of Total Lead in Water by EPA 7010 Series

Sample Number	Date Analyzed	Lead µg/L
Method Blank	11/15/15	nd
MW-1	11/15/15	nd
MW-2	11/15/15	nd
MW-3	11/15/15	nd
MW-4	11/15/15	nd
MW-5	11/15/15	nd
MW-6	11/15/15	nd
Practical Quantitation Limit		5.0

"nd" Indicates not detected at the listed detection limits.

ANALYSES PERFORMED BY: Dirk Peterson

Libby Environmental, Inc.

4139 Libby Road NE
Olympia, WA 98506
Phone: (360) 352-2110
FAX: (360) 352-4154
Email: libbyenv@aol.com

BREAKWATER MARINA PROJECT
ECI
Tacoma, Washington
Libby Project # L151113-3
Client Project # 0483-06

QA/QC for Lead in Water by EPA 7010 Series

Sample Number	Date Analyzed	Lead (% Recovery)
LCS	11/15/15	114%
L151112-3 MS	11/15/15	106%
L151112-3 MSD	11/15/15	103%
RPD	11/15/15	3%

ACCEPTABLE RECOVERY LIMITS FOR MATRIX SPIKES: 75%-125%
ACCEPTABLE RPD IS 20%

ANALYSES PERFORMED BY: Dirk Peterson

Appendix D

Sample Collection Forms

Monitoring Well Sampling Logs

ECI MONITORING WELL PURGE AND SAMPLE FORM

Date:

Project Name: Breakwater	Project No.: 0483-06	Well No.: MW-1
Field Personnel: Kyle, Gina	Static Water Level:	
Water Level Measurement Method:		
Time Start Purge: 9.05	Time End Purge: 15 min	Time Sampled: 9:20
Measuring Point Description: North corner, TOC		
Purge Method: Low flow	Purge Depth:	

Well Volume Calculation (Fill in before purging)	Total Depth (ft)	Depth to Water (ft)	Water Column (ft)	Multiplier for Casing Diameter (in) (Circle) d^2 .0406			Casing Volume (gal) L
	12.35	5.60	6.75				0.8262

Volume Purged (gal)	.027	.027	.0.27				
pH	7.16	7.20	7.15				
Temperature C.	13.2	13.2	13.2				
Conductivity uS/cm	1024	1010	1025				
Turbidity	clear	clear	clear				
Color	water	water	water				
Odor/Sheen	NO	NO	NO				
Number Volumes Removed	1	2	3				

Comments:

Percent Recovery:	Depth to Water at Sampling (ft):
Sampling Equipment:	

Sample No.	No. of Containers	Container Type	Preservative	Field Filtration	Analysis Request (Method)	Comments
[illegible]						
MW-1	3	VOA	HCl	NO		
MW-1	1	1 Lamber	NO	No		
MW 1	1	250 ml Poly	HNO_3	NO		

Total Discharge (gal):	Disposal Method:	Drum Designation(s)/Volume:

WELL HEAD CONDITIONS CHECKLIST (Circle YES or NO -- if NO, add comments)

Well Security Devices OK (Bollards, Christy Lid, Casing Lid and Lock): YES / (NO)

Inside of Well Head and Outer Casing Dry: YES / (NO)

Well Casing: (YES) / NO

Notes: _____

ECI MONITORING WELL PURGE AND SAMPLE FORM

Date:

Project Name: Breakwater	Project No.: 0483-06	Well No.: MW-2
Field Personnel: Kyle, Gina	Static Water Level:	
Water Level Measurement Method:		
Time Start Purge:	Time End Purge:	Time Sampled: 10:40
Measuring Point Description: North casing		
Purge Method: low flow	Purge Depth:	

Well Volume Calculation (Fill in before purging)	Total Depth (ft)	Depth to Water (ft)	Water Column (ft)	Multiplier for Casing Diameter (in) (Circle)			Casing Volume ~~(gal)~~ L
	10.40	5.93	4.47				0.55

Volume Purged (gal)	0.18	0.18	0.18				
pH	7.01	6.99	6.78				
Temperature C.	12.3	12.3	12.11				
Conductivity uS/cm	1621	1626	1540				
Turbidity	Clear	Clear	Clear				
Color	Water	Water	Water				
Odor/Sheen	None	None	None				
Number Volumes Removed	1	2	3				

Comments:

Percent Recovery:	Depth to Water at Sampling (ft):
Sampling Equipment:	

Sample No.	No. of Containers	Container Type	Preservative	Field Filtration	Analysis Request (Method)	Comments
MW-2	3	VOA	HCl	No		
MW-2	1	1L amber	None			
MW-2	1	250mL poly	HNO_3			

Total Discharge (gal): 0.55L | Disposal Method: drum | Drum Designation(s)/Volume: 2 55gals

WELL HEAD CONDITIONS CHECKLIST (Circle YES or NO -- if NO, add comments)

Well Security Devices OK (Bollards, Christy Lid, Casing Lid and Lock): (YES) / NO

Inside of Well Head and Outer Casing Dry: YES / (NO)

Well Casing: (YES) / NO

Notes: _____

ECI MONITORING WELL PURGE AND SAMPLE FORM

Date:

Project Name: Breakwater	Project No.: 0483-06	Well No.: MW-3
Field Personnel: Kyle, Gina	Static Water Level: 6.23	
Water Level Measurement Method:		
Time Start Purge:	Time End Purge:	Time Sampled: 10:55
Measuring Point Description: North well casing		
Purge Method: Low flow	Purge Depth:	

Well Volume Calculation (Fill in before purging)	Total Depth (ft)	Depth to Water (ft)	Water Column (ft)	Multiplier for Casing Diameter (in) (Circle)			Casing Volume (gal)
	11.8	6.23	5.57				0.69

Volume Purged (gal)	0.22	0.22	0.22				
pH	6.99	6.8	6.79				
Temperature C.	12.5	13.1	13.1				
Conductivity uS/cm	1307	1309	12.99				
Turbidity	Clear	clear	Clear				
Color	Water	Water	water				
Odor/Sheen	None	None	None				
Number Volumes Removed	1	2	3				

Comments:

Percent Recovery:	Depth to Water at Sampling (ft):
Sampling Equipment:	

Sample No.	No. of Containers	Container Type	Preservative	Field Filtration	Analysis Request (Method)	Comments
MW-3	3	VOA	HCl	No		
MW-3	1	1L amber	None			
MW-3	1	250mL poly	HNO_3			

Total Discharge (gal): 0.69	Disposal Method: Drums	Drum Designation(s)/Volume:

WELL HEAD CONDITIONS CHECKLIST (Circle YES or NO -- if NO, add comments)

Well Security Devices OK (Bollards, Christy Lid, Casing Lid and Lock): (YES) / NO

Inside of Well Head and Outer Casing Dry: YES / (NO)

Well Casing: (YES) / NO

Notes: _____

ECI MONITORING WELL PURGE AND SAMPLE FORM

Date:

Project Name: Breakwater	Project No.: 0403-06	Well No.: MW-4
Field Personnel: Kyle, Gina	Static Water Level: 5.85	
Water Level Measurement Method:		
Time Start Purge:	Time End Purge: 1500	Time Sampled: 10:15
Measuring Point Description:		
Purge Method:	Purge Depth:	

Well Volume Calculation (Fill in before purging)	Total Depth (ft)	Depth to Water (ft)	Water Column (ft)	Multiplier for Casing Diameter (in) (Circle)			Casing Volume (gal)
	9.94'	5.85'	4.09				0.50

Volume Purged (gal)	0.17	0.17	0.17				
pH	6.96	6.56	6.79				
Temperature C.	10.9	12.1	12.2				
Conductivity uS/cm	788	784	796				
Turbidity	Clear	clear	clear				
Color	water	water	water				
Odor/Sheen	None	none	none				
Number Volumes Removed	1	2	3				

Comments:

Percent Recovery:	Depth to Water at Sampling (ft):
Sampling Equipment:	

Sample No.	No. of Containers	Container Type	Preservative	Field Filtration	Analysis Request (Method)	Comments
FB						
MW-4	3	VOA	HCl	No		
MW-4	1	1L amber	none	1		
MW-4	1	250mL Poly	HNO_3			

Total Discharge (gal):	Disposal Method:	Drum Designation(s)/Volume:

WELL HEAD CONDITIONS CHECKLIST (Circle YES or NO -- if NO, add comments)

Well Security Devices OK (Bollards, Christy Lid, Casing Lid and Lock): (YES) / NO

Inside of Well Head and Outer Casing Dry: (YES) / NO

Well Casing: (YES) / NO

Notes: _____

ECI MONITORING WELL PURGE AND SAMPLE FORM

Date:

Project Name: Breakwater	Project No.: 0483-06	Well No.: MW-5
Field Personnel: Kyle Gina	Static Water Level: 5.28	
Water Level Measurement Method:		
Time Start Purge: 9:45	Time End Purge: 15min	Time Sampled: 10:00
Measuring Point Description:		
Purge Method:	Purge Depth:	

Well Volume Calculation (Fill in before purging)	Total Depth (ft)	Depth to Water (ft)	Water Column (ft)	Multiplier for Casing Diameter (in) (Circle)			Casing Volume (gal)
	10.79	5.28	5.51				0.67

Volume Purged (gal)	0.22	0.22	0.22				
pH	6.92	6.89	6.89				
Temperature C.	12.2	12.3	12.3				
Conductivity uS/cm	644	689	684				
Turbidity	clear	clear	clear				
Color	water	water	water				
Odor/Sheen	NO	NO	NO				
Number Volumes Removed	1	2	3				

Comments:

Percent Recovery:	Depth to Water at Sampling (ft):
Sampling Equipment:	

Sample No.	No. of Containers	Container Type	Preservative	Field Filtration	Analysis Request (Method)	Comments
MW-5	3	VOA	HCl	NO		
MW-5	1	1 Lamber	None	NO		
MW-5	1	250mL Poly	HNO_3	NO		

Total Discharge (gal):	Disposal Method:	Drum Designation(s)/Volume:

WELL HEAD CONDITIONS CHECKLIST (Circle YES or NO -- if NO, add comments)

Well Security Devices OK (Bollards, Christy Lid, Casing Lid and Lock): (YES) / NO

Inside of Well Head and Outer Casing Dry: (YES) / NO

Well Casing: (YES) / NO

Notes: _____

ECI MONITORING WELL PURGE AND SAMPLE FORM

Date:

Project Name: Breakwater	Project No.: 0483-06	Well No.: MW-6
Field Personnel: Kyle S. Gena M.	Static Water Level:	
Water Level Measurement Method:		
Time Start Purge:	Time End Purge: 15min	Time Sampled: 10:25
Measuring Point Description:		
Purge Method: Low flow	Purge Depth:	

Well Volume Calculation (Fill in before purging)	Total Depth (ft)	Depth to Water (ft)	Water Column (ft)	Multiplier for Casing Diameter (in) (Circle)			Casing Volume ~~(gal)~~ L
	8.00	5.40	2.6				0.83

Volume Purged (gal)	0.25	0.25	0.25				
pH	7.71	7.61	7.99				
Temperature C.	12.3	12.3	12.3				
Conductivity uS/cm	829	825	835				
Turbidity	Clear	clear	clear				
Color	Water	Water	Water				
Odor/Sheen	None	None	None				
Number Volumes Removed	1	2	3				

Comments:

Percent Recovery:	Depth to Water at Sampling (ft):
Sampling Equipment:	

Sample No.	No. of Containers	Container Type	Preservative	Field Filtration	Analysis Request (Method)	Comments
MW-6	3	VOA	HCl	No		
MW-6	1	1L amber	None	No		
MW-6	1	250mL poly	HNO_3	NO		

Total Discharge ~~(gal)~~: 6L	Disposal Method: Drum	Drum Designation(s)/Volume: 25gal

WELL HEAD CONDITIONS CHECKLIST (Circle YES or NO -- if NO, add comments)

Well Security Devices OK (Bollards, Christy Lid, Casing Lid and Lock): (YES) / NO

Inside of Well Head and Outer Casing Dry: (YES) / NO

Well Casing: (YES) / NO

Notes: _____