

April 21, 2014



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Submitted To:
City of Richland, Parks and Recreation
P.O. Box 190
2700 Duportail Street
Building 100, MS 6
Richland, Washington 99352

By:
Shannon & Wilson, Inc.
2705 St. Andrews Loop, Suite A
Pasco, Washington 99301

22-1-11288-001

April 21, 2014

City of Richland, Parks and Recreation
P.O. Box 190
2700 Duportail Street
Building 100, MS 6
Richland, Washington 99354

Attn: Mr. Phil Pinard

**RE: REMEDIAL INVESTIGATION, COLUMBIA PARK WEST MARINA, ECOLOGY
SITE 84244226, RICHLAND, WASHINGTON**

The attached report provides the results of a remedial investigation conducted at the Columbia Park West Marina in Richland, Washington. The investigation was performed at the request of the Washington Department of Ecology to evaluate the potential for petroleum products to have impacted soil and groundwater in the vicinity of removed underground fuel storage tanks.

Thank you for the opportunity to provide these services. Please contact us if you have questions, or would like further explanation of the materials or conclusions presented.

Respectfully submitted,

SHANNON & WILSON, INC.



Donna R. Parkes
Principal Environmental Specialist

DRP:SWG/drp

Enclosure: Remedial Investigation Report

TABLE OF CONTENTS

	Page
1.0 INTRODUCTION.....	1
1.1 Background Information	1
1.2 Physical Setting.....	3
1.2.1 Geology, Topography and Soils.....	3
1.2.2 Regional Groundwater	3
2.0 GROUNDWATER MONITORING WELL INSTALLATION AND SAMPLING	4
2.1 Well Construction	4
2.2 Soil Sampling and Analysis.....	4
2.3 Well Development	5
2.4 Groundwater Sampling and Analysis	5
2.5 Surveying	5
2.6 Groundwater Depth and Flow Direction	6
3.0 RESULTS OF LABORATORY ANALYSES	7
3.1 Soil Samples	7
3.2 Groundwater Samples	7
3.3 Investigation-derived Waste	7
4.0 FINDINGS AND CONCLUSIONS.....	7
5.0 CLOSURE	8
REFERENCES	9

TABLES

Table No.	
1	Soil Sample Identification, Depths and Analytical Results
2	Groundwater Sample Analytical Results

FIGURES

Figure No.	
1	Site Location Map
2	Site Plan and Monitoring Well Locations

APPENDICES

APPENDIX A	MONITORING WELL LOGS
APPENDIX B	LABORATORY REPORTS
APPENDIX C	IMPORTANT INFORMATION ABOUT YOUR ENVIRONMENTAL REPORT

**REMEDIAL INVESTIGATION
COLUMBIA PARK WEST MARINA
RICHLAND, WASHINGTON**

1.0 INTRODUCTION

This report describes a remedial investigation (RI) conducted by Shannon & Wilson, Inc. at the Columbia Park West Marina (Marina) on behalf of the City of Richland (City) and Mr. Lynne Koehler. The Washington Department of Ecology (Ecology) issued letters to the City and Mr. Koehler dated April 19, 2013 requiring that a RI be conducted to characterize potential impacts to subsurface soil and groundwater at the Marina site. The triggering event was the release of gasoline that was discovered during removal of two underground storage tanks (USTs) in 1994.

The site is identified in Ecology's records as Columbia Park Marina, Facility ID #84244226. It is located at 1776 Columbia Park Trail in Richland, Washington. The Marina is approximately 950 feet east of the Columbia Center Boulevard and Columbia Park Trail intersection. The site's location is shown on a vicinity map on Figure 1, and Figure 2 is a site plan.

1.1 Background Information

Shannon & Wilson reviewed previous reports and correspondence regarding the UST closure to obtain background information about the site. References are listed in Section 6.

The subject site is owned by the United States Army Corps of Engineers (Corps) and is adjacent to the Columbia River. The City leases the property, and previously subleased the Marina to Lynne Koehler. Mr. Koehler owned and operated The Boat Shop, which is no longer present.

According to a tank closure report (White Shield, 1994) two 1,000-gallon leaded gasoline USTs were removed from the site in April 1994. Based on drawings and descriptions in the report, the tanks and dispensers were located approximately 40 feet south of the Columbia River and west of the boat launch ramp. The estimated former UST and The Boat Shop locations are shown on Figure 2.

The 1994 report indicates that the two USTs were removed from a single basin that measured approximately 10 by 23 feet by 8 feet deep. A soil sample collected from approximately 8 feet below the ground surface (bgs) in the excavation had a concentration of 6,300 milligrams per kilogram (mg/kg) of gasoline range total petroleum hydrocarbons (TPH-G), and also had detections of benzene, toluene, ethylbenzene and xylenes (BTEX). A water sample collected from

within the tank basin had a TPH-G concentration of 39,000 micrograms per liter (µg/L). These detections exceeded the Model Toxics Control Act (MTCA) Method A cleanup levels.

The report indicates that cleanup actions were performed related to water and soil. Water remediation involved operating an aeration system in the tank basin, followed by pumping the standing water into barrels. A week later after the water recharged, another water sample was collected from the basin. TPH-G and BTEX were not detected in the second sample at greater than the laboratory test detection limits.

Soil remediation consisted of over-excavating approximately 7 cubic yards of soil from the basin base. A follow-up soil sample was collected from the base, and detected concentrations of TPH-G and/or BTEX were less than MTCA Method A cleanup levels that were current in 1994.

The following table summarizes laboratory results for two soil and two groundwater samples, which were reportedly representative of the pre- and post-remediation conditions. The tank closure report includes data on additional soil samples (White Shield, 1994).

Sample No. (date)	Sample Media/Type	TPH-G mg/kg	Benzene mg/kg	Toluene mg/kg	Ethylbenzene mg/kg	Xylenes mg/kg	Lead mg/kg
RHS-1094-301 (5/23/94)	Soil/Pre-remediation	6,300	12	302	105	637	NA
RHS-1094-302 (6/3/94)	Soil/Post-remediation	66	<0.1	0.27	0.25	4.1	NA
MTCA-A*		30**	0.03	7	6	9	250
Sample No. (date)	Sample Media/Type	TPH-G µg/L	Benzene µg/L	Toluene µg/L	Ethylbenzene µg/L	Xylenes µg/L	Lead µg/L
RHS-1094-150W (4/8/94)	Water/Pre-remediation	39,000	1,100	4,600	730	5,100	87
RHS-1094-350W (5/23/94)	Water/Post-remediation	<50	<1	<1	<1	<3	NA
MTCA-A*		800**	5	1,000	700	1,000	15

- mg/kg milligrams per kilogram
- µg/L micrograms per liter
- NA Not analyzed
- TPH-G Gasoline range total petroleum hydrocarbons
- MTCA-A Model Toxics Control Act Method A soil cleanup levels for unrestricted land uses, or cleanup levels for groundwater
- * Current MTCA Method A cleanup levels
- ** TPH-G cleanup level when benzene is detected OR the total of ethylbenzene, toluene and xylenes exceed 1% of the gasoline mixture; otherwise cleanup level is 100 mg/kg for soil; 1,000 µg/L for groundwater

1.2 Physical Setting

1.2.1 Geology, Topography and Soils

The Geologic Map of the Richland 1:100,000 Quadrangle maps the site as alluvium (Qa) of Holocene to Pleistocene age. The map describes the deposits as clay, silt, sand and gravel of varied thickness, sorting, and composition.

The site is adjacent to the south side of the Columbia River. The ground surface elevation at the site is approximately 352 feet above mean sea level based on elevations obtained by Stratton Surveying & Mapping for this project. The normal pool elevation in Lake Wallula (Columbia River) is 340 feet.

The Soil Conservation Service's (SCS) publication titled, "Soil Survey Benton County Area, Washington" indicates that the predominant soil types in the site area are Finley stony fine sandy loam and Pasco fine sandy loam. The Finley soils occur on old alluvial terraces and bottom lands, and Pasco soils developed in recent alluvium deposited in ponded areas.

Shannon & Wilson oversaw installation of groundwater monitoring wells for the current project. Soils encountered in the borings were gravelly or sandy silt overlying silt. Boring logs are in Appendix A.

1.2.2 Regional Groundwater

The UST closure report indicated that groundwater was encountered approximately 8 feet bgs in the UST excavation. Groundwater was encountered between 7 and 10 feet in the borings drilled for the current RI.

General information regarding groundwater depth and flow direction was researched and is summarized in this section. Additional information regarding site groundwater, based on monitoring wells installed as part of the current study, is included in Section 2.6.

Figure 26 in USGS Water Resources Investigations Report 96-4086 *Changes in Ground-Water Levels and Ground-Water Budgets, from Predevelopment to 1986, in Parts of the Pasco Basin, Washington* shows the water table altitude as of March 1986. The figure indicates that the water table elevation at the subject site was likely between 350 and 340 feet. Contours indicate a groundwater flow direction toward the north northeast.

Information from another publication, *Review of Water-Well Data from the Unconfined Aquifer in the Eastern and Southern Parts of the Pasco Basin* (Brown, 1979) indicates that the

water table elevation at or near the subject site was approximately 340 feet in 1979. Contours on Plate 8A also indicate a north northeasterly groundwater flow direction.

2.0 GROUNDWATER MONITORING WELL INSTALLATION AND SAMPLING

The objective of the current project is to evaluate soil and groundwater quality related to the apparent previous gasoline release. The project involved installation and sampling of three groundwater monitoring wells located upgradient and downgradient of the former USTs location.

Shannon & Wilson subcontracted with Environmental West Explorations (EWE) of Spokane, Washington to install three groundwater monitoring wells in the vicinity of the former USTs. Borings were made using an air rotary drill. Drilling and well construction occurred on February 25, 2014. Monitoring well logs are included in Appendix A.

Relative to the former tank basin, monitoring well MW-1 is located to the south, MW-2 is located northwest and MW-3 is located northeast. The well locations are shown on Figure 2.

2.1 Well Construction

Prior to mobilization, Shannon & Wilson notified the one-call public utility locate service to mark underground utilities at the site. We also utilized the services of a private locator.

An underground fuel line is present in the planned exploration area, but its route is unknown. The line is used to transfer gasoline from aboveground storage tanks (ASTs) to the boat dock. The line apparently does not have a tracer or other features that make locating it possible. Therefore, the potential for being too close to the fuel line was taken into account when selecting boring locations for MW-2 and MW-3. As a further precaution, the upper four feet of soil at the MW-2 location was evacuated with a vacuum truck prior to drilling.

Groundwater was encountered between 7 and 10 feet bgs during drilling. The three borings were completed as flush-mount, 2-inch-diameter, PVC-cased monitoring wells. Casing and screen sections have threaded connections. The 15-foot-deep wells have 10 feet of 20-slot screen between 5 and 15 feet bgs (Appendix A). Filter pack material around the screens is 10-20 silica sand, and seal material above the filter pack includes bentonite chips and concrete.

2.2 Soil Sampling and Analysis

Soil samples were collected with a split-spoon sampler at 5-foot intervals. Shannon & Wilson's representative logged the borings, observed the samples for indications of petroleum

contamination, and selected soil samples for analytical testing. Soil cuttings were containerized in labeled drums and left at the site.

Soil samples from MW-2 and MW-3 borings were submitted to an Ecology-accredited laboratory for analysis of gasoline range TPH; volatile constituents BTEX; and lead. The selected sample depths corresponded to the approximate groundwater interface.

Results of the analyses were used to characterize the containerized soil cuttings for disposal, and to evaluate whether or not gasoline contamination is present in soil at explored locations around the former USTs location.

2.3 Well Development

Shannon & Wilson personnel developed the wells on March 5, 2014. Methods included surging and bailing. Water from well development activities was placed in 5-gallon, covered buckets, which were labeled and left on site for later disposal.

2.4 Groundwater Sampling and Analysis

Shannon & Wilson's representative collected groundwater samples from the three wells on March 11, 2014. Monitoring and sampling activities, and the sequence, were as follows:

- Measure depth to groundwater using an electronic water level indicator (WLI); decontaminate WLI between wells.
- Purge standing water (at least three well volumes) from the well using a disposable bailer. Collect groundwater samples directly into laboratory-furnished bottles. Label bottles, log samples onto chain-of-custody form, and place sample bottles on ice in a cooler.
- Ship samples for overnight delivery to OnSite Environmental of Redmond, Washington. Samples were analyzed by the following methods: Northwest TPH (gasoline range) and BTEX (NWTPH-Gx/BTEX), and total lead by EPA Method 200.8.

Water samples from all of the wells were slightly to very turbid (460 to >1,000 nephelometric turbidity units [NTU]). The color was light brown, similar to the soil color observed during well installation. The sample from MW-2 had the highest turbidity of the three.

2.5 Surveying

Stratton Surveying & Mapping of Kennewick surveyed the well locations and elevations. Survey information is shown on the logs (Appendix A) and is summarized in the following table.

Features	MW-1	MW-2	MW-3
Latitude	46 14 16.799	46 14 18.161	46 14 18.065
Longitude	-119 13 09.939	-119 13 10.189	-119 13 09.339
Top of casing*	352.92	349.63	350.26
Monument rim*	353.26	350.09	350.63

* Measurement point is on the north side.
 Horizontal Datum: NAD 1983/91; degrees, minutes, and seconds
 Vertical Datum: NAVD 88, US; measurements are in feet.

2.6 Groundwater Depth and Flow Direction

During drilling, groundwater was encountered approximately 10 feet bgs at MW-1 and 7 to 8 feet bgs at MW-2 and MW-3. A summary of water elevations as measured on two dates subsequent to well installation is summarized in the following table.

	Well Identification		
	MW-1	MW-2	MW-3
Total Well Depth (measured)	14.8	14.15	13.4
Top of Casing Elevation	352.92	349.63	350.26
Depth to Water:			
02/26/2014	9.66	6.86	7.41
03/11/2014	8.93	5.63	6.19
Groundwater Elevation:			
02/26/2014	343.27	342.77	342.85
03/11/2014	343.99	344.00	344.07

Measurements and elevations are in feet.

On February 26, the water surface elevation was higher at the south well, indicating a groundwater flow direction toward the river, or toward the north. Figure 2 shows approximate groundwater elevation contours and the groundwater flow direction on February 26, 2014.

On March 11, the water surface elevation was higher at all of the wells, and was essentially flat across the site. This situation likely reflects a rising river water elevation, and a groundwater recharge condition rather than discharge. Based on the site’s close proximity to the Columbia River, groundwater elevations likely fluctuate according to river water elevations.

3.0 RESULTS OF LABORATORY ANALYSES

3.1 Soil Samples

Two soil samples from MW-2 and MW-3 collected near the groundwater interface were analyzed for gasoline range TPH and BTEX by Method NWTPH-Gx/BTEX and total lead by EPA Method 6010C. Petroleum constituents and lead were not detected at greater than the laboratory practical quantitation limits (PQLs). Results are summarized in Table 1 and compared to MTCA cleanup levels for unrestricted land uses. The laboratory report is included in Appendix B.

3.2 Groundwater Samples

Groundwater samples from the three wells were analyzed by the following methods: NWTPH-Gx/BTEX and total lead by EPA Method 200.8. Results are summarized in Table 2, and the laboratory report is included in Appendix B.

Petroleum constituents (gasoline range TPH and BTEX) were not detected in the samples at greater than the laboratory PQLs. Lead was detected in the samples at concentrations of 7.0, 11 and 71 micrograms per liter ($\mu\text{g/L}$) in samples from MW-3, MW-1, and MW-2, respectively. The MTCA Method A cleanup level for groundwater is 15 $\mu\text{g/L}$. Two of the results are less than this level, however, the sample from MW-2 at a concentration of 71 $\mu\text{g/L}$ exceeds this level.

3.3 Investigation-derived Waste

Contaminants of concern were not detected in the soil samples collected from the borings. Therefore, there are no specific disposal requirements for the soil (one 55-gallon drum). Likewise, wash water used to clean the downhole drill equipment may be disposed of as non-contaminated waste (two 55-gallon drums).

Petroleum constituents were not detected in the groundwater samples. Lead was detected at concentrations ranging from 7 to 71 $\mu\text{g/L}$. We compared the maximum detected concentration to Washington State Dangerous Waste Regulations criteria. The maximum concentration for the toxicity characteristic is 5,000 $\mu\text{g/L}$ for lead. Therefore, groundwater generated during well development and purging (stored in 5-gallon buckets) is not classified as a dangerous waste.

4.0 FINDINGS AND CONCLUSIONS

Soil and groundwater sampling conducted during the current RI in the vicinity and downgradient of the former USTs location did not detect residual petroleum product impacts to soil or groundwater.

Lead was detected in the groundwater sample from one downgradient well (MW-2) at a concentration that exceeds the MTCA Method A cleanup level of 15 µg/L. As indicated in Section 2.4, the water sample from MW-2 was very turbid. There is a potential that the lead concentration was elevated due to the presence of soil particulates in the sample.

The current RI scope includes a second groundwater sampling event to occur approximately six months after the initial sampling event. Shannon & Wilson recommends that the samples be analyzed for total and dissolved lead, to help determine if the initial findings were skewed by the presence of sediment in the water sample.

5.0 CLOSURE

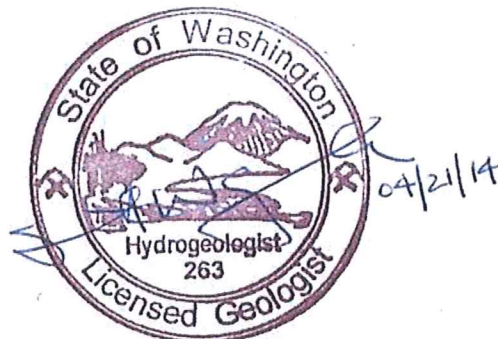
The data presented in this report are based on limited research at the site and should be considered representative at the time of our observations. Shannon & Wilson performed this work within its best judgment to adequately describe site conditions. Changes in the conditions of the site can occur with time from both natural processes and human activities. In addition, changes in governmental codes, regulations, or law may occur. Such changes are beyond our control, and should they occur, our observations and recommendations applicable to this facility may need to be revised wholly or in part.

This report was prepared for the use of the City of Richland, Mr. Lynne Koehler, and their representatives. Shannon & Wilson in no way guarantees that an agency or its staff will reach the same conclusions as Shannon & Wilson, Inc. Shannon & Wilson has prepared the attached "Important Information about Your Environmental Report" to assist you and others in understanding the use and limitations of our reports (Appendix C).

SHANNON & WILSON, INC.

Donna R. Parkes

Donna R. Parkes
Principal Environmental Specialist



SCOTT W. GAULKE

Scott W. Gaulke, PE, LHG
Vice President

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- Washington State Department of Ecology, Amended October 12, 2007, Model Toxics Control Act Cleanup Regulation, Chapter 173-340 WAC, Publication No. 94-06.
- Washington State Department of Ecology, Updated June 30, 2009, Dangerous Waste Regulations, Chapter 173-303 WAC, Publication No. 92-91.
- Washington State Department of Ecology, May 30, 2000, correspondence to Mr. Lynne Koehler RE: Voluntary Cleanup Review, The Boat Shop, 1238 Columbia Drive, Richland.
- Washington State Department of Ecology, November 17, 2009, correspondence to Mr. Lynne Koehler RE: Release of Hazardous Substance at the Columbia Park Marina located at 1776 Columbia Drive SE, Richland, Washington; Facility/Site ID #84244226.
- Washington State Department of Ecology, April 19, 2013, correspondence to City of Richland and to Mr. Lynne Koehler RE: A Reported Release of Hazardous Substances and Potential Liability for the Release.
- White Shield, Inc., June 27, 1994, *LUST Closure/Interim Cleanup Report, The Boat Shop WSDOE Site #009266, Richland, Washington.*

TABLE 1
SOIL SAMPLE IDENTIFICATION,
DEPTHS AND ANALYTICAL RESULTS in mg/kg

Boring ID	Sample No.	Approximate Sample Depth, ft.	TPH-G	Benzene	Toluene	Ethyl-benzene	Xylenes	Lead
MW-2	MW2-S-01	10	<10	<0.020	<0.10	<0.10	<0.10	<7.2
MW-3	MW3-S-01	9	<14	<0.028	<0.14	<0.14	<0.14	<7.6
MTCA Method A Cleanup Level			100	0.03	7	6	9	250

mg/kg milligrams per kilogram

Samples collected 2/25/2014

TPH-G gasoline range total petroleum hydrocarbons (Method NWTPH-Gx)

MTCA Method A Model Toxics Control Act Method A soil cleanup level for unrestricted land uses

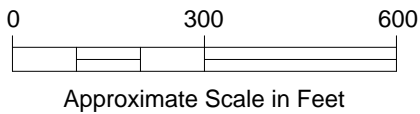
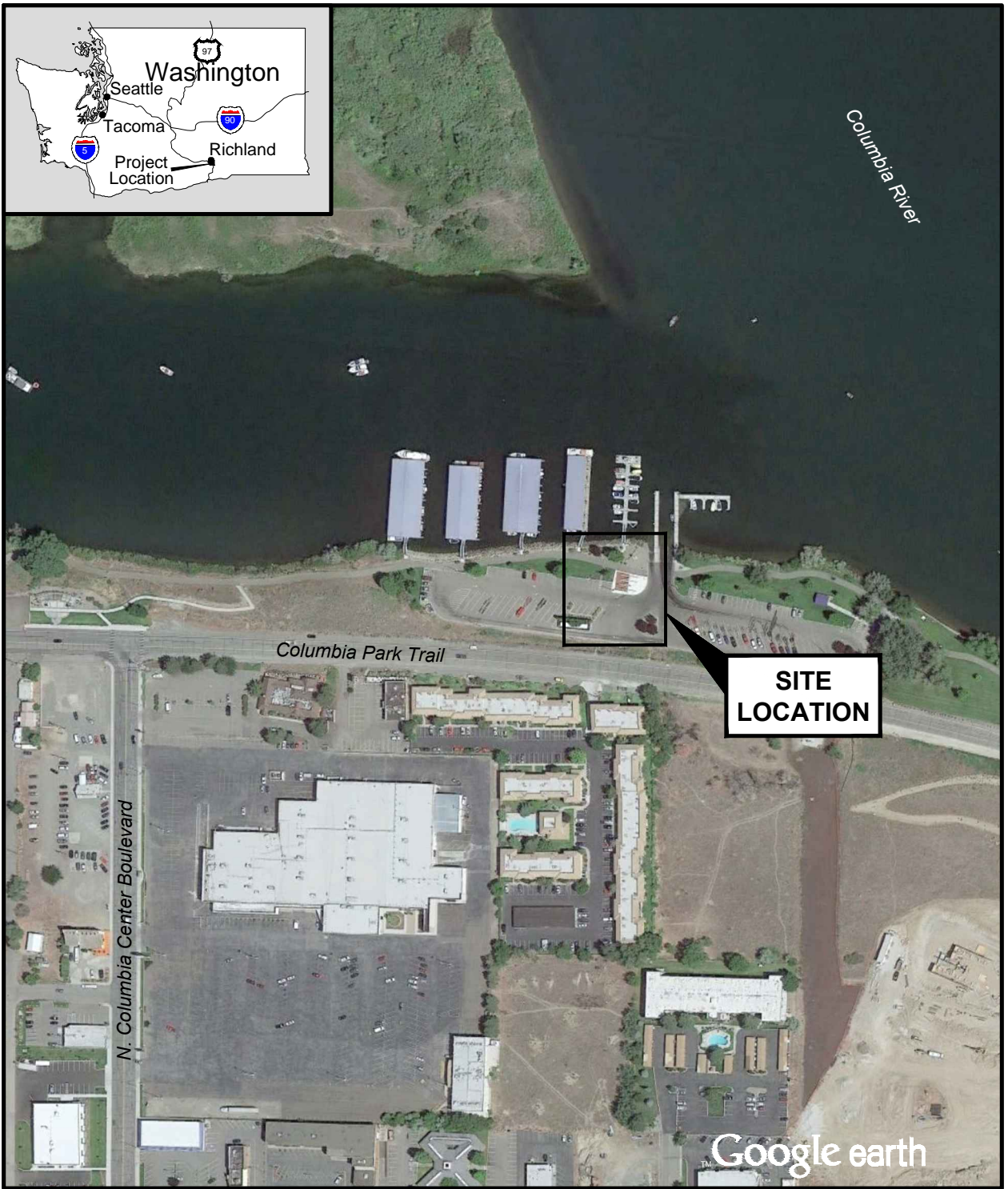
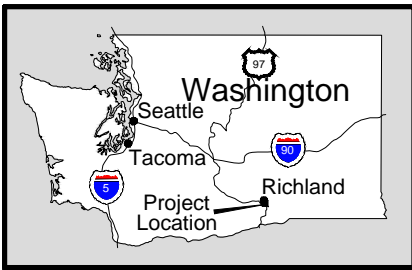
TABLE 2
GROUNDWATER SAMPLE ANALYTICAL RESULTS in µg/L

Monitoring Well	Sample No.	TPH-G	Benzene	Toluene	Ethyl-benzene	Xylenes	Lead
MW-1	CPWM-MW1-01	<100	<1.0	<1.0	<1.0	<1.0	11
MW-2	CPWM-MW2-01	<100	<1.0	<1.0	<1.0	<1.0	71
MW-3	CPWM-MW3-01	<100	<1.0	<1.0	<1.0	<1.0	7.0
MTCA Method A Cleanup Level		1,000	5	1,000	700	1,000	15

µg/L micrograms per liter

Samples collected 3/11/2014

MTCA Method A Model Toxics Control Act Method A cleanup levels for groundwater



NOTE

Map adapted from aerial imagery provided by Google Earth Pro, reproduced by permission granted by Google Earth™ Mapping Service.

Columbia Park West Marina
Richland, Washington

SITE LOCATION MAP

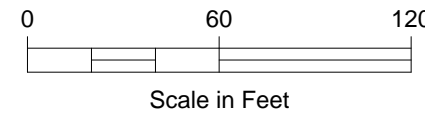
April 2014

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FIG. 1

Filename: J:\22\11288-00\22-1-11288-001 Fig 2.dwg Date: 04-01-2014 Login: lr



LEGEND

- MW-1** ⊕ Monitoring Well Designation and Approximate Location (Groundwater Elevation in Feet, 2-26-14)
- 342.8 — — Approximate Groundwater Elevation
- ← — — Approximate Groundwater Flow Direction

NOTE

This figure is adapted from *City of Richland Columbia Park West Parking Lot and Landscaping Improvements Site and Utility Plan*, dated June 1998.

Columbia Park West Marina
Richland, Washington

**SITE PLAN AND
MONITORING WELL LOCATIONS**

April 2014 22-1-11288-001

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 2

APPENDIX A
MONITORING WELL LOGS

Shannon & Wilson, Inc. (S&W), uses a soil identification system modified from the Unified Soil Classification System (USCS). Elements of the USCS and other definitions are provided on this and the following pages. Soil descriptions are based on visual-manual procedures (ASTM D2488) and laboratory testing procedures (ASTM D2487), if performed.

S&W INORGANIC SOIL CONSTITUENT DEFINITIONS

CONSTITUENT ²	FINE-GRAINED SOILS (50% or more fines) ¹	COARSE-GRAINED SOILS (less than 50% fines) ¹
Major	Silt, Lean Clay, Elastic Silt, or Fat Clay³	Sand or Gravel⁴
Modifying (Secondary) Precedes major constituent	30% or more coarse-grained: Sandy or Gravelly⁴	More than 12% fine-grained: Silty or Clayey³
Minor Follows major constituent	15% to 30% coarse-grained: with Sand or with Gravel⁴ 30% or more total coarse-grained and lesser coarse-grained constituent is 15% or more: with Sand or with Gravel⁵	5% to 12% fine-grained: with Silt or with Clay³ 15% or more of a second coarse-grained constituent: with Sand or with Gravel⁵

¹All percentages are by weight of total specimen passing a 3-inch sieve.
²The order of terms is: *Modifying Major with Minor*.
³Determined based on behavior.
⁴Determined based on which constituent comprises a larger percentage.
⁵Whichever is the lesser constituent.

MOISTURE CONTENT TERMS

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, from below water table

STANDARD PENETRATION TEST (SPT) SPECIFICATIONS

Hammer:	140 pounds with a 30-inch free fall. Rope on 6- to 10-inch-diam. cathead 2-1/4 rope turns, > 100 rpm
	NOTE: If automatic hammers are used, blow counts shown on boring logs should be adjusted to account for efficiency of hammer.
Sampler:	10 to 30 inches long Shoe I.D. = 1.375 inches Barrel I.D. = 1.5 inches Barrel O.D. = 2 inches
N-Value:	Sum blow counts for second and third 6-inch increments. Refusal: 50 blows for 6 inches or less; 10 blows for 0 inches.
	NOTE: Penetration resistances (N-values) shown on boring logs are as recorded in the field and have not been corrected for hammer efficiency, overburden, or other factors.

PARTICLE SIZE DEFINITIONS

DESCRIPTION	SIEVE NUMBER AND/OR APPROXIMATE SIZE
FINES	< #200 (0.075 mm = 0.003 in.)
SAND Fine Medium Coarse	#200 to #40 (0.075 to 0.4 mm; 0.003 to 0.02 in.) #40 to #10 (0.4 to 2 mm; 0.02 to 0.08 in.) #10 to #4 (2 to 4.75 mm; 0.08 to 0.187 in.)
GRAVEL Fine Coarse	#4 to 3/4 in. (4.75 to 19 mm; 0.187 to 0.75 in.) 3/4 to 3 in. (19 to 76 mm)
COBBLES	3 to 12 in. (76 to 305 mm)
BOULDERS	> 12 in. (305 mm)

RELATIVE DENSITY / CONSISTENCY

COHESIONLESS SOILS		COHESIVE SOILS	
N, SPT, BLOWS/FT.	RELATIVE DENSITY	N, SPT, BLOWS/FT.	RELATIVE CONSISTENCY
< 4	Very loose	< 2	Very soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium dense	4 - 8	Medium stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very dense	15 - 30	Very stiff
		> 30	Hard

WELL AND BACKFILL SYMBOLS

	Bentonite		Surface Cement Seal
	Cement Grout		Asphalt or Cap
	Bentonite Grout		Slough
	Bentonite Chips		Inclinometer or Non-perforated Casing
	Silica Sand		Vibrating Wire Piezometer
	Perforated or Screened Casing		

PERCENTAGES TERMS^{1,2}

Trace	< 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

¹Gravel, sand, and fines estimated by mass. Other constituents, such as organics, cobbles, and boulders, estimated by volume.

²Reprinted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.

Columbia Park West Marina
Richland, Washington

SOIL DESCRIPTION AND LOG KEY
















April 2014

22-1-112288-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-1
Sheet 1 of 3

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)
(Modified From USACE Tech Memo 3-357, ASTM D2487, and ASTM D2488)

MAJOR DIVISIONS			GROUP/GRAPHIC SYMBOL	TYPICAL IDENTIFICATIONS
COARSE-GRAINED SOILS (more than 50% retained on No. 200 sieve)	Gravels (more than 50% of coarse fraction retained on No. 4 sieve)	Gravel (less than 5% fines)	GW 	Well-Graded Gravel; Well-Graded Gravel with Sand
			GP 	Poorly Graded Gravel; Poorly Graded Gravel with Sand
		Silty or Clayey Gravel (more than 12% fines)	GM 	Silty Gravel; Silty Gravel with Sand
			GC 	Clayey Gravel; Clayey Gravel with Sand
	Sands (50% or more of coarse fraction passes the No. 4 sieve)	Sand (less than 5% fines)	SW 	Well-Graded Sand; Well-Graded Sand with Gravel
			SP 	Poorly Graded Sand; Poorly Graded Sand with Gravel
		Silty or Clayey Sand (more than 12% fines)	SM 	Silty Sand; Silty Sand with Gravel
			SC 	Clayey Sand; Clayey Sand with Gravel
FINE-GRAINED SOILS (50% or more passes the No. 200 sieve)	Silts and Clays (liquid limit less than 50)	Inorganic	ML 	Silt; Silt with Sand or Gravel; Sandy or Gravelly Silt
			CL 	Lean Clay; Lean Clay with Sand or Gravel; Sandy or Gravelly Lean Clay
		Organic	OL 	Organic Silt or Clay; Organic Silt or Clay with Sand or Gravel; Sandy or Gravelly Organic Silt or Clay
	Silts and Clays (liquid limit 50 or more)	Inorganic	MH 	Elastic Silt; Elastic Silt with Sand or Gravel; Sandy or Gravelly Elastic Silt
			CH 	Fat Clay; Fat Clay with Sand or Gravel; Sandy or Gravelly Fat Clay
		Organic	OH 	Organic Silt or Clay; Organic Silt or Clay with Sand or Gravel; Sandy or Gravelly Organic Silt or Clay
HIGHLY-ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor	PT 	Peat or other highly organic soils (see ASTM D4427)	

NOTE: No. 4 size = 4.75 mm = 0.187 in.; No. 200 size = 0.075 mm = 0.003 in.

NOTES

- Dual symbols (symbols separated by a hyphen, i.e., SP-SM, Sand with Silt) are used for soils with between 5% and 12% fines or when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart. Graphics shown on the logs for these soil types are a combination of the two graphic symbols (e.g., SP and SM).
- Borderline symbols (symbols separated by a slash, i.e., CL/ML, Lean Clay to Silt; SP-SM/SM, Sand with Silt to Silty Sand) indicate that the soil properties are close to the defining boundary between two groups.

Columbia Park West Marina
Richland, Washington

**SOIL DESCRIPTION
AND LOG KEY**

April 2014

22-1-112288-001

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FIG. A-1
Sheet 2 of 3

2013 BORING CLASS 22-1-112288 BORING & MW LOGS.GPJ SWNEW.GDT 4/2/14

GRADATION TERMS

Poorly Graded	Narrow range of grain sizes present or, within the range of grain sizes present, one or more sizes are missing (Gap Graded). Meets criteria in ASTM D2487, if tested.
Well-Graded	Full range and even distribution of grain sizes present. Meets criteria in ASTM D2487, if tested.

CEMENTATION TERMS¹

Weak	Crumbles or breaks with handling or slight finger pressure
Moderate	Crumbles or breaks with considerable finger pressure
Strong	Will not crumble or break with finger pressure

PLASTICITY²

DESCRIPTION	VISUAL-MANUAL CRITERIA	APPROX. PLASTICITY INDEX RANGE
Nonplastic	A 1/8-in. thread cannot be rolled at any water content.	< 4%
Low	A thread can barely be rolled and a lump cannot be formed when drier than the plastic limit.	4 to 10%
Medium	A thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. A lump crumbles when drier than the plastic limit.	10 to 20%
High	It take considerable time rolling and kneading to reach the plastic limit. A thread can be rerolled several times after reaching the plastic limit. A lump can be formed without crumbling when drier than the plastic limit.	> 20%

ADDITIONAL TERMS

Mottled	Irregular patches of different colors.
Bioturbated	Soil disturbance or mixing by plants or animals.
Diamict	Nonsorted sediment; sand and gravel in silt and/or clay matrix.
Cuttings	Material brought to surface by drilling.
Slough	Material that caved from sides of borehole.
Sheared	Disturbed texture, mix of strengths.

PARTICLE ANGULARITY AND SHAPE TERMS¹

Angular	Sharp edges and unpolished planar surfaces.
Subangular	Similar to angular, but with rounded edges.
Subrounded	Nearly planar sides with well-rounded edges.
Rounded	Smoothly curved sides with no edges.
Flat	Width/thickness ratio > 3.
Elongated	Length/width ratio > 3.

¹Reprinted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.

²Adapted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.

ACRONYMS AND ABBREVIATIONS

ATD	At Time of Drilling
approx.	Approximate/Approximately
Diam.	Diameter
Elev.	Elevation
ft.	Feet
FeO	Iron Oxide
gal.	Gallons
Horiz.	Horizontal
HSA	Hollow Stem Auger
I.D.	Inside Diameter
in.	Inches
lbs.	Pounds
MgO	Magnesium Oxide
mm	Millimeter
MnO	Manganese Oxide
NA	Not Applicable or Not Available
NP	Nonplastic
O.D.	Outside Diameter
OW	Observation Well
pcf	Pounds per Cubic Foot
PID	Photo-Ionization Detector
PMT	Pressuremeter Test
ppm	Parts per Million
psi	Pounds per Square Inch
PVC	Polyvinyl Chloride
rpm	Rotations per Minute
SPT	Standard Penetration Test
USCS	Unified Soil Classification System
q _u	Unconfined Compressive Strength
VWP	Vibrating Wire Piezometer
Vert.	Vertical
WOH	Weight of Hammer
WOR	Weight of Rods
Wt.	Weight

STRUCTURE TERMS¹

Interbedded	Alternating layers of varying material or color with layers at least 1/4-inch thick; singular: bed.
Laminated	Alternating layers of varying material or color with layers less than 1/4-inch thick; singular: lamination.
Fissured	Breaks along definite planes or fractures with little resistance.
Slickensided	Fracture planes appear polished or glossy; sometimes striated.
Blocky	Cohesive soil that can be broken down into small angular lumps that resist further breakdown.
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay.
Homogeneous	Same color and appearance throughout.

Columbia Park West Marina
Richland, Washington

SOIL DESCRIPTION AND LOG KEY

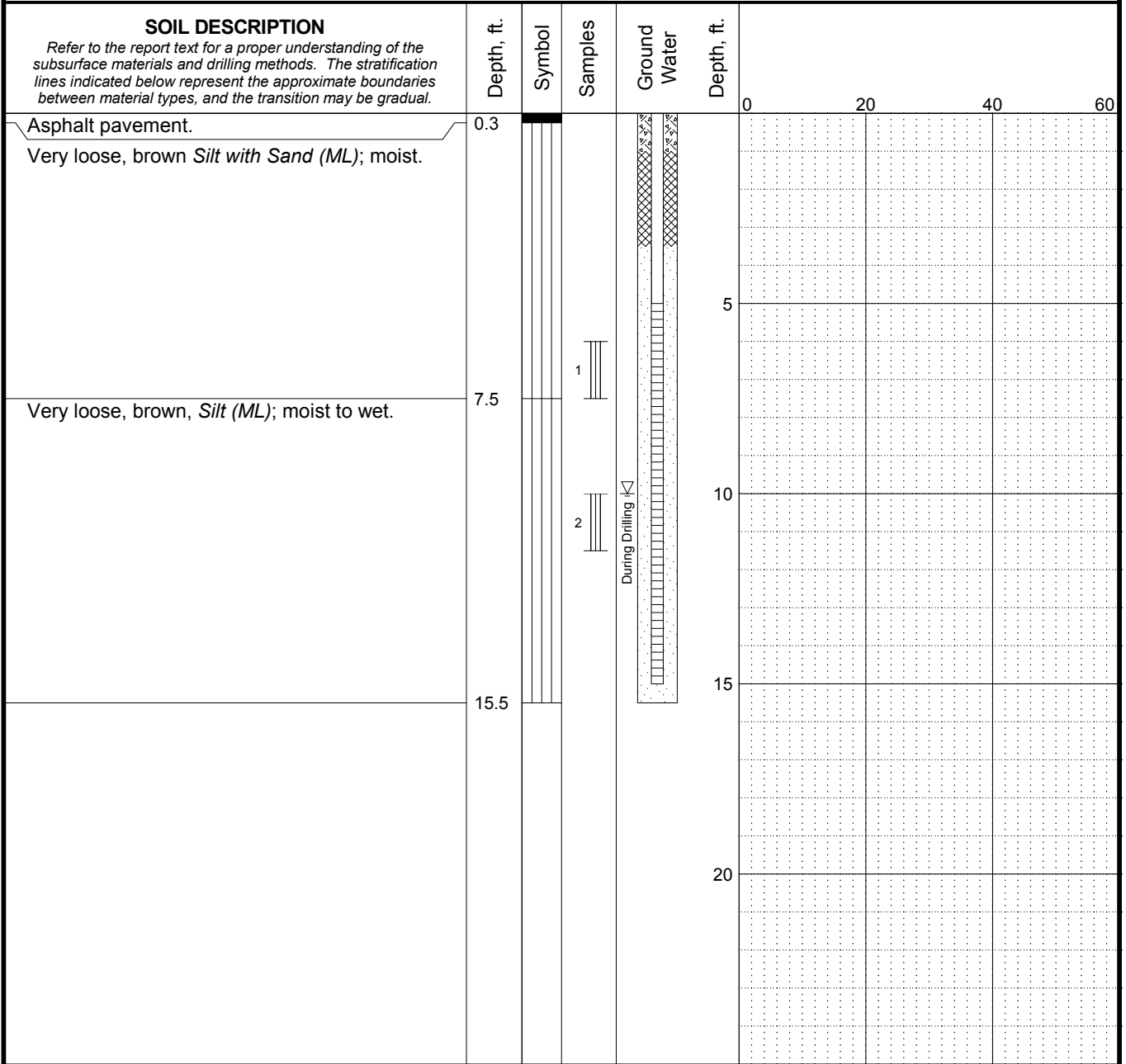
April 2014

22-1-112288-001

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FIG. A-1
Sheet 3 of 3

Total Depth: 15.5 ft. Latitude: 46° 14' 16.799" Drilling Method: Air Rotary Hole Diam.: _____
 Top Elevation: ~ 353.26 ft. Longitude: -119° 13' 09.939" Drilling Company: EWE Rod Diam.: _____
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: B-80 Mobile Hammer Type: _____
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



- LEGEND**
- * Sample Not Recovered
 - III 3" O.D. Split Spoon Sample
 - [Grid] Piezometer Screen and Sand Filter
 - [Diagonal Lines] Bentonite-Cement Grout
 - [Cross-hatch] Bentonite Chips/Pellets
 - [Wavy Lines] Bentonite Grout
 - ∇ Ground Water Level ATD
 - ◇ % Fines (<0.075mm)
 - % Water Content

- NOTES**
1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
 2. Groundwater level, if indicated above, is for the date specified and may vary.
 3. USCS designation is based on visual-manual classification and selected lab testing.

Columbia Park West Marina
Richland, Washington

LOG OF MONITORING WELL MW-1

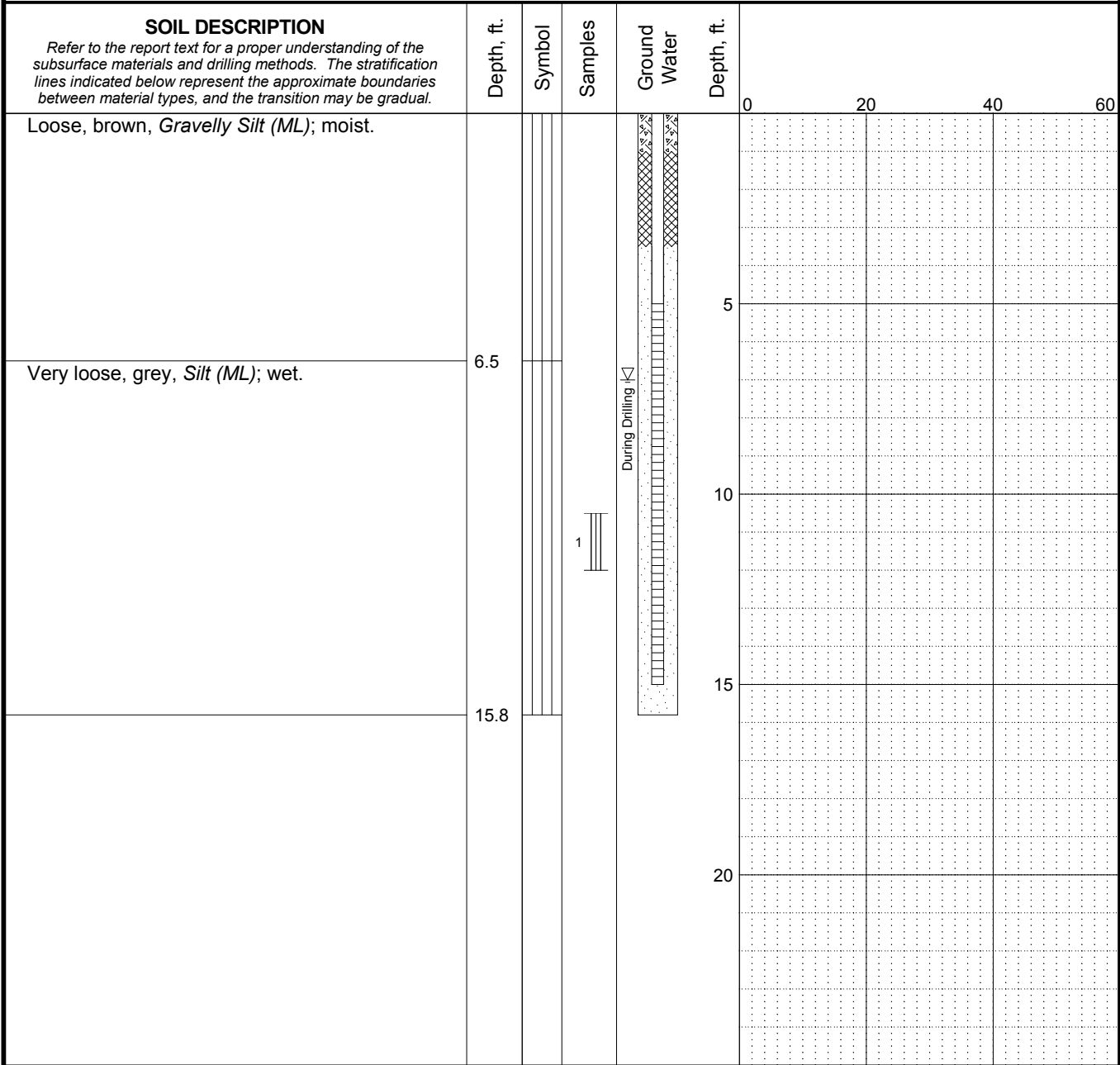
April 2014 22-1-112288-001

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FIG. A-2

MASTER LOG E 22-1-112288 BORING & MW LOGS.GPJ SHAN V1103.DWG 3/14/14 Rev: DRP Typ: CVM

Total Depth: 15.8 ft. Latitude: 46° 14' 18.161" Drilling Method: Air Rotary Hole Diam.: _____
 Top Elevation: ~ 350.09 ft. Longitude: -119° 13' 10.189" Drilling Company: EWE Rod Diam.: _____
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: B-80 Mobile Hammer Type: _____
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



MASTER LOG E 22-1-112288 BORING & MW LOGS.GPJ SHAN V1003DT 4/13/16 Rev. Typ:

LEGEND

- * Sample Not Recovered
- III 3" O.D. Split Spoon Sample
- Piezometer Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Ground Water Level ATD
- % Fines (<0.075mm)
- % Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

Columbia Park West Marina
Richland, Washington

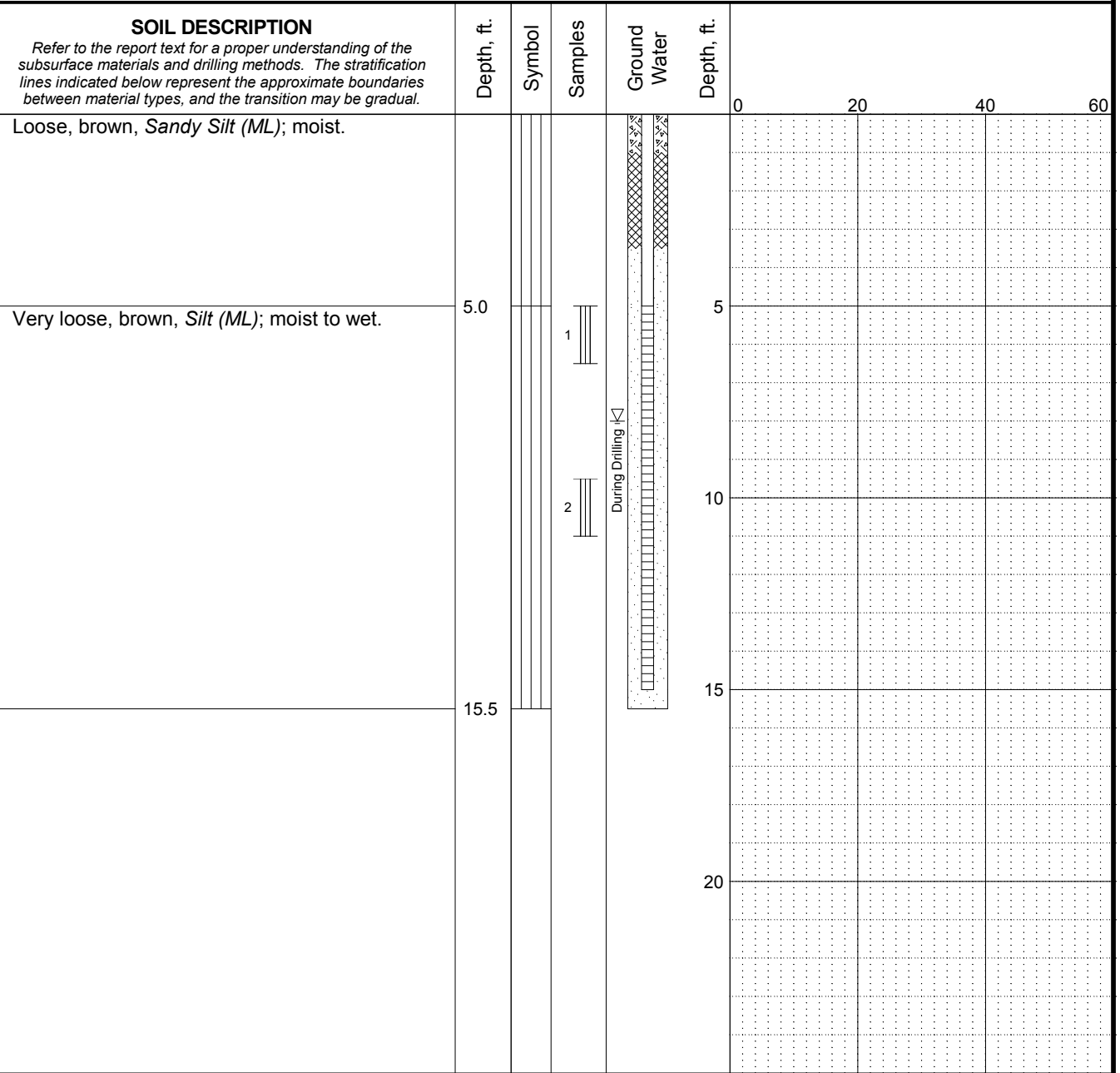
LOG OF MONITORING WELL MW-2

April 2014 22-1-112288-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-3

Total Depth: 15.5 ft. Latitude: 46° 14' 18.065" Drilling Method: Air Rotary Hole Diam.: _____
 Top Elevation: ~ 350.63 ft. Longitude: -119° 13' 09.339" Drilling Company: EWE Rod Diam.: _____
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: B-80 Mobile Hammer Type: _____
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



- LEGEND**
- * Sample Not Recovered
 - III 3" O.D. Split Spoon Sample
 - [Grid Symbol] Piezometer Screen and Sand Filter
 - [Diagonal Lines] Bentonite-Cement Grout
 - [Cross-hatch] Bentonite Chips/Pellets
 - [Diagonal Lines] Bentonite Grout
 - ▽ Ground Water Level ATD
 - ◇ % Fines (<0.075mm)
 - % Water Content

- NOTES**
1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
 2. Groundwater level, if indicated above, is for the date specified and may vary.
 3. USCS designation is based on visual-manual classification and selected lab testing.

Columbia Park West Marina
Richland, Washington

LOG OF MONITORING WELL MW-3

April 2014 22-1-112288-001

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FIG. A-4

MASTER LOG E 22-1-112288 BORING & MW LOGS.GPJ SHAN V1003DT 4/13/16 Rev. Typ:

APPENDIX B
LABORATORY REPORTS



14648 NE 95th Street, Redmond, WA 98052 • (425) 883-3881

March 7, 2014

Donna Parkes
Shannon & Wilson, Inc.
2705 Saint Andrews Loop, Suite A
Pasco, WA 99301

Re: Analytical Data for Project 22-1-11288
Laboratory Reference No. 1402-209

Dear Donna:

Enclosed are the analytical results and associated quality control data for samples submitted on February 27, 2014.

The standard policy of OnSite Environmental, Inc. is to store your samples for 30 days from the date of receipt. If you require longer storage, please contact the laboratory.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning the data, or need additional information, please feel free to call me.

Sincerely,

A handwritten signature in black ink, appearing to read "DB", with a long horizontal flourish extending to the right.

David Baumeister
Project Manager

Enclosures

Date of Report: March 7, 2014
Samples Submitted: February 27, 2014
Laboratory Reference: 1402-209
Project: 22-1-11288

Case Narrative

Samples were collected on February 25, 2014 and received by the laboratory on February 27, 2014. They were maintained at the laboratory at a temperature of 2°C to 6°C.

General QA/QC issues associated with the analytical data enclosed in this laboratory report will be indicated with a reference to a comment or explanation on the Data Qualifier page. More complex and involved QA/QC issues will be discussed in detail below.

NWTPH Gx/BTEX Analysis

Per EPA Method 5035A, samples were received by the laboratory in pre-weighed 40 mL VOA vials within 48 hours of sample collection. They were stored in a freezer at between -7°C and -20°C until extraction or analysis.

Any other QA/QC issues associated with this extraction and analysis will be indicated with a footnote reference and discussed in detail on the Data Qualifier page.

Date of Report: March 7, 2014
 Samples Submitted: February 27, 2014
 Laboratory Reference: 1402-209
 Project: 22-1-11288

NWTPH-Gx/BTEX

Matrix: Soil
 Units: mg/kg (ppm)

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	MW2-S-1					
Laboratory ID:	02-209-01					
Benzene	ND	0.020	EPA 8021B	2-28-14	2-28-14	
Toluene	ND	0.10	EPA 8021B	2-28-14	2-28-14	
Ethyl Benzene	ND	0.10	EPA 8021B	2-28-14	2-28-14	
m,p-Xylene	ND	0.10	EPA 8021B	2-28-14	2-28-14	
o-Xylene	ND	0.10	EPA 8021B	2-28-14	2-28-14	
Gasoline	ND	10	NWTPH-Gx	2-28-14	2-28-14	
<i>Surrogate:</i>	<i>Percent Recovery</i>	<i>Control Limits</i>				
<i>Fluorobenzene</i>	<i>108</i>	<i>71-121</i>				
Client ID:	MW3-S-1					
Laboratory ID:	02-209-02					
Benzene	ND	0.028	EPA 8021B	2-28-14	2-28-14	
Toluene	ND	0.14	EPA 8021B	2-28-14	2-28-14	
Ethyl Benzene	ND	0.14	EPA 8021B	2-28-14	2-28-14	
m,p-Xylene	ND	0.14	EPA 8021B	2-28-14	2-28-14	
o-Xylene	ND	0.14	EPA 8021B	2-28-14	2-28-14	
Gasoline	ND	14	NWTPH-Gx	2-28-14	2-28-14	
<i>Surrogate:</i>	<i>Percent Recovery</i>	<i>Control Limits</i>				
<i>Fluorobenzene</i>	<i>101</i>	<i>71-121</i>				

Date of Report: March 7, 2014
 Samples Submitted: February 27, 2014
 Laboratory Reference: 1402-209
 Project: 22-1-11288

**NWTPH-Gx/BTEX
 QUALITY CONTROL**

Matrix: Soil
 Units: mg/kg (ppm)

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
METHOD BLANK						
Laboratory ID:	MB0228S1					
Benzene	ND	0.020	EPA 8021B	2-28-14	2-28-14	
Toluene	ND	0.050	EPA 8021B	2-28-14	2-28-14	
Ethyl Benzene	ND	0.050	EPA 8021B	2-28-14	2-28-14	
m,p-Xylene	ND	0.050	EPA 8021B	2-28-14	2-28-14	
o-Xylene	ND	0.050	EPA 8021B	2-28-14	2-28-14	
Gasoline	ND	5.0	NWTPH-Gx	2-28-14	2-28-14	
<i>Surrogate:</i>	<i>Percent Recovery</i>	<i>Control Limits</i>				
<i>Fluorobenzene</i>	91	71-121				

Analyte	Result	Spike Level	Source Result	Percent Recovery	Recovery Limits	RPD	RPD Limit	Flags
DUPLICATE								
Laboratory ID:	02-222-01							
	ORIG	DUP						
Benzene	ND	ND	NA	NA	NA	NA	NA	30
Toluene	ND	ND	NA	NA	NA	NA	NA	30
Ethyl Benzene	ND	ND	NA	NA	NA	NA	NA	30
m,p-Xylene	ND	ND	NA	NA	NA	NA	NA	30
o-Xylene	ND	ND	NA	NA	NA	NA	NA	30
Gasoline	ND	ND	NA	NA	NA	NA	NA	30
<i>Surrogate:</i>								
<i>Fluorobenzene</i>				91	84	71-121		

SPIKE BLANKS

Laboratory ID:	SB0228S1								
	SB	SBD	SB	SBD	SB	SBD			
Benzene	1.02	1.08	1.00	1.00	102	108	73-121	6	10
Toluene	1.02	1.08	1.00	1.00	102	108	75-124	6	10
Ethyl Benzene	1.03	1.09	1.00	1.00	103	109	75-125	6	9
m,p-Xylene	1.04	1.10	1.00	1.00	104	110	75-126	6	9
o-Xylene	1.03	1.10	1.00	1.00	103	110	74-123	7	8
<i>Surrogate:</i>									
<i>Fluorobenzene</i>					91	93	71-121		

Date of Report: March 7, 2014
 Samples Submitted: February 27, 2014
 Laboratory Reference: 1402-209
 Project: 22-1-11288

**TOTAL LEAD
 EPA 6010C**

Matrix: Soil
 Units: mg/kg (ppm)

Analyte	Result	PQL	EPA Method	Date Prepared	Date Analyzed	Flags
Lab ID:	02-209-01					
Client ID:	MW2-S-1					
Lead	ND	7.2	6010C	2-28-14	2-28-14	
Lab ID:	02-209-02					
Client ID:	MW3-S-1					
Lead	ND	7.6	6010C	2-28-14	2-28-14	

Date of Report: March 7, 2014
Samples Submitted: February 27, 2014
Laboratory Reference: 1402-209
Project: 22-1-11288

**TOTAL LEAD
EPA 6010C
METHOD BLANK QUALITY CONTROL**

Date Extracted: 2-28-14
Date Analyzed: 2-28-14

Matrix: Soil
Units: mg/kg (ppm)

Lab ID: MB0228SM1

Analyte	Method	Result	PQL
Lead	6010C	ND	5.0

Date of Report: March 7, 2014
Samples Submitted: February 27, 2014
Laboratory Reference: 1402-209
Project: 22-1-11288

**TOTAL LEAD
EPA 6010C
DUPLICATE QUALITY CONTROL**

Date Extracted: 2-28-14

Date Analyzed: 2-28-14

Matrix: Soil

Units: mg/kg (ppm)

Lab ID: 02-222-01

Analyte	Sample Result	Duplicate Result	RPD	PQL	Flags
Lead	5.75	5.05	13	5.0	

Date of Report: March 7, 2014
Samples Submitted: February 27, 2014
Laboratory Reference: 1402-209
Project: 22-1-11288

**TOTAL LEAD
EPA 6010C
MS/MSD QUALITY CONTROL**

Date Extracted: 2-28-14

Date Analyzed: 2-28-14

Matrix: Soil

Units: mg/kg (ppm)

Lab ID: 02-222-01

Analyte	Spike Level	MS	Percent Recovery	MSD	Percent Recovery	RPD	Flags
Lead	250	236	92	240	94	2	

Date of Report: March 7, 2014
Samples Submitted: February 27, 2014
Laboratory Reference: 1402-209
Project: 22-1-11288

% MOISTURE

Date Analyzed: 2-28-14

Client ID	Lab ID	% Moisture
MW2-S-1	02-209-01	31
MW3-S-1	02-209-02	34



Data Qualifiers and Abbreviations

- A - Due to a high sample concentration, the amount spiked is insufficient for meaningful MS/MSD recovery data.
 - B - The analyte indicated was also found in the blank sample.
 - C - The duplicate RPD is outside control limits due to high result variability when analyte concentrations are within five times the quantitation limit.
 - E - The value reported exceeds the quantitation range and is an estimate.
 - F - Surrogate recovery data is not available due to the high concentration of coeluting target compounds.
 - H - The analyte indicated is a common laboratory solvent and may have been introduced during sample preparation, and be impacting the sample result.
 - I - Compound recovery is outside of the control limits.
 - J - The value reported was below the practical quantitation limit. The value is an estimate.
 - K - Sample duplicate RPD is outside control limits due to sample inhomogeneity. The sample was re-extracted and re-analyzed with similar results.
 - L - The RPD is outside of the control limits.
 - M - Hydrocarbons in the gasoline range are impacting the diesel range result.
 - M1 - Hydrocarbons in the gasoline range (toluene-naphthalene) are present in the sample.
 - N - Hydrocarbons in the lube oil range are impacting the diesel range result.
 - N1 - Hydrocarbons in diesel range are impacting lube oil range results.
 - O - Hydrocarbons indicative of heavier fuels are present in the sample and are impacting the gasoline result.
 - P - The RPD of the detected concentrations between the two columns is greater than 40.
 - Q - Surrogate recovery is outside of the control limits.
 - S - Surrogate recovery data is not available due to the necessary dilution of the sample.
 - T - The sample chromatogram is not similar to a typical _____.
 - U - The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
 - U1 - The practical quantitation limit is elevated due to interferences present in the sample.
 - V - Matrix Spike/Matrix Spike Duplicate recoveries are outside control limits due to matrix effects.
 - W - Matrix Spike/Matrix Spike Duplicate RPD are outside control limits due to matrix effects.
 - X - Sample extract treated with a mercury cleanup procedure.
 - X1 - Sample extract treated with a Sulfuric acid/Silica gel cleanup procedure.
 - Y - The calibration verification for this analyte exceeded the 20% drift specified in method 8260C, and therefore the reported result should be considered an estimate. The overall performance of the calibration verification standard met the acceptance criteria of the method.
 - Z -
- ND - Not Detected at PQL
 PQL - Practical Quantitation Limit
 RPD - Relative Percent Difference

Chain of Custody

Laboratory Number: **02-209**

Company: Shannon + Wilson, Pasco
 Project Number: 22-1-112-88
 Project Name: Columbia Park West Marina
 Project Manager: D. Parkes
 Sampled by: D. Parkes

Turnaround Request (in working days)

(Check One)
 Same Day 1 Day
 2 Days 3 Days
 Standard (7 Days) (TPH analysis 5 Days)
 _____ (other)

Number of Containers

Date Sampled	Time Sampled	Matrix
2/25/14	12:40	Soil
2/25/14	2:55	"

Lab ID	Sample Identification	NWTPH-HCID	NWTPH-GX/BTEX	NWTPH-GX	NWTPH-DX	Volatiles 8260C	Halogenated Volatiles 8260C	Semivolatiles 8270D/SIM (with low-level PAHs)	PAHs 8270D/SIM (low-level)	PCBs 8082A	Organochlorine Pesticides 8081B	Organophosphorus Pesticides 8270D/SIM	Chlorinated Acid Herbicides 8151A	Total RCRA Metals/ MTCRA Metals (circle one)	TCLP Metals	HEM (oil and grease) 1664A	Total lead	% Moisture
1	mw2-5-1	X															X	
2	mw3-5-1	X															X	

Signature	Company	Date	Time	Comments/Special Instructions
	Donna Parkes	2/25/14	10:30	
	D. Parkes	2/27/14	1000	
Relinquished				
Received				
Relinquished				
Received				
Relinquished				
Received				
Reviewed/Date				Chromatograms with final report <input type="checkbox"/>



14648 NE 95th Street, Redmond, WA 98052 • (425) 883-3881

March 20, 2014

Donna Parkes
Shannon & Wilson, Inc.
2705 Saint Andrews Loop, Suite A
Pasco, WA 99301

Re: Analytical Data for Project 22-1-11288-001
Laboratory Reference No. 1403-077

Dear Donna:

Enclosed are the analytical results and associated quality control data for samples submitted on March 12, 2014.

The standard policy of OnSite Environmental, Inc. is to store your samples for 30 days from the date of receipt. If you require longer storage, please contact the laboratory.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning the data, or need additional information, please feel free to call me.

Sincerely,

A handwritten signature in black ink, appearing to read "D. Baumeister", with a long horizontal flourish extending to the right.

David Baumeister
Project Manager

Enclosures

Date of Report: March 20, 2014
Samples Submitted: March 12, 2014
Laboratory Reference: 1403-077
Project: 22-1-11288-001

Case Narrative

Samples were collected on March 11, 2014 and received by the laboratory on March 12, 2014. They were maintained at the laboratory at a temperature of 2°C to 6°C.

General QA/QC issues associated with the analytical data enclosed in this laboratory report will be indicated with a reference to a comment or explanation on the Data Qualifier page. More complex and involved QA/QC issues will be discussed in detail below.

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NWTPH-Gx/BTEX

Matrix: Water
 Units: ug/L (ppb)

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	CPWM-MW1-01					
Laboratory ID:	03-077-01					
Benzene	ND	1.0	EPA 8021B	3-12-14	3-12-14	
Toluene	ND	1.0	EPA 8021B	3-12-14	3-12-14	
Ethyl Benzene	ND	1.0	EPA 8021B	3-12-14	3-12-14	
m,p-Xylene	ND	1.0	EPA 8021B	3-12-14	3-12-14	
o-Xylene	ND	1.0	EPA 8021B	3-12-14	3-12-14	
Gasoline	ND	100	NWTPH-Gx	3-12-14	3-12-14	
<i>Surrogate:</i>	<i>Percent Recovery</i>	<i>Control Limits</i>				
<i>Fluorobenzene</i>	93	71-112				
Client ID:	CPWM-MW2-01					
Laboratory ID:	03-077-02					
Benzene	ND	1.0	EPA 8021B	3-12-14	3-12-14	
Toluene	ND	1.0	EPA 8021B	3-12-14	3-12-14	
Ethyl Benzene	ND	1.0	EPA 8021B	3-12-14	3-12-14	
m,p-Xylene	ND	1.0	EPA 8021B	3-12-14	3-12-14	
o-Xylene	ND	1.0	EPA 8021B	3-12-14	3-12-14	
Gasoline	ND	100	NWTPH-Gx	3-12-14	3-12-14	
<i>Surrogate:</i>	<i>Percent Recovery</i>	<i>Control Limits</i>				
<i>Fluorobenzene</i>	92	71-112				
Client ID:	CPWM-MW3-01					
Laboratory ID:	03-077-03					
Benzene	ND	1.0	EPA 8021B	3-12-14	3-12-14	
Toluene	ND	1.0	EPA 8021B	3-12-14	3-12-14	
Ethyl Benzene	ND	1.0	EPA 8021B	3-12-14	3-12-14	
m,p-Xylene	ND	1.0	EPA 8021B	3-12-14	3-12-14	
o-Xylene	ND	1.0	EPA 8021B	3-12-14	3-12-14	
Gasoline	ND	100	NWTPH-Gx	3-12-14	3-12-14	
<i>Surrogate:</i>	<i>Percent Recovery</i>	<i>Control Limits</i>				
<i>Fluorobenzene</i>	92	71-112				

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**NWTPH-Gx/BTEX
 QUALITY CONTROL**

Matrix: Water
 Units: ug/L (ppb)

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
METHOD BLANK						
Laboratory ID:	MB0312W1					
Benzene	ND	1.0	EPA 8021B	3-12-14	3-12-14	
Toluene	ND	1.0	EPA 8021B	3-12-14	3-12-14	
Ethyl Benzene	ND	1.0	EPA 8021B	3-12-14	3-12-14	
m,p-Xylene	ND	1.0	EPA 8021B	3-12-14	3-12-14	
o-Xylene	ND	1.0	EPA 8021B	3-12-14	3-12-14	
Gasoline	ND	100	NWTPH-Gx	3-12-14	3-12-14	
<i>Surrogate:</i>	<i>Percent Recovery</i>	<i>Control Limits</i>				
<i>Fluorobenzene</i>	93	71-112				

Analyte	Result	Spike Level	Source Result	Percent Recovery	Recovery Limits	RPD	RPD Limit	Flags
DUPLICATE								
Laboratory ID:	03-077-01							
	ORIG	DUP						
Benzene	ND	ND	NA	NA	NA	NA	NA	30
Toluene	ND	ND	NA	NA	NA	NA	NA	30
Ethyl Benzene	ND	ND	NA	NA	NA	NA	NA	30
m,p-Xylene	ND	ND	NA	NA	NA	NA	NA	30
o-Xylene	ND	ND	NA	NA	NA	NA	NA	30
Gasoline	ND	ND	NA	NA	NA	NA	NA	30
<i>Surrogate:</i>								
<i>Fluorobenzene</i>				93	92	71-112		

MATRIX SPIKES

Laboratory ID:	03-077-01									
	MS	MSD	MS	MSD	MS	MSD				
Benzene	51.6	53.9	50.0	50.0	ND	103	108	78-120	4	12
Toluene	51.4	53.6	50.0	50.0	ND	103	107	80-121	4	12
Ethyl Benzene	50.8	53.0	50.0	50.0	ND	102	106	81-120	4	13
m,p-Xylene	50.8	52.8	50.0	50.0	ND	102	106	81-119	4	13
o-Xylene	50.8	52.9	50.0	50.0	ND	102	106	79-117	4	13
<i>Surrogate:</i>										
<i>Fluorobenzene</i>						89	96	71-112		

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**TOTAL LEAD
 EPA 200.8**

Matrix: Water
 Units: ug/L (ppb)

Analyte	Result	PQL	EPA Method	Date Prepared	Date Analyzed	Flags
Lab ID:	03-077-01					
Client ID:	CPWM-MW1-01					
Lead	11	1.0	200.8	3-17-14	3-17-14	
Lab ID:	03-077-02					
Client ID:	CPWM-MW2-01					
Lead	71	1.0	200.8	3-17-14	3-17-14	
Lab ID:	03-077-03					
Client ID:	CPWM-MW3-01					
Lead	7.0	1.0	200.8	3-17-14	3-17-14	

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**TOTAL LEAD
EPA 200.8
METHOD BLANK QUALITY CONTROL**

Date Extracted: 3-17-14
Date Analyzed: 3-17-14

Matrix: Water
Units: ug/L (ppb)

Lab ID: MB0317WH1

Analyte	Method	Result	PQL
Lead	200.8	ND	1.0

Date of Report: March 20, 2014
Samples Submitted: March 12, 2014
Laboratory Reference: 1403-077
Project: 22-1-11288-001

**TOTAL LEAD
EPA 200.8
DUPLICATE QUALITY CONTROL**

Date Extracted: 3-17-14

Date Analyzed: 3-17-14

Matrix: Water

Units: ug/L (ppb)

Lab ID: 03-108-01

Analyte	Sample Result	Duplicate Result	RPD	PQL	Flags
Lead	1.22	ND	NA	1.0	

Date of Report: March 20, 2014
Samples Submitted: March 12, 2014
Laboratory Reference: 1403-077
Project: 22-1-11288-001

**TOTAL LEAD
EPA 200.8
MS/MSD QUALITY CONTROL**

Date Extracted: 3-17-14

Date Analyzed: 3-17-14

Matrix: Water

Units: ug/L (ppb)

Lab ID: 03-108-01

Analyte	Spike Level	MS	Percent Recovery	MSD	Percent Recovery	RPD	Flags
Lead	100	97.6	96	99.3	98	2	



Data Qualifiers and Abbreviations

- A - Due to a high sample concentration, the amount spiked is insufficient for meaningful MS/MSD recovery data.
 - B - The analyte indicated was also found in the blank sample.
 - C - The duplicate RPD is outside control limits due to high result variability when analyte concentrations are within five times the quantitation limit.
 - E - The value reported exceeds the quantitation range and is an estimate.
 - F - Surrogate recovery data is not available due to the high concentration of coeluting target compounds.
 - H - The analyte indicated is a common laboratory solvent and may have been introduced during sample preparation, and be impacting the sample result.
 - I - Compound recovery is outside of the control limits.
 - J - The value reported was below the practical quantitation limit. The value is an estimate.
 - K - Sample duplicate RPD is outside control limits due to sample inhomogeneity. The sample was re-extracted and re-analyzed with similar results.
 - L - The RPD is outside of the control limits.
 - M - Hydrocarbons in the gasoline range are impacting the diesel range result.
 - M1 - Hydrocarbons in the gasoline range (toluene-naphthalene) are present in the sample.
 - N - Hydrocarbons in the lube oil range are impacting the diesel range result.
 - N1 - Hydrocarbons in diesel range are impacting lube oil range results.
 - O - Hydrocarbons indicative of heavier fuels are present in the sample and are impacting the gasoline result.
 - P - The RPD of the detected concentrations between the two columns is greater than 40.
 - Q - Surrogate recovery is outside of the control limits.
 - S - Surrogate recovery data is not available due to the necessary dilution of the sample.
 - T - The sample chromatogram is not similar to a typical _____.
 - U - The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
 - U1 - The practical quantitation limit is elevated due to interferences present in the sample.
 - V - Matrix Spike/Matrix Spike Duplicate recoveries are outside control limits due to matrix effects.
 - W - Matrix Spike/Matrix Spike Duplicate RPD are outside control limits due to matrix effects.
 - X - Sample extract treated with a mercury cleanup procedure.
 - X1 - Sample extract treated with a Sulfuric acid/Silica gel cleanup procedure.
 - Y - The calibration verification for this analyte exceeded the 20% drift specified in method 8260C, and therefore the reported result should be considered an estimate. The overall performance of the calibration verification standard met the acceptance criteria of the method.
 - Z -
- ND - Not Detected at PQL
 PQL - Practical Quantitation Limit
 RPD - Relative Percent Difference



Analytical Laboratory Testing Services
 14648 NE 95th Street • Redmond, WA 98052
 Phone: (425) 883-3881 • www.onsite-env.com

Chain of Custody

Laboratory Number: **03-077**

Turnaround Request (in working days)
 (Check One)
 Same Day 1 Day
 2 Days 3 Days
 Standard (7 Days) (TPH analysis 5 Days)
 _____ (other)

Company: **Shannon + Wilson, Pasco**
 Project Number: **22-1-11288-001**
 Project Name: **Columbia Park West Marina, Richland**
 Project Manager: **D. Parkes**
 Sampled by: **D. Parkes**

Lab ID	Sample Identification	Date Sampled	Time Sampled	Matrix	Number of Containers
1	CPWM-mw1-01	3/11/14	10:05	water	3
2	CPWM-mw2-01	↓	11:00	↓	3
3	CPWM-mw3-01	↓	11:45	↓	3

NWTPH-HCID	NWTPH-GX/BTEX	NWTPH-GX	NWTPH-DX	Volatiles 8260C	Halogenated Volatiles 8260C	Semivolatiles 8270D/SIM	(With low-level PAHs)	PAHs 8270D/SIM (low-level)	PCBs 8082A	Organochlorine Pesticides 8081B	Organophosphorus Pesticides 8270D/SIM	Chlorinated Acid Herbicides 8151A	Total RCRA Metals/ MTCAs Metals (circle one)	TCLP Metals	HEM (oil and grease) 1664A	% Moisture
	X															
	X															
	X															

Signature	Company	Date	Time	Comments/Special Instructions
<i>Norma Parkes</i>	STW	3/11/14	3:00	
<i>[Signature]</i>	ORE	3/12/14	1000	
Reviewed/Date				Chromatograms with final report <input type="checkbox"/>

APPENDIX C
IMPORTANT INFORMATION ABOUT YOUR
ENVIRONMENTAL REPORT



Date: April 21, 2014
To: City of Richland, Parks & Recreations
Columbia Park West Marina

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL/ENVIRONMENTAL REPORT

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include: the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used: (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors which were considered in the development of the report have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the
ASFE/Association of Engineering Firms Practicing in the Geosciences, Silver Spring, Maryland