Jacobs

Northwest Pipe Company
Portland Plant
ECSI No. 138

Monitored Natural Attenuation Evaluation Work Plan

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Northwest Pipe Company

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Acronyms and Abbreviations

°C	degree(s) Celsius
µg/L	microgram(s) per liter
µmol/L	micromole(s) per liter
A	annually
bgs	below ground surface
CUL	cleanup level
DCE	dichloroethene
DEQ	Oregon Department of Environmental Quality
EPA	U.S. Environmental Protection Agency
ft/day	foot per day
ft/ft	foot per foot
HCl	hydrochloric acid
H_2SO_4	sulfuric acid
HDPE	high-density polyethylene
IT Slip	Schnitzer International Terminals Slip
Jacobs	Jacobs Engineering Group Inc.
MDL	method detection limit
mg/kg	milligram(s) per kilogram
mg/L	milligram(s) per liter
mL	milliliter(s)
MNA	monitored natural attenuation
MRL	method reporting limit
NA	not applicable
OSC	Oregon Shipbuilding Corporation
PCE	tetrachloroethene
Q	quarterly
RBC	risk-based concentration
RBDM	risk-based decision making
RI	Remedial Investigation
ROD	Record of Decision
SA	semiannually
SCE	Source Control Evaluation
TCE	trichloroethene

TOC	total organic carbon
USGS	U.S. Geological Survey
VOA	volatile organic analysis
VOCs	volatile organic compounds

1. Introduction

Shallow groundwater in the Southeast Area (shown on Figure 1-1) of the Northwest Pipe Company (Northwest Pipe) Portland Plant (the Site) property contains volatile organic compounds (VOCs) at concentrations that exceed the U.S. Environmental Protection Agency (EPA) Record of Decision (ROD) cleanup levels (CULs) for the Portland Harbor Superfund site. The purpose of this Monitored Natural Attenuation (MNA) Evaluation Work Plan (MNA Work Plan), prepared in concurrence with the Oregon Department of Environmental Quality (DEQ) (2020), is to confirm that natural attenuation of VOCs in the shallow groundwater at the Southeast Area is a suitable source control measure to contain VOCs and is capable of preventing the adverse effects of VOCs on the Willamette River at concentrations above the Portland Harbor ROD CULs.

Jacobs Engineering Group Inc. (Jacobs) has prepared this Work Plan on behalf of Northwest Pipe regarding the Site located at 12005 North Burgard Road, Portland, Oregon (Figure 1-1; figures are located at the end of his document). This Work Plan was prepared in accordance with the EPA document *Performance Monitoring of MNA Remedies for VOCs in Ground Water* (2004).

Northwest Pipe has conducted investigations and focused remedial actions to address environmental conditions at the Site since it began operations at the Site in 1982. This work has provided environmental data that defined the nature and extent of constituents at the Site and documented the effectiveness of the targeted remedial actions taken by Northwest Pipe. A Remedial Investigation (RI) and Source Control Evaluation (SCE) were conducted under the 2004 Voluntary Agreement for Remedial Investigation and Source Control Evaluation (DEQ agreement LQDVC-NWR-04-01). The RI/SCE documents detail the environmental investigations and remedial actions conducted at the Site over the last 30 plus years, which form the basis for this Work Plan. This Work Plan focuses on the VOCs in the Southeast Area shallow groundwater. For information on other Site media, historical Site data, source control measures, and interim remedial actions, the RI/SCE provides a comprehensive presentation and evaluation (Jacobs 2021a).

This MNA Work Plan includes the long-term performance monitoring data evaluation and reporting activities. This MNA Work Plan is organized as follows:

- Section 1—Introduction
- Section 2—Background
- Section 3—Monitored Natural Attenuation Data Evaluation
- Section 4—Monitored Natural Attenuation Evaluation Work Plan
- Section 5—References

2. Background

This section includes a description of the Site setting and facility history, as well as background information needed to characterize the conceptual site model for natural attenuation in the Southeast Area. The RI/SCE report (Jacobs 2021a) presents a detailed discussion of the Site background information, particularly for areas of the Site outside of the Southeast Area, the location of which is depicted on Figure 1-1.

2.1 Property Description

The Site is located in the area generally referred to as the Burgard Industrial Park, in the northern part of Portland (Figure 1-1). "Burgard Industrial Park" refers to a collection of industrial parcels located east and south of the Schnitzer International Terminals Slip (IT Slip) and includes the Site (Figure 1-1). The Site measures approximately 1,013 feet long and 777 feet wide and is located approximately 1,500 feet from the eastern bank of the Willamette River.

The Site borders no surface water body and is situated between and east of two manmade slips: the Port of Portland Terminal 4 Slip 1 and the IT Slip, which is privately owned by Schnitzer Investment Corp (now known as MMGL Corp.) and Schnitzer Steel Industries. Encompassing 29.15 acres of flat terrain, the Site includes property owned by Northwest Pipe (25.96 acres split into a 25.29-acre manufacturing area and a 0.67-acre office area) and property owned by 12005 Burgard Equities LLC (Burgard Equities) (3.19 acres), which Burgard Equities leases to Northwest Pipe. The 3.19-acre property is managed by Burgard Equities' agent, Felton Properties, Inc., of Portland, Oregon, and is located at the southern border of the Northwest Pipe property. The property is used to store finished pipe prior to shipping.

2.2 Facility History

Property currently owned and leased by Northwest Pipe Company has been used for industrial activities since its development by the Oregon Shipbuilding Corporation (OSC) (one of the Kaiser shipyards) in 1941. Under contract to the federal government and at its direction, OSC constructed and operated a shipyard on the Site that produced more than 450 Liberty ships, Victory ships, and troop transports as part of the war effort. Following the war, a portion of the Site was used as a grain warehouse. Activities on other parts of the Site during this time are not known. The warehouse was destroyed by fire in 1961 and rebuilt prior to Northwest Pipe's ownership. From 1950 through 1982, Beall Pipe and Tank Company (which was acquired by and operated as a division of LB Foster until its assets were sold to NW Pipe in 1982) used the Site to manufacture steel pipe and tanker trucks as well as to clean and repair used tanker trucks.

Northwest Pipe began operations at the Site in 1982 under a lease and purchased the Site in 1997. Northwest Pipe manufactures steel pipe at the Site that is used for a variety of municipal, industrial, and utility applications, primarily potable water transmission. The Site includes an administrative office, the main production buildings (Bays 1 through 6 in the large building and Bay 9 in a smaller building), the pipe coating and lining operations, a general storage area for supplies, a cement mortar coating operation, and the flammable materials storage building. Steel pipe is manufactured using the submerged arc welding process. The Site is a "job shop" in which operations are run as needed to fill specific orders, meaning not all equipment or operations run continuously.

2.3 Geology

The Site occupies a former alluvial floodplain of the Willamette River, as shown in an 1897 U.S. Geological Survey (USGS) map of the area (USGS 1897) (Figure 2-1). The historical location of a former alluvial

channel, identified by the USGS as Gatton Creek, was offsite to the east of the Site and flowed south to the area now occupied by Terminal 4 Slip 1. Dredged material consisting of silty sand was used to fill and level the area in early 1941 (OSC 1945). The Linnton USGS 7.5-minute topographic map indicates that the current topography of the Site is relatively flat (USGS 1961). Surface elevations range from 30 to 35 feet above mean sea level, with elevations in the northern part of the Site slightly lower than in the southern part. Most native surface soil at the Site has been covered by fill, modified by re-grading and construction, and capped by pavement or structures.

The subsurface geology of northwestern Portland is characterized by Neogene and Quaternary sedimentary and volcanic deposits. The Site lies within a north-northwest-trending structural depression that contains late Neogene and Quaternary sediment deposits of fluvial (river) and lacustrine (lake) origin. At the Site, the shallow dredge fill is underlain by native silt historically deposited in side channels of the Willamette River and interpreted by CH2M HILL (2005) to be the former surface of the floodplain that existed prior to filling and site development. The thickness of the native silt may exceed 100 feet based on Oregon Water Resources Department logs of water wells (Jacobs 2021a).

2.4 Hydrogeology

As described in Section 2.3, the Site is located on flat floodplain deposits and fill material east of the Willamette River. Fill and fluvial/lacustrine deposits extend from the ground surface to at least 258 feet below ground surface (bgs) and are composed of interbedded silt, sand, and gravel layers, consisting of the following distinct zones:

- A shallow zone of fine sand and silty sand fill material (0 to 28 feet bgs), saturated in its lower half under unconfined conditions, and underlain by a low-permeability confining layer.
- An upper confining layer of low-permeability silt with sparsely interbedded sand from approximately 28 feet to 161 feet bgs. The top of this confining layer represents the historical ground surface prior to site filling and development. Principal sandy horizons within the upper confining layer are from 98 to 118 feet bgs and from 129 to 133 feet bgs.
- A deep confined, water-bearing zone of sand and gravel from 161 feet to 221 feet bgs, in which the Site's production well is screened.
- A deep confining layer from 221 to at least 258 feet bgs (maximum depth of the Site's production well).

The depth to shallow groundwater varies seasonally between approximately 6 and 14 feet bgs and is encountered in the shallow fill water-bearing zone. The depth to groundwater is shallower in the central part of the Site. A groundwater divide occurs between the IT Slip, located north-northwest of the Site, and the Terminal 4 Slip 1, located southwest of the Site, with groundwater occurring deeper on the northern and southern edges of the Site. The groundwater flow direction in the southeastern portion of the Site is consistently south-southwest.

2.5 Southeast Area Conceptual Site Model

The Southeast Area of the Site has been the subject of environmental investigation and monitoring since the late 1980s. Contamination in shallow soil in the Southeast Area was discovered in 1989 associated with a former aboveground waste oil tank that had been located near current monitoring well MW-06 (Dames & Moore 1989). Approximately 170 cubic yards of soil were excavated to a depth of 9 feet bgs in the area of contamination (Crosby & Overton 1989). Following excavation, confirmation sampling was performed, and low levels of tetrachloroethene (PCE) were detected in soil. Confirmation soil sample results for PCE ranged from below the reporting limit of 0.005 milligram per kilograms (mg/kg) in two

samples to a maximum of 0.17 mg/kg from the eastern wall of the excavation. This work was done in communication with DEQ, which considered the site a low-priority project (DEQ 1989), and although it was done several years before DEQ issued its Risk-Based Decision Making (RBDM) guidance, the post-remedial action confirmation samples showed that PCE levels in soil after remediation were well below potentially applicable RBDM values.

Follow-up investigations in the Southeast Area identified VOCs in shallow groundwater. The VOCs of concern in the Southeast Area are PCE and its breakdown products trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), and vinyl chloride. While TCE is a breakdown product of PCE, it was also used as a commercially available solvent, and its presence may be attributable, in part, to the historical use of products containing TCE. Groundwater contamination is limited to the shallow aquifer and does not extend below the confining layer at approximately 28 feet bgs. Groundwater in the shallow aquifer discharges to Terminal 4 Slip 1 of the Willamette River, approximately 1,000 feet downgradient from the Southeast Area. A discussion of the primary transport pathways and potential risks to receptors is presented in Section 3.2. Groundwater monitoring performed since 2016 has shown that concentrations in groundwater samples from wells closest to the river are below ROD CULs.

3. Monitored Natural Attenuation Data Evaluation

This MNA Work Plan was developed in accordance with MNA guidance (EPA 2004) and in concurrence with DEQ (2020),. Site data supporting an MNA decision are presented in greater detail in Sections 3.1 through 3.5. In summary, the source area meets the following agency criteria:

- The Northwest Pipe groundwater source area has been remediated.
- Human health or ecological risk are addressed by MNA.
- The groundwater conditions exhibit a reducing geochemical environment, favorable to degradation of site-related VOCs.
- Concentrations of VOCs remaining in onsite and offsite groundwater are relatively low, and there is consistent evidence in monitoring data collected over the past six years that groundwater containing VOCs does not reach the Willamette River above protective levels established in the ROD.
- The decade of groundwater monitoring at the site indicates that the groundwater plume is stable or decreasing, consistent with EPA guidance.

3.1 Source Area Remediation

As discussed in Section 2.5, contamination associated with a former aboveground waste oil tank located near current monitoring well MW-06 (Dames & Moore 1989) was remediated in 1989. Following excavation, confirmation sampling was performed, and low levels of PCE were detected in soil. Confirmation soil sample results ranged from below the reporting limit of 0.005 mg/kg in two samples to a maximum of 0.17 mg/kg PCE from the eastern wall of the excavation. This work was done in communication with DEQ, which considered the site a low-priority project (DEQ 1989), and although it was done several years before DEQ issued its RBDM guidance, the post-remedial action confirmation samples showed PCE levels in soil after remediation were well below potentially applicable RBDM values. Because this potential source area has been remediated in the past, the source area was capped in 2009/2010 and no other onsite potential source area has been identified in more than 25 years of investigation at the site, the source control element of an onsite MNA remedy (EPA 2004) has been met.

3.2 Human Health and Ecological Risk

The primary transport pathways from the source area to potential receptors include the following: (1) shallow groundwater discharge to offsite surface water, (2) contact with shallow groundwater during excavation activities, and (3) volatilization of VOCs from shallow groundwater to indoor and outdoor air. Conclusions from the human health risk screening for groundwater as presented in the RI/SCE (Jacobs 2021a) are that maximum VOC concentrations in groundwater do not pose an unacceptable risk to human health or animals, as summarized for each pathway below:

- **Groundwater Discharge to Offsite Surface Water** – Groundwater samples collected at wells closest to the river have not exceeded ROD CULs, indicating that there is no unacceptable risk to human health from the groundwater-to-surface-water pathway. Groundwater samples collected at wells closest to the river have not exceeded DEQ Level II screening level values for potential aquatic, bird, or mammalian receptors, indicating that there is no unacceptable risk to ecological receptors from groundwater-to-surface-water pathway. Furthermore, the soil gas investigation conducted in 2021 indicate that the groundwater-to-surface-water (Willamette River at Terminal 4 Slip 1) transport pathway is incomplete (Jacobs 2021b).
- **Shallow Groundwater in a Potential Excavation** – Historical PCE and TCE concentrations in certain groundwater monitoring wells and Geoprobe sampling locations exceeded the noncancer hazard

index target of 1 for hypothetical future excavation workers. However, the most recent data generated since groundwater monitoring resumed in 2016 (and continues to the present) confirm that the risk posed by recent and current concentrations is below the DEQ hazard index target of 1. The more recent data are a better reflection of risk at the Site because they account for continued and active degradation of VOCs. Contact with groundwater through excavation work is controlled by the Site's Contaminated Media Management Plan (included as an appendix to the RI/SCE [Jacobs 2021a]). The media management plan includes worker notification, health and safety precautions, and proper management and disposal of groundwater encountered during a potential excavation.

- **Volatilization from Shallow Groundwater to Indoor and Outdoor Air** – Maximum detected concentrations for groundwater samples collected from onsite and offsite monitoring wells and Geoprobe samples were compared to DEQ groundwater vapor intrusion risk-based concentrations (RBCs), groundwater outdoor air RBCs, and groundwater in an excavation RBCs. None of the VOC concentrations, either historical or current, exceeded indoor or outdoor air occupational worker RBCs.

The risk assessment presented in the RI/SCE (Jacobs 2021a) concluded that no excess human health or ecological risk exists from VOCs in the Southeast Area of the Site. In addition, given the ongoing process of reductive dechlorination, VOC concentrations in the Southeast Area of the Site are anticipated to continue to attenuate below levels of potential concern before reaching surface water.

3.3 Geochemical Environment Supports Reductive Dechlorination

Reductive dechlorination is most effective in the range corresponding to sulfate reduction and methanogenesis (which occurs through the reduction of carbon dioxide) (EPA 1998). Groundwater chemistry that indicates sulfate-reducing or methanogenic conditions in the Southeast Area include the following:

- Low dissolved oxygen concentrations, typically less than 0.5 milligram per liter (mg/L)
- Low oxidation-reduction potential, typically less than 50 millivolts and preferably below -100 millivolts
- Low concentrations of nitrate, typically less than 1 mg/L
- Presence of ferrous iron (Fe2+), which results from the reduction of ferric iron (Fe3+), at concentrations greater than 1 mg/L

Natural attenuation parameters were measured in 2005 and from 2016 through 2021 to evaluate the potential for reductive dechlorination based on geochemical conditions at the Site (Appendix A). The dissolved oxygen and oxidation-reduction potential levels measured at site monitoring wells typically meet the criteria for sulfate-reducing or methanogenic conditions listed above. Additionally, pH measurements are within the range amenable to microorganism survival, and the alkalinity (measured in 2005) is sufficient for buffering the pH against acids naturally produced by bacteria during biodegradation.

The natural attenuation data also were evaluated using EPA's screening worksheet to assess the potential for reductive dechlorination based on geochemical conditions (EPA 1998). The evaluation was performed using data from MW-02 for background conditions for both the 2005 and 2016 through 2021 data sets. For data representing the higher-concentration zone of VOCs, wells MW-01, MW-04, and MW-06 were selected for 2005, and wells MW-05 and MW-06 were selected for 2016 through 2021. The potential for reductive dechlorination on the Port site also was evaluated for 2016 through 2021 using wells T4S1MW-03S, T4S1MW-09, T4S1MW-23, and T4S1MW-24, although the evaluation and determinations about the presence of ongoing biodegradation is intended for use with data from the zone containing the highest concentrations (EPA 1998).

The points awarded during the screening performed in the worksheet are interpreted as presented in Table 3-1 (EPA 1998).

Table 3-1. Interpretation of Points Awarded during Screening

Score	Interpretation
0 to 5	Inadequate evidence for anaerobic biodegradation of chlorinated organics
6 to 14	Limited evidence for anaerobic biodegradation of chlorinated organics
15 to 20	Adequate evidence for anaerobic biodegradation of chlorinated organics
>20	Strong evidence for anaerobic biodegradation of chlorinated organics

Biodegradation = Reductive dechlorination

Table 3-2 contains the worksheet along with scores assigned to the Northwest Pipe Company facility for 2005 and 2016 through 2021 and to the Port of Portland wells for 2016 through 2021 based on available monitoring well data. The total scores of 23 for 2005 data and 23 for 2016 through 2021 for Northwest Pipe data both fall within the "strong evidence" category identified by EPA for VOC degradation via reductive dechlorination (EPA 1998) (Table 3-1), indicating that geochemical conditions at the Site are well suited to reductive dechlorination and consistent with the observed limited migration of VOCs.

The worksheet score for the Port of Portland wells is 8 for data collected from 2016 through 2021, falling within the "limited evidence" category identified by EPA for VOC degradation via reductive dechlorination (EPA 1998). This score is expected because many of the factors in the worksheet target predictable geochemical changes that are known to occur during biodegradation (EPA 1998). In the absence of chlorinated VOCs, many of these geochemical changes would not be present. Moreover, it is important to note that these wells are located far downgradient from the Southeast Area where VOC concentrations already have undergone significant reductive dechlorination. These results are meaningful because they indicate that the interval of the aquifer between MW-06 and MW-03 is removing a substantial fraction of the VOCs from groundwater. Furthermore, the much slower rate of biodegradation occurring downgradient from MW-03 is further reducing concentrations to acceptable levels, given the greater distance (and timeframe) over which this slower degradation rate has the opportunity to operate. Overall, this evaluation supports the selection of MNA for the Southeast Area because it shows the geochemical environment of the Southeast Area supports VOC degradation via reductive dechlorination.

Table 3-2. Analytical Parameters and Weighting for Preliminary Screening for Anaerobic Biodegradation Processes

Analysis	Concentration in Most Contaminated Zone[a]	Interpretation	Value	Northwest Pipe Score		Port of Portland Score
				2005	2016 to 2021	2016 to 2021
Dissolved Oxygen	< 0.5 mg/L	Tolerated; suppresses the reductive pathway at higher concentrations	3	3	3	0
Nitrate	< 1 mg/L	At higher concentrations, may compete with reductive pathway	2	2	2	0
Iron II	> 1 mg/L	Reductive pathway possible	3	3	3	0

Table 3-2. Analytical Parameters and Weighting for Preliminary Screening for Anaerobic Biodegradation Processes

Analysis	Concentration in Most Contaminated Zone[a]	Interpretation	Value	Northwest Pipe Score		Port of Portland Score
				2005	2016 to 2021	2016 to 2021
Sulfate	< 20 mg/L	At higher concentrations, may compete with reductive pathway	2	2	2	2
Sulfide	> 1 mg/L	Reductive pathway possible	3	ND	ND	ND
Methane	> 0.5 mg/L	Ultimate reductive daughter product	3	3	3	0
Oxidation Reduction Potential	< 50 millivolts	Reductive pathway likely	2	1	1	0
pH	5 <pH< 9	Optimal range for reductive pathway	0	0	0	0
TOC	> 20 mg/L	Carbon and energy source; drives dechlorination; can be natural or anthropogenic	2	0	0	0
Temperature	>20°C	At T > 20°C, biochemical process is accelerated	1	0	0	0
Carbon Dioxide	> 2x background[a]	Ultimate oxidative daughter product	1	1	1	0
Alkalinity	> 2x background[a]	Results from interaction between carbon dioxide and aquifer minerals	1	0	ND	ND
Chloride	> 2x background[a]	Daughter product of organic chlorine	2	2	2	0
Hydrogen	> 1 nM	Reductive pathway possible	3	ND	ND	ND
TCE		Daughter product of PCE	2[b]	2	2	2
DCE		Daughter product of TCE	2[b]	2	2	2
Vinyl Chloride		Daughter product of DCE	2[b]	2	2	2
		Total Score		**23**	**23**	**8**

[a] Data from MW-02 is used to indicate background conditions. MW-01, MW-04, and MW-06 are used to represent the most contaminated zone for 2005, and MW-05 and MW-06 are used for 2016 to 2021. Data from 2016 to 2021 were also analyzed for Port of Portland wells T4S1MW-03S, T4S1MW-09, T4S1MW-23, and T4S1MW-24.

[b] Points awarded only if it can be shown that the compound is a daughter product (i.e., not a constituent of the source material). The presence of TCE and further breakdown products, combined with the limited migration distance away from the area of highest concentration, indicate that TCE, DCE, and vinyl chloride are breakdown products.

Notes:
°C = degree(s) Celsius
DCE = dichloroethene
mg/L = milligrams per liter
ND = Not determined. Assigned a value of zero although the actual value, if data were available, may be higher.
PCE = tetrachloroethene
TCE = trichloroethene
TOC = total organic carbon

3.4 VOC Concentrations in the Southeast Area

VOC concentrations in the Southeast Area have decreased significantly since monitoring began, and recent concentrations are low enough to support MNA as the source control measure. Samples in the Southeast Area were collected from six wells in the area from 2001 through 2005, 2007, and 2016 through 2021. Groundwater sampling using Geoprobes was conducted in 2001, 2002, and 2004. Port wells were included in the monitoring program from 2016 through 2021. Routine groundwater monitoring is continuing in the Southeast Area on a semiannual basis until MNA monitoring begins, as outlined in Section 4. A compilation of all the groundwater data collected in the Southeast Area from 2001 through October 2021 is included in Appendix A.

Historical VOC concentrations in groundwater in the Southeast Area collected from 2001 through 2005 are shown on Figure 3-1. The highest historical concentrations of PCE occurred near MW-06 and MW-01, with lower concentrations detected both upgradient (MW-05) and downgradient (MW-03 and MW-04) of these wells. Monitoring well data for both the Northwest Pipe site and Port site from 2003 through 2021 are shown on Figures 3-2 and 3-3, respectively. Trend plots for this time period are presented in Figures 3-4 and 3-5. The wells with the highest VOC concentrations have consistently been wells MW-05 and MW-06. By comparison, MW-01, MW-03, and MW-04 have shown consistently moderate concentrations, and MW-02 and the Port property wells have concentrations near or less than the laboratory reporting limits for VOCs. Although the recent data (collected from 2016 through 2021) exhibit temporal variability in concentrations (Figures 3-6 and 3-7), the maximum value of the most highly concentrated VOC identified in data (PCE in MW-05) is less than half the maximum concentration previously detected in groundwater at the site (PCE in GP-1). This reduction in the concentration of PCE is consistent with a stable or decreasing plume that is controlled by the natural attenuation processes.

By eliminating the effect of the molecular weights of the different constituents, the downward trends of PCE and TCE to their daughter products (cis-1,2-DCE and vinyl chloride) are illustrated in wells MW-06 and MW-03 (Figure 3-8). PCE is a definitive parent compound, while TCE may be a parent compound or a breakdown or daughter product of PCE. The increasing trend of PCE in MW-05, upgradient of the source area except for seasonal, low-gradient and temporary flow reversals, could be explained by migration of an upgradient, offsite PCE plume onto the Site. The presence and increasing magnitude of the daughter products of PCE and TCE are evidence that reductive dechlorination is active in the Southeast Area.

Figure 3-8 presents trend plots in molar concentrations. Figure 3-9 presents the average molar concentration for the three highest-concentration wells in the Southeast Area (MW-05, MW-06, and MW-03) and the Port wells closest to Terminal 4 Slip 1 (T4S1MW-03S and T4S1MW-09). Molar concentrations of PCE decrease from an average of 18.0 micromoles per liter (µmol/L) at MW-05 to 2.6 µmol/L at MW-03. Degradation product cis-1,2-DCE peaks in concentration at MW-06 and is further degraded by the time groundwater reaches MW-03. Downgradient on the Port site, all average VOC molar concentrations are less than 0.05 µmol/L, confirming that VOC concentrations are substantially reduced on the Site and are not detected above ROD CULs in Port wells T4S1MW-03S and T4S1MW-09. This pattern is consistent with degradation of the plume of VOCs by natural attenuation processes.

3.5 Evidence of Plume Stability

Jacobs reviewed EPA documents and other supporting information on plume stability in the context of MNA decision making to evaluate the stability of the Southeast Area VOC plume.

As stated in *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites*, "sites where the contaminant plumes are no longer increasing in extent, or are shrinking, would be the most appropriate candidates for MNA remedies" (EPA 1999). To verify the stability of the VOC plume in the Southeast Area, the factors that characterize plume stability must be assessed. The key factors to determining plume stability outlined in EPA 1999 are as follows:

- The plume area is not expanding.
- The geochemical environment is favorable to degradation of site-related constituents.

When defining the plume area, EPA (1999) states that a plume boundary is more realistically defined by a zone rather than a line, and concentration fluctuations occurring within this zone likely result from factors such as analytical, seasonal, or spatial variations, and may or may not be indicative of a trend in plume migration. One way to counter this variability is presented in the EPA guidance (2004), which states that data from downgradient limits of a plume should be considered in a group of wells to determine stable or decreasing trends compared to previous sampling rounds (EPA 2004).

The Southeast Area plume meets the metrics for stability presented in these documents as evidenced by VOC concentrations in the plume's margin, in downgradient wells, and in the soil gas investigation performed in 2021. The results of the soil gas sampling indicate that the downgradient migration of VOCs in groundwater is limited because nearly all the passive soil gas sampler results on Port property showed no detectable chlorinated ethenes. Furthermore, wells at the plume margins (such as MW-03 and T4S1MW-22) have shown clearly decreasing trends in the concentrations of parent VOCs. The wells closest to Terminal 4 Slip 1 (T4S1MW-03S and T4S1MW-09) have had concentrations below detection limits since 2018 and below ROD CULs since monitoring resumed in 2016.

As described in Section 4.2, trends in concentrations in wells within the plume interior exhibit temporal variability. According to EPA (2004), contaminant concentrations at individual sampling points may exhibit fluctuations, including small-scale expansion and shrinkage in response to groundwater flow rates and biological degradation rates throughout the year. In addition, VOC concentrations in individual wells may fluctuate with changes in plume configuration caused by oscillations in groundwater flow (EPA 2004). Concentrations in MW-03 are a good example of this characteristic. While some concentrations were higher in 2016 than previously measured in 2005, concentrations of PCE and TCE have been consistently decreasing since monitoring resumed in 2016. Likewise, cross-gradient wells T4S1MW-22 and T4S1MW-23 both show much lower concentrations in recent monitoring than were found in historical samples, as do wells closer to the source area, MW-01 and MW-04. Minor variations in concentration in the plume interior should not be interpreted as instability in the plume and are consistent with a stable to decreasing plume.

EPA's *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water* (1998) states the determination of plume stability should be based on the following:

1) Contaminant properties, including volatility, sorptive properties, and biodegradability
2) Aquifer properties, including hydraulic gradient, hydraulic conductivity, porosity, and concentrations of native organic material in the sediment (TOC)
3) The location of the plume and contaminant source relative to potential receptor exposure points (i.e., the distance between the leading edge of the plume and the potential receptor exposure points)

The first point in support of plume stability is addressed by the screening worksheet (described in Section 4.1), also included in EPA (1998), which integrates the contaminant properties, including volatility, sorptive properties, TOC (from the second point), and biodegradability. When screened, site data scored in the "strong evidence" category, indicating that geochemical conditions at the Site support reductive dechlorination and are consistent with the data demonstrating limited migration of VOCs.

Regarding the second point in EPA's (1998) protocol in support of plume stability, aquifer properties were investigated using aquifer testing in November 2016 to provide additional site-specific information on aquifer hydraulic characteristics and better determine the groundwater flow velocity at the site (Jacobs 2021a). Single-well rising head tests, commonly referred to as slug-withdrawal tests, were performed on three of the six monitoring wells on the Northwest Pipe site (MW-05, MW-06, and MW-03) and two Port wells (T4S1MW-22 and T4S1MW-03S). The typical hydraulic conductivity for the shallow aquifer along the flow path ranges from approximately 2 to 25 feet per day (ft/day). The hydraulic conductivity of MW-05 was calculated to be higher than the typical range (130 ft/day), indicating that this well is screened in a zone of higher conductivity. The higher hydraulic conductivity at this well is consistent with observations of minimal drawdown during sampling. However, this zone of higher hydraulic conductivity is bounded by lower conductivity in the downgradient direction and that lower conductivity will ultimately determine the rate of flow through this area (Jacobs 2021a). The average hydraulic conductivity over the flow path is 12.5 ft/day.

Groundwater flow direction is consistently south to southwest toward Terminal 4 Slip 1 on the Port site, downgradient of the Southeast Area. The hydraulic gradient increases approaching Terminal 4 Slip 1, from an average of 0.005 foot per foot (ft/ft) from the boundary of the Northwest Pipe site through the middle of the Port site, transitioning to an average of 0.01 ft/ft near the slip. Water levels on the Port site, particularly closer to the Terminal 4 Slip 1, are more susceptible to influence from river stage because of closer proximity to surface water. This effect is most pronounced in wells located closest to the Terminal 4 Slip 1. On the Northwest Pipe site, the hydraulic gradient appears to be nearly flat and more variable than further south, but flow is predominantly southerly as well. The observed variability in hydraulic gradient appears to be caused by a combination of the gradual gradient and short-term aquifer response to changes in river stage or precipitation events. The groundwater flow direction in the area of MW-04, to the east of the high-concentration area, appears to vary seasonally with westerly and, infrequently, northerly flow directions. The significant decrease in hydraulic gradient (an average of 0.0006 ft/ft) across the Southeast Area compared to the Port site, results in slower groundwater flow compared to the Port site. Groundwater levels farther away from surface water, such as at the Southeast Area, have less sensitivity to changes in river stage. Actual groundwater movement during short periods of hydraulic gradient reversal are minimal because of the combination of low hydraulic gradient, low hydraulic conductivity, and the brief duration of gradient reversal.

Using these site-specific parameters, groundwater velocity can be calculated for the Southeast Area using a version of Darcy's Law:

$$v = K * l/n$$

where:

v = groundwater velocity (ft/day)
K = hydraulic conductivity (ft/day)
l = hydraulic gradient (ft/ft)
n = effective porosity (unitless)

The average hydraulic conductivity (12.5 ft/day), hydraulic gradient (0.005 ft/day), and typical effective porosity based on soil type (0.2) results in a groundwater velocity across the Southeast Area and the upper Port property of 0.31 ft/day.

Regarding the third point in the EPA (1998) protocol in support of plume stability, the slow rate of groundwater flow and the distance from the Southeast Area to the river (1,370 feet from MW-06 to Terminal 4 Slip 1) provides sufficient distance between the leading edge of the plume and the potential receptor exposure point at the river, thereby addressing the third point in EPA (1998) establishing plume stability. Therefore, data for the Southeast Area support all three points, thus verifying plume stability as described in EPA guidance (1998).

According to the evaluation presented in this work plan by the metrics outlined in EPA guidance on MNA, the VOC plume in the Southeast Area is stable.

4. Monitored Natural Attenuation Evaluation Work Plan

In the context of source control under DEQ's Joint Source Control Strategy, MNA would be considered a Source Control Measure. The purpose of this MNA Work Plan, which has been prepared in concurrence with DEQ (2020), is to confirm that natural attenuation of VOCs in the shallow groundwater at the Southeast Area is a suitable source control measure to contain VOCs and is capable of preventing adverse effects on the Willamette River (i.e., adverse effects in the form of VOCs at concentrations above the Portland Harbor ROD CULs). The success of the MNA remedy will be evaluated based on whether concentrations of VOCs at the boundary wells to the Willamette River remain below ROD CULs. Should the MNA evaluation indicate the exceedance of ROD CULs in these wells, then an onsite remedial evaluation may be required. Sampling, data evaluation, and reporting to support long-term MNA at the Site are proposed as outlined in this section. A Sampling and Analysis Plan is provided in Appendix B.

4.1 Monitoring Well Network

Monitoring well locations were selected using criteria presented in EPA's *Performance Monitoring MNA Remedies for VOCs in Groundwater* (EPA 2004). Three new monitoring wells (MW-10, MW-11, and MW-12) were installed at the Site in March 2022, per DEQ email approval on January 26, 2022. These wells were sited based on DEQ (2021) and EPA (2021) requested locations in response to the passive soil gas sampling completed in March 2021 and described in the technical memorandum, *Passive Soil Gas Investigation Results and Proposed Well Locations* (Jacobs 2021b). As requested, monitoring well MW-10 is located between PSG12 and PSG13 and downgradient of T4S1MW-23. MW-11 is located near PSG16 and downgradient of MW-03. MW-12 is located east of PSG19 in the vicinity of the historical Gatton Creek and downgradient of T4S1MW-22. Following consultation with the Port of Portland, MW-12 was moved slightly north of the location proposed by DEQ and EPA to stay north of the current silt fence and provide sufficient clearance from the two railroad lines in that area while still meeting the objectives stated by DEQ and EPA. The well network for long-term MNA monitoring depicted on Figure 4-1 includes the three new wells and the following existing wells, and is based on the following rationale to fulfill the criteria in EPA guidance (2004), as follows:

- Upgradient uncontaminated relative to the zone of contamination – Well MW-02 is in the upgradient portion of the site and meets the requirement for an uncontaminated area because it rarely has detectable VOC concentrations. MW-02 is also used for background concentrations in evaluating geochemical conditions at the Site.
- Source area / main plume core – Well MW-06 is in the general area of the former aboveground tank, a suspected source area. Well MW-06 has had high levels of VOC concentrations compared to other wells and likely represents conditions in the plume core. Well MW-03 is located in the main plume body and shows VOC concentrations in groundwater approaching the Northwest Pipe Company facility boundary.
- Cross-gradient – Well MW-01 shows VOC concentrations along the eastern margin of the plume, and MW-04 shows the western margin of the plume in the plume core area. The proposed network also includes Well T4S1MW-22 and T4S1MW-23, both wells are on the Port property, and monitor the lateral extent of VOC concentrations.
- Uncontaminated downgradient parts of the aquifer – Wells T4S1MW-03S and T4S1MW-09 are uncontaminated and show groundwater quality prior to discharge to the Willamette River Terminal 4 Slip 1.
- Distinct geochemical zones – The geochemistry of groundwater on the Northwest Pipe site differs from that on the Port's site as described in Section 3.3. The proposed network includes wells in the Southeast Area (MW-01 through MW06) and wells on the Port site (MW-10, MW-11, MW-12,

T4S1MW-22, T4S1MW-23, T4S1MW-09, and T4S1MW-03S). These wells will be used to monitor each of these two geochemical zones.

- Groundwater flow characterization – Groundwater-level monitoring will include four more wells in addition to those targeted for sampling (Table 4-1). This network of monitoring wells will provide sufficient basis to confirm that the already well-documented flow direction remains consistent with past observations.
- High-permeability zones – No high-permeability zones have been identified within the plume area, other than the area monitored by MW-05, where slug testing and water level response during purging and sampling have identified a higher permeability than in other nearby wells. The soil gas investigation provided one line of evidence that any remnant of the historical Gatton Creek is not a preferential pathway for VOC migration.

The construction information for the monitoring wells selected for the MNA program are summarized in the Sampling and Analysis Plan. Figure 4-1 shows the proposed MNA monitoring well network and the groundwater flow direction from the most recent sampling event.

Table 4-1. Well Construction Details for MNA Program

Well	Coordinates		Screened Interval (feet bgs)		Total Depth (feet bgs)	Well Use in MNA Network
	Northing (feet)	Easting (feet)	Screen Top	Screen Bottom		
MW-01	7621115.44	715674.70	14	24	25	Analytical and Water Level
MW-02	7620821.90	715683.93	10.5	20.5	22	Analytical and Water Level
MW-03	7620850.03	715487.66	14.5	24.5	26	Analytical and Water Level
MW-04	7621087.85	715497.29	16.5	26.5	27	Analytical and Water Level
MW-05	7621060.97	715816.63	17.5	27.5	28	Analytical and Water Level
MW-06	7621020.40	715649.12	18.5	28.5	29	Analytical and Water Level
MW-10	7620334.01[a]	715196.95[a]	9.0	29.0	29	Analytical and Water Level
MW-11	7620715.29[a]	715182.10[a]	15.0	35.0	35	Analytical and Water Level
MW-12	7621011.80[a]	715214.92[a]	15.0	30.0	30	Analytical and Water Level
T4S1MW-02S	7621214.97	714998.33	20	30	30	Water Level Only
T4S1MW-03S	7620492.60	714732.19	20	30	30	Analytical and Water Level
T4S1MW-09	7620519.44	714609.19	20	30	30	Analytical and Water Level
T4S1MW-10	7620514.97	714448.17	10	20	20	Water Level Only

Table 4-1. Well Construction Details for MNA Program

Well	Coordinates		Screened Interval (feet bgs)		Total Depth (feet bgs)	Well Use in MNA Network
	Northing (feet)	Easting (feet)	Screen Top	Screen Bottom		
T4S1MW-22	7621091.96	715327.08	13	23	30	Analytical and Water Level
T4S1MW-23	7620347.24	715358.39	15	25	30	Analytical and Water Level
T4S1MW-25	7620880.20	714518.94	10	20	20	Water Level Only

[a]Coordinates are estimated and will be confirmed upon completion of the well survey.
Notes:
Coordinate System: North American Datum 1983 State Plane Oregon North (U.S. feet)

4.2 Laboratory Analysis

Groundwater samples will be collected using low-flow (also known as low-stress) sampling techniques. Samples will be submitted to the selected laboratory for analysis. The sample containers, preservative requirements, and maximum holding times for individual analyses are shown in Table 4-2. The selected laboratory will be certified under the National Environmental Laboratory Accreditation Program as well as the Oregon Environmental Laboratory Accreditation Program.

ROD CULs included in Table 4-2 for use as screening values were selected from Table 17 of the Portland Harbor ROD (EPA 2017). Values were selected from remedial action objectives 4 and 8 associated with migration of contaminated groundwater. Values reflect changes from Errata for Portland Harbor ROD (EPA 2018) and Errata #2 for Portland Harbor ROD (EPA 2020). Despite selecting the analytical method with the lowest method reporting limit (MRL), the MRL for vinyl chloride is still above the ROD CUL. However, the method detection limit (MDL) is below the ROD CUL. The MDL is the minimum measured concentration of a substance that can be reported with 99 percent confidence that the measured concentration is distinguishable from method blank results. Results below the MRL, but above the MDL, will be "J" flagged, indicating they are estimated. Results from this analytical method will provide a reliable indication of whether vinyl chloride is present above the ROD CULs.

Table 4-2. Sample Containers, Holding Times, and Analytical Methods

Analysis	Method	Container Size	Container Type	Preservative	Holding Time	ROD CULs[a] (µg/L)	MDL (µg/L)	MRL (µg/L)
TCE	SW8260SIM	(3) 40-mL VOA vials	Glass VOA vials	HCl, ≤6°C	14 days	0.6	0.011	0.2
cis-1,2-DCE						70	0.032	0.2
Vinyl Chloride						0.022	0.014	0.1
PCE						0.24	0.019	0.2
Ferrous Iron	Field-measured	NA	NA	NA	NA	--	10	100
Chloride	E300.0	(1) 250-mL	HDPE	None, ≤6°C	28 days	--	430	1500
Sulfate					28 days	--	800	1500
Nitrate-N					48 hours	--	30	200

Table 4-2. Sample Containers, Holding Times, and Analytical Methods

Analysis	Method	Container Size	Container Type	Preservative	Holding Time	ROD CULs[a] (µg/L)	MDL (µg/L)	MRL (µg/L)
Total Organic Carbon	SM5310	(1) 250-mL	HDPE	H_2SO_4, ≤6°C	28 days	--	50	100
Methane	RSK175	(3) 40-mL VOA vials	Glass VOA vials	None, ≤6°C	7 days	--	0.078	1
Carbon Dioxide	Field-measured or RSK175	NA	NA	NA	NA	--	39.8	100

[a] ROD cleanup level (CUL) concentrations are selected from Table 17 of the Portland Harbor ROD (EPA 2017). Values were selected from remedial action objectives 4 and 8 associated with migration of contaminated groundwater. Values reflect changes from Errata for Portland Harbor ROD (EPA 2018) and Errata #2 for Portland Harbor ROD (EPA 2020).

Notes:
-- = Not applicable
µg/L = microgram(s) per liter
H_2SO_4 = sulfuric acid
HCl = hydrochloric acid
HDPE = high-density polyethylene
mL = milliliter
NA = not applicable
VOA = volatile organic analysis

4.3 Groundwater Monitoring Frequency

In accordance with EPA guidance (2004), the sampling frequency of the monitoring program is designed to accomplish the following:

- Provide timely warning of impacts on receptors.
- Detect VOC releases to groundwater that warn of possible plume expansion.
- Detect changes in plume size/concentration.
- Determine temporal variability of data.
- Detect changes in geochemistry that warn of changes in attenuation.
- Yield data necessary to reliably evaluate progress toward VOC reduction objectives.

In accordance with EPA guidance, quarterly monitoring will be conducted for the three new monitoring wells after installation in order to establish baseline conditions, observe seasonal trends including response to recharge, and estimate attenuation rates for key constituents (EPA 2004). Quarterly monitoring for several years provides baseline data to determine trends at new monitoring points and tests key hypotheses of the conceptual site model (EPA 2004). It is assumed that groundwater data from the new wells will show the same stability in trends as the other site wells, which have been monitored for many years. Therefore, 2 years of quarterly monitoring will be performed for the new wells, while the existing wells continue to be sampled on a semiannual basis. After this two-year period, the monitoring frequency will then transition to annual for all wells. Groundwater depth-to-water measurements will be performed on all wells in the monitoring program (Table 4-1) during sampling events prior to purging and sample collection. The proposed monitoring schedule is presented in Table 4-3.

Table 4-3. Sampling Frequency by Well

Well	Year 1	Year 2	Year 3	Year 4	Year 5+
MW-01	SA	SA	A	A	A
MW-02	SA	SA	A	A	A
MW-03	SA	SA	A	A	A
MW-04	SA	SA	A	A	A
MW-05	SA	SA	A	A	A
MW-06	SA	SA	A	A	A
MW-10	Q	Q	A	A	A
MW-11	Q	Q	A	A	A
MW-12	Q	Q	A	A	A
T4S1MW-03S	SA	SA	A	A	A
T4S1MW-09	SA	SA	A	A	A
T4S1MW-22	SA	SA	A	A	A
T4S1MW-23	SA	SA	A	A	A

Notes:
Q = quarterly
SA = semiannually
A = annually

EPA guidance supports reducing monitoring over time in situations where hydrologic, geochemical, and contaminant trends are stable, and the conceptual site model is verified by measured site data (EPA 2004). Reduction in groundwater monitoring to an annual rate after initial data are collected on the three new wells is supported by the consistent data collected over the past 5 years, the relatively slow groundwater velocity, and the active reductive dechlorination occurring at the site. There is little difference between the two monitoring frequencies when considering groundwater movement. As discussed in Section 3.5, groundwater velocity in the Southeast Area and over the upper portion of the Port site is approximately 0.31 ft/day. Over the course of a year, groundwater could migrate 113 feet between monitoring events compared to 56 feet between semiannual events. VOCs in groundwater would migrate even shorter distances because of retardation and reductive dechlorination. Northwest Pipe will assess monitoring frequency in light of monitoring results and may recommend future changes in monitoring frequency, if warranted by the data.

4.4 Annual Data Evaluation

The EPA guidance indicates data evaluation should include a plan for verifying attainment of monitoring objectives, proposed time period for verifying attainment of objectives and ending monitoring, and specific statistical methods of data analysis to be used in determining attainment. Monitoring data collected regularly since 2016 have shown that the VOC plume in the Southeast Area attenuates before reaching the monitoring wells located closest to the river. The continued success of the MNA remedy will be based on whether concentrations of VOCs at the boundary wells to the Willamette River (T4S1MW-03S and T4S1MW-09) remain below ROD CULs.

Annual data evaluation will be based primarily on qualitative methods following the format developed in monitoring since 2016. Annual Data Evaluations will include trend plots and plan view maps of the groundwater flow directions and VOC concentrations, as described in Section 4.5. Concentrations on the margins of the plume will be evaluated qualitatively to verify that the plume is not expanding. Concentrations at the boundary wells to the Willamette River (T4S1MW-03S and T4S1MW-09) will be evaluated to confirm no exceedances of ROD CULs have occurred. If the qualitative analysis yields unclear information, quantitative methods to assess plume stability will be evaluated for use and submitted for DEQ approval. Annual Data Evaluations will be included in the reporting, as described in Section 4.5.

4.5 Annual Reporting

Data from the long-term MNA groundwater monitoring will be included in an annual monitoring report summarizing the groundwater sampling and any other site activities related to groundwater source control completed during each calendar year. The report will provide an evaluation of whether the MNA-efforts are satisfying the source control objective. Reports will be submitted to DEQ within 60 days of completion of data validation from the last event for the year. The annual reports generally include the following:

- A description of field activities completed
- Deviations from this MNA Work Plan (if any)
- A figure showing the MNA monitoring well network
- A table summarizing depths to groundwater and groundwater elevations
- Potentiometric surface maps for each monitoring event
- Analytical summary tables presenting groundwater sample results compared to ROD CULs
- Tables of VOC concentrations indicating detections and exceedances of ROD CULs posted on Site map
- Trend graphs
- Results from quantitative analysis, if any are completed due to unclear qualitative evaluation of results
- Laboratory analytical reports
- Laboratory data validation memorandum

The following will be completed to evaluate the MNA work:

- Review and update (if needed) the conceptual site model.
- Assess the geochemical environment.
- Verification that the plume is not expanding laterally or vertically; the following will be used to support this assessment:
  - Tables of VOC concentrations indicating detections and exceedances of ROD CULs posted on Site map Trend analysis of concentrations at individual monitoring wells
  - Statistical analyses, if performed
- Confirm there are no unacceptable impacts on downgradient receptors (Willamette River).

Should the MNA evaluation indicate that the VOCs at the boundary wells to the Willamette River (T4S1MW-03S and T4S1MW-09) exceed ROD CULs, options to address the issue will be evaluated with DEQ, including, if necessary, an onsite remedial evaluation. Any future monitoring program will be evaluated on 5-year intervals, and any proposed changes will be submitted for DEQ approval.

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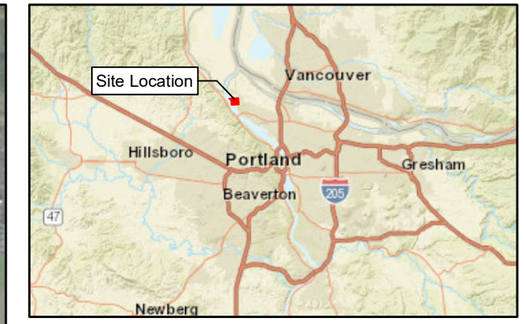
Figures



LEGEND

- Northwest Pipe Site Boundary
- Burgard Industrial Park
- Felton Property

N

0 250 500 1,000
Feet

Figure 1-1. Vicinity Map
Northwest Pipe Company
Portland, Oregon

Jacobs

\\PDXFPP01\PROJ\NORTHWESTPIPECOMPANY\485880PORTHARBSUP\GIS\MAPFILES\2021\MNA WORK PLAN\FIGURE1-1_VICINITYMAP.MXD GGEE 10/8/2021 2:37:13 PM

LEGEND

1897 Surface Water Features

- Historical Waterbody
- Historical Marsh/Mudflat
- Historical Gatton Creek[1]
- Northwest Pipe Site Boundary

Note:
[1]The depicted location of historical Gatton Creek is based on its mapped location shown by the U.S. Geological Survey in its 1897 topographic map of the area. However, the historical creek channel may have shifted to the east or west over time, as is common for stream channels, before it was buried by fill placed in the area in the early 1940s.

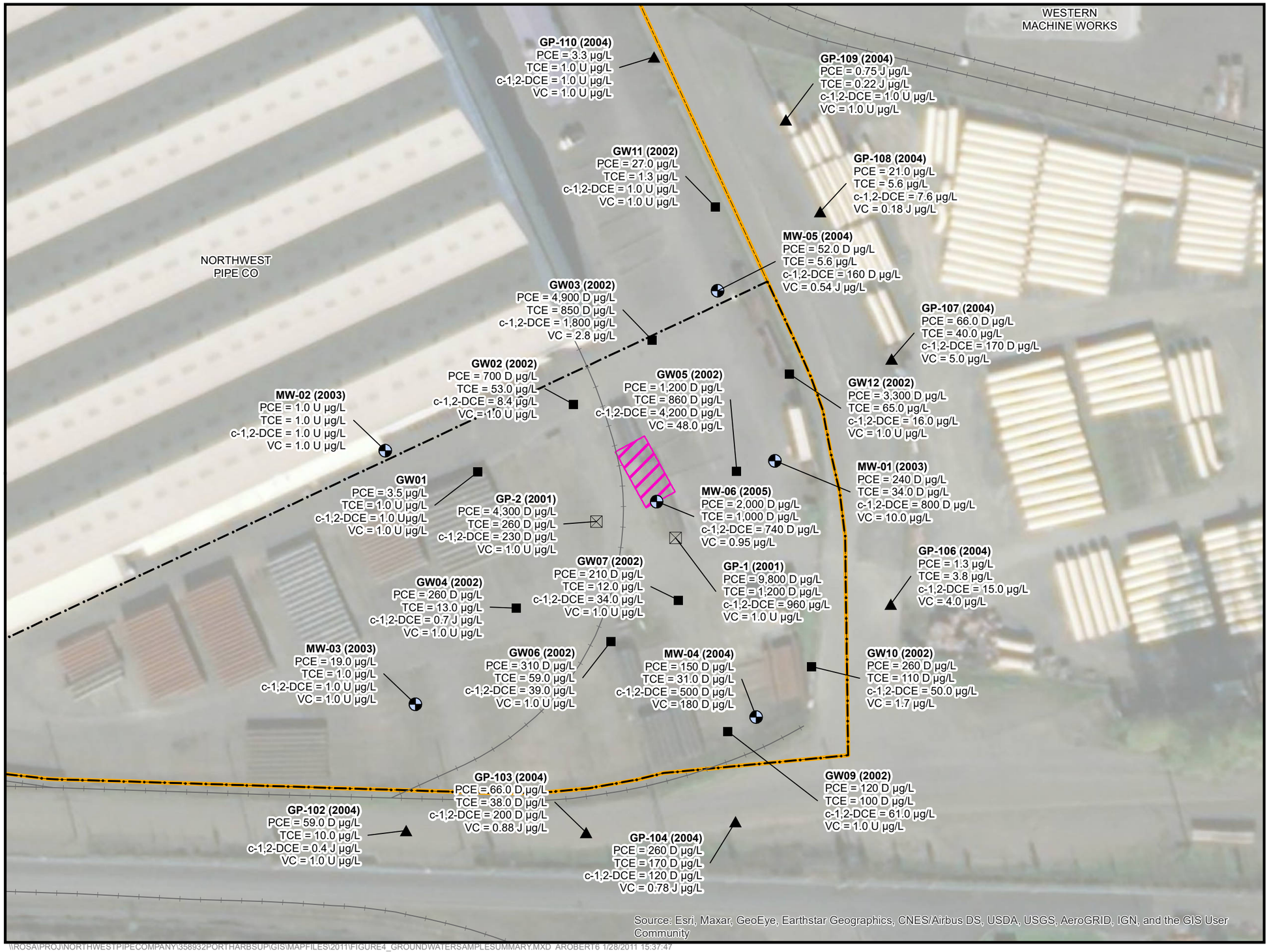
N

0 200 400 800
Feet

Figure 2-1. Selected Hydrologic Features from 1897 Map Digitized onto Current Aerial
Northwest Pipe Company
Portland, Oregon

Jacobs

\\PDXFPP01\PROJNORTHWESTPIPECOMPANY\485880PORTHARBSUP\GIS\MAPFILES\2021\MNA WORK PLAN\FIGURE2-1_1897USGSMAP.MXD GGEE 10/1/2021 4:05:56 PM



LEGEND

Groundwater Sample Location

- September, 2001 Geoprobe Sample
- August, 2002 Geoprobe Sample
- 2003 - Present Monitoring Well Location
- July, 2004 Geoprobe Sample
- Approximate Location of Former Waste Oil Tank[1]
- Railroad Line
- Leased Property Boundary
- Northwest Pipe Site Boundary

Notes:
µg/L = micrograms per Liter
PCE = tetrachloroethene
TCE = trichloroethene
c-1,2-DCE = cis-1,2-dichloroethene
VC = vinyl chloride
U = nondetect
J = estimated
D = dilution
[1] Dames & Moore, 1989

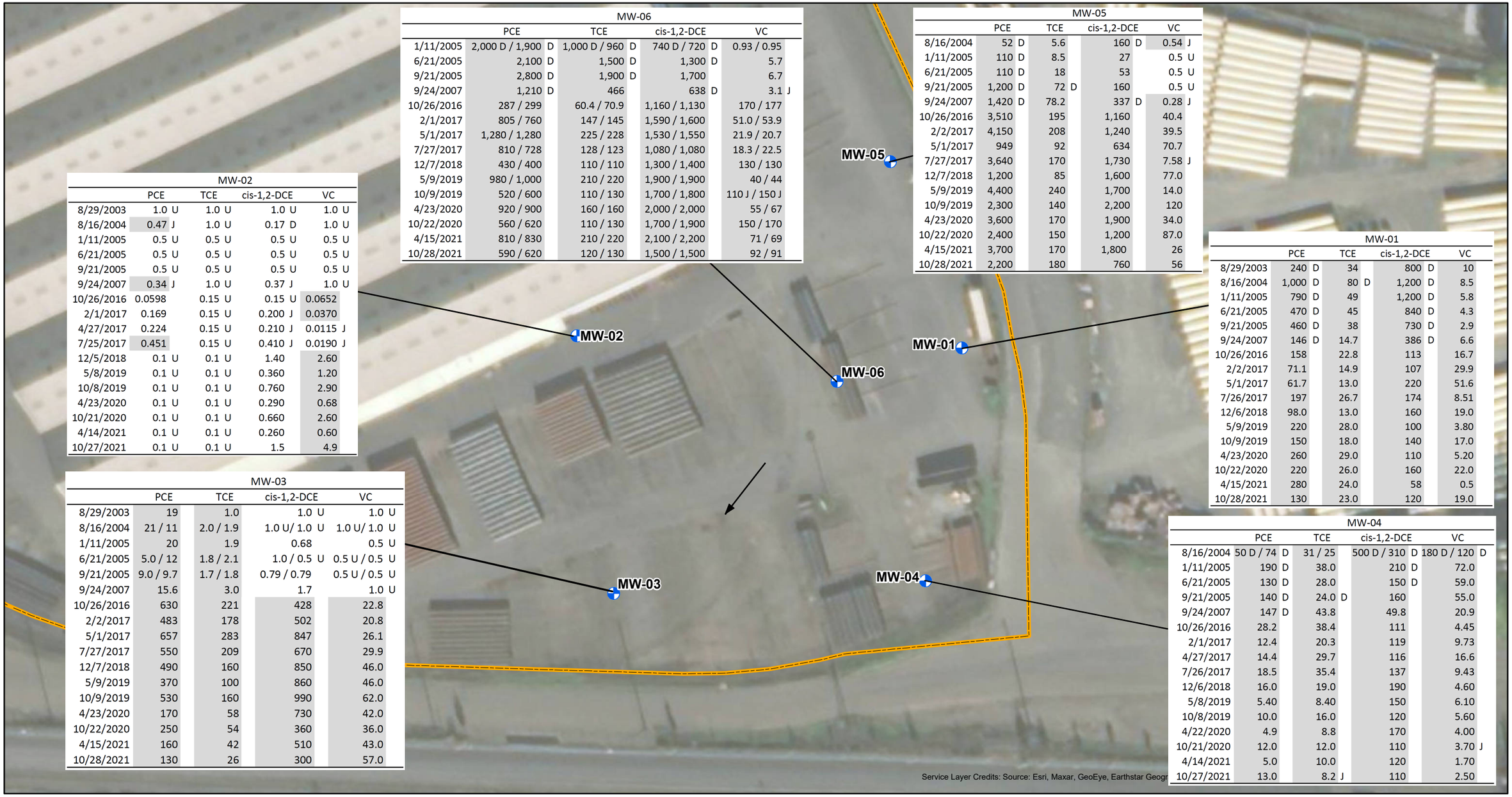
N

0 37.5 75 150
Feet

Figure 3-1. VOCs in Groundwater 2001 through 2005
Northwest Pipe Company
Portland, Oregon

Jacobs

\\ROSA\PROJ\NORTHWESTPIPECOMPANY\358932PORTHARBSUP\GIS\MAPFILES\2011\FIGURE4_GROUNDWATERSAMPLESUMMARY.MXD AROBERT6 1/28/2011 15:37:47



MW-06

	PCE	TCE	cis-1,2-DCE	VC
1/11/2005	2,000 D / 1,900 D	1,000 D / 960 D	740 D / 720 D	0.93 / 0.95
6/21/2005	2,100 D	1,500 D	1,300 D	5.7
9/21/2005	2,800 D	1,900 D	1,700	6.7
9/24/2007	1,210 D	466	638 D	3.1 J
10/26/2016	287 / 299	60.4 / 70.9	1,160 / 1,130	170 / 177
2/1/2017	805 / 760	147 / 145	1,590 / 1,600	51.0 / 53.9
5/1/2017	1,280 / 1,280	225 / 228	1,530 / 1,550	21.9 / 20.7
7/27/2017	810 / 728	128 / 123	1,080 / 1,080	18.3 / 22.5
12/7/2018	430 / 400	110 / 110	1,300 / 1,400	130 / 130
5/9/2019	980 / 1,000	210 / 220	1,900 / 1,900	40 / 44
10/9/2019	520 / 600	110 / 130	1,700 / 1,800	110 J / 150 J
4/23/2020	920 / 900	160 / 160	2,000 / 2,000	55 / 67
10/22/2020	560 / 620	110 / 130	1,700 / 1,900	150 / 170
4/15/2021	810 / 830	210 / 220	2,100 / 2,200	71 / 69
10/28/2021	590 / 620	120 / 130	1,500 / 1,500	92 / 91

MW-05

	PCE	TCE	cis-1,2-DCE	VC
8/16/2004	52 D	5.6	160 D	0.54 J
1/11/2005	110 D	8.5	27	0.5 U
6/21/2005	110 D	18	53	0.5 U
9/21/2005	1,200 D	72 D	160	0.5 U
9/24/2007	1,420 D	78.2	337 D	0.28 J
10/26/2016	3,510	195	1,160	40.4
2/2/2017	4,150	208	1,240	39.5
5/1/2017	949	92	634	70.7
7/27/2017	3,640	170	1,730	7.58 J
12/7/2018	1,200	85	1,600	77.0
5/9/2019	4,400	240	1,700	14.0
10/9/2019	2,300	140	2,200	120
4/23/2020	3,600	170	1,900	34.0
10/22/2020	2,400	150	1,200	87.0
4/15/2021	3,700	170	1,800	26
10/28/2021	2,200	180	760	56

MW-02

	PCE	TCE	cis-1,2-DCE	VC
8/29/2003	1.0 U	1.0 U	1.0 U	1.0 U
8/16/2004	0.47 J	1.0 U	0.17 D	1.0 U
1/11/2005	0.5 U	0.5 U	0.5 U	0.5 U
6/21/2005	0.5 U	0.5 U	0.5 U	0.5 U
9/21/2005	0.5 U	0.5 U	0.5 U	0.5 U
9/24/2007	0.34 J	1.0 U	0.37 J	1.0 U
10/26/2016	0.0598	0.15 U	0.15 U	0.0652
2/1/2017	0.169	0.15 U	0.200 J	0.0370
4/27/2017	0.224	0.15 U	0.210 J	0.0115 J
7/25/2017	0.451	0.15 U	0.410 J	0.0190 J
12/5/2018	0.1 U	0.1 U	1.40	2.60
5/8/2019	0.1 U	0.1 U	0.360	1.20
10/8/2019	0.1 U	0.1 U	0.760	2.90
4/23/2020	0.1 U	0.1 U	0.290	0.68
10/21/2020	0.1 U	0.1 U	0.660	2.60
4/14/2021	0.1 U	0.1 U	0.260	0.60
10/27/2021	0.1 U	0.1 U	1.5	4.9

MW-01

	PCE	TCE	cis-1,2-DCE	VC
8/29/2003	240 D	34	800 D	10
8/16/2004	1,000 D	80 D	1,200 D	8.5
1/11/2005	790 D	49	1,200 D	5.8
6/21/2005	470 D	45	840 D	4.3
9/21/2005	460 D	38	730 D	2.9
9/24/2007	146 D	14.7	386 D	6.6
10/26/2016	158	22.8	113	16.7
2/2/2017	71.1	14.9	107	29.9
5/1/2017	61.7	13.0	220	51.6
7/26/2017	197	26.7	174	8.51
12/6/2018	98.0	13.0	160	19.0
5/9/2019	220	28.0	100	3.80
10/9/2019	150	18.0	140	17.0
4/23/2020	260	29.0	110	5.20
10/22/2020	220	26.0	160	22.0
4/15/2021	280	24.0	58	0.5
10/28/2021	130	23.0	120	19.0

MW-03

	PCE	TCE	cis-1,2-DCE	VC
8/29/2003	19	1.0	1.0 U	1.0 U
8/16/2004	21 / 11	2.0 / 1.9	1.0 U/ 1.0 U	1.0 U/ 1.0 U
1/11/2005	20	1.9	0.68	0.5 U
6/21/2005	5.0 / 12	1.8 / 2.1	1.0 / 0.5 U	0.5 U / 0.5 U
9/21/2005	9.0 / 9.7	1.7 / 1.8	0.79 / 0.79	0.5 U / 0.5 U
9/24/2007	15.6	3.0	1.7	1.0 U
10/26/2016	630	221	428	22.8
2/2/2017	483	178	502	20.8
5/1/2017	657	283	847	26.1
7/27/2017	550	209	670	29.9
12/7/2018	490	160	850	46.0
5/9/2019	370	100	860	46.0
10/9/2019	530	160	990	62.0
4/23/2020	170	58	730	42.0
10/22/2020	250	54	360	36.0
4/15/2021	160	42	510	43.0
10/28/2021	130	26	300	57.0

MW-04

	PCE	TCE	cis-1,2-DCE	VC
8/16/2004	50 D / 74 D	31 / 25	500 D / 310 D	180 D / 120 D
1/11/2005	190 D	38.0	210 D	72.0
6/21/2005	130 D	28.0	150 D	59.0
9/21/2005	140 D	24.0 D	160	55.0
9/24/2007	147 D	43.8	49.8	20.9
10/26/2016	28.2	38.4	111	4.45
2/1/2017	12.4	20.3	119	9.73
4/27/2017	14.4	29.7	116	16.6
7/26/2017	18.5	35.4	137	9.43
12/6/2018	16.0	19.0	190	4.60
5/8/2019	5.40	8.40	150	6.10
10/8/2019	10.0	16.0	120	5.60
4/22/2020	4.9	8.8	170	4.00
10/21/2020	12.0	12.0	110	3.70 J
4/14/2021	5.0	10.0	120	1.70
10/27/2021	13.0	8.2 J	110	2.50

LEGEND

- Groundwater Quality Monitoring Well (VOC concentrations in µg/L)
- Well Used for Water Level Measurements Only
- General Groundwater Flow Direction
- Northwest Pipe Facility Boundary

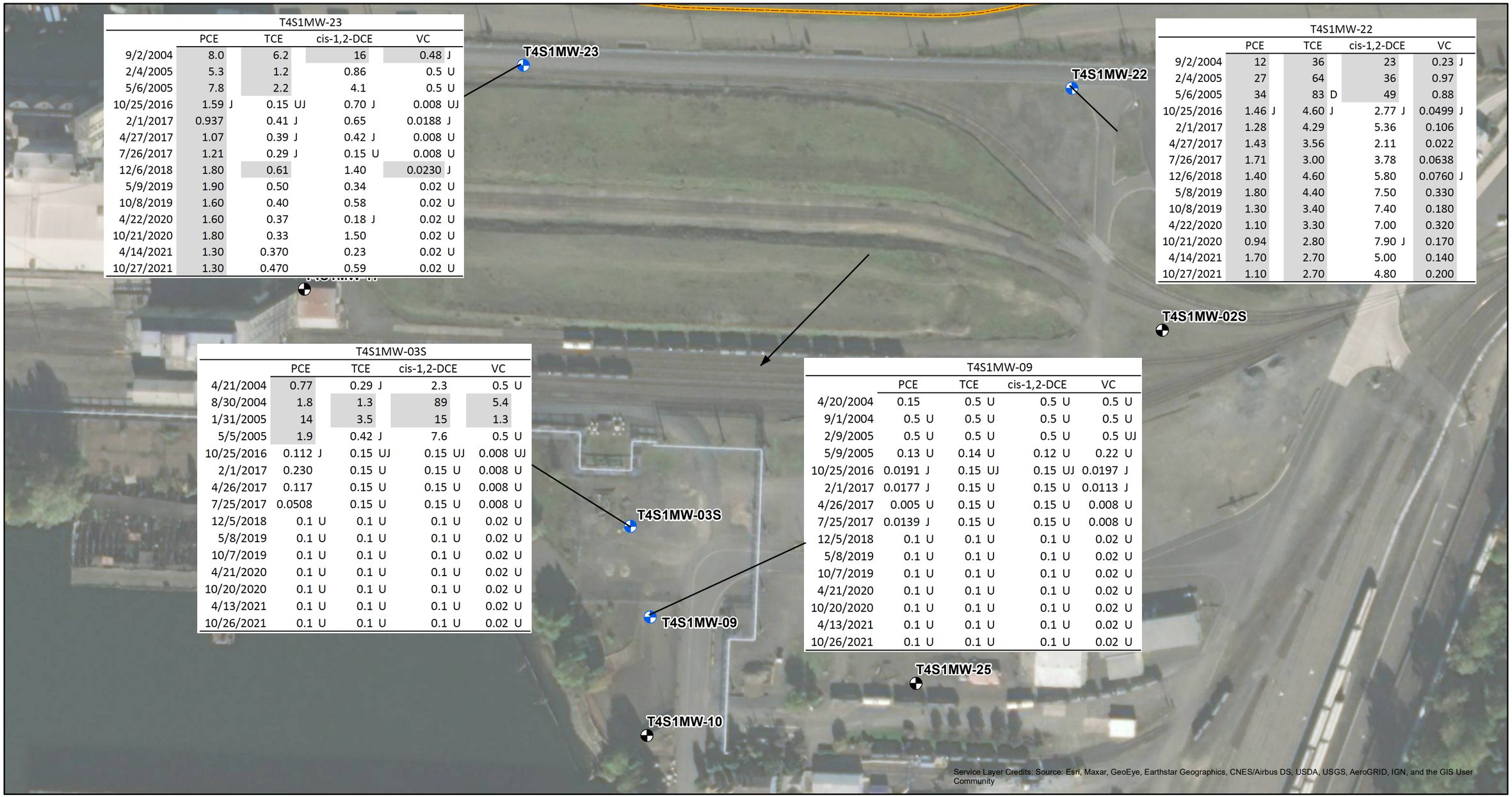
Notes:
All volatile organic compound (VOC) concentrations are reported in micrograms per liter (µg/L).
PCE = Tetrachloroethene; TCE = Trichloroethene; cis-1,2-DCE = cis-1,2-Dichloroethene; VC = Vinyl Chloride
D - the sample was diluted for analysis.
U - the analyte was analyzed for but was not detected above the detection limit.
J - the analyte was detected, but the analytical laboratory has flagged the associated numerical value as estimated.
UJ - the analyte was not detected above the detection limit. However, the detection limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
Shaded values exceed ROD concentrations selected from Table 17 of the Portland Harbor Record of Decision (U.S. Environmental Protection Agency Region 10, 2017). Values were selected from remedial action objectives (RAOs) 4 and 8 associated with migration of contaminated groundwater. The following values are used:
PCE = 0.24, TCE = 0.6, cis-1,2-DCE = 70, and VC = 0.022. All values in µg/L.

N

0 25 50 100
Feet

Figure 3-2. Southeast Area VOC Concentrations
August 2003 through October 2021
Northwest Pipe Company
Portland, Oregon

Jacobs



T4S1MW-23

	PCE	TCE	cis-1,2-DCE	VC
9/2/2004	8.0	6.2	16	0.48 J
2/4/2005	5.3	1.2	0.86	0.5 U
5/6/2005	7.8	2.2	4.1	0.5 U
10/25/2016	1.59 J	0.15 UJ	0.70 J	0.008 UJ
2/1/2017	0.937	0.41 J	0.65	0.0188 J
4/27/2017	1.07	0.39 J	0.42 J	0.008 U
7/26/2017	1.21	0.29 J	0.15 U	0.008 U
12/6/2018	1.80	0.61	1.40	0.0230 J
5/9/2019	1.90	0.50	0.34	0.02 U
10/8/2019	1.60	0.40	0.58	0.02 U
4/22/2020	1.60	0.37	0.18 J	0.02 U
10/21/2020	1.80	0.33	1.50	0.02 U
4/14/2021	1.30	0.370	0.23	0.02 U
10/27/2021	1.30	0.470	0.59	0.02 U

T4S1MW-22

	PCE	TCE	cis-1,2-DCE	VC
9/2/2004	12	36	23	0.23 J
2/4/2005	27	64	36	0.97
5/6/2005	34	83 D	49	0.88
10/25/2016	1.46 J	4.60 J	2.77 J	0.0499 J
2/1/2017	1.28	4.29	5.36	0.106
4/27/2017	1.43	3.56	2.11	0.022
7/26/2017	1.71	3.00	3.78	0.0638
12/6/2018	1.40	4.60	5.80	0.0760 J
5/8/2019	1.80	4.40	7.50	0.330
10/8/2019	1.30	3.40	7.40	0.180
4/22/2020	1.10	3.30	7.00	0.320
10/21/2020	0.94	2.80	7.90 J	0.170
4/14/2021	1.70	2.70	5.00	0.140
10/27/2021	1.10	2.70	4.80	0.200

T4S1MW-03S

	PCE	TCE	cis-1,2-DCE	VC
4/21/2004	0.77	0.29 J	2.3	0.5 U
8/30/2004	1.8	1.3	89	5.4
1/31/2005	14	3.5	15	1.3
5/5/2005	1.9	0.42 J	7.6	0.5 U
10/25/2016	0.112 J	0.15 UJ	0.15 UJ	0.008 UJ
2/1/2017	0.230	0.15 U	0.15 U	0.008 U
4/26/2017	0.117	0.15 U	0.15 U	0.008 U
7/25/2017	0.0508	0.15 U	0.15 U	0.008 U
12/5/2018	0.1 U	0.1 U	0.1 U	0.02 U
5/8/2019	0.1 U	0.1 U	0.1 U	0.02 U
10/7/2019	0.1 U	0.1 U	0.1 U	0.02 U
4/21/2020	0.1 U	0.1 U	0.1 U	0.02 U
10/20/2020	0.1 U	0.1 U	0.1 U	0.02 U
4/13/2021	0.1 U	0.1 U	0.1 U	0.02 U
10/26/2021	0.1 U	0.1 U	0.1 U	0.02 U

T4S1MW-09

	PCE	TCE	cis-1,2-DCE	VC
4/20/2004	0.15	0.5 U	0.5 U	0.5 U
9/1/2004	0.5 U	0.5 U	0.5 U	0.5 U
2/9/2005	0.5 U	0.5 U	0.5 U	0.5 UJ
5/9/2005	0.13 U	0.14 U	0.12 U	0.22 U
10/25/2016	0.0191 J	0.15 UJ	0.15 UJ	0.0197 J
2/1/2017	0.0177 J	0.15 U	0.15 U	0.0113 J
4/26/2017	0.005 U	0.15 U	0.15 U	0.008 U
7/25/2017	0.0139 J	0.15 U	0.15 U	0.008 U
12/5/2018	0.1 U	0.1 U	0.1 U	0.02 U
5/8/2019	0.1 U	0.1 U	0.1 U	0.02 U
10/7/2019	0.1 U	0.1 U	0.1 U	0.02 U
4/21/2020	0.1 U	0.1 U	0.1 U	0.02 U
10/20/2020	0.1 U	0.1 U	0.1 U	0.02 U
4/13/2021	0.1 U	0.1 U	0.1 U	0.02 U
10/26/2021	0.1 U	0.1 U	0.1 U	0.02 U

LEGEND

- Groundwater Quality Monitoring Well (VOC concentrations in µg/L)
- Well Used for Water Level Measurements Only
- General Groundwater Flow Direction
- Northwest Pipe Facility Boundary

Notes:
All volatile organic compound (VOC) concentrations are reported in micrograms per liter (µg/L).
PCE = Tetrachloroethene; TCE = Trichloroethene; cis-1,2-DCE = cis-1,2-Dichloroethene; VC = Vinyl Chloride
D - the sample was diluted for analysis.
U - the analyte was analyzed for but was not detected above the detection limit.
J - the analyte was detected, but the analytical laboratory has flagged the associated numerical value as estimated.
UJ - the analyte was not detected above the detection limit. However, the detection limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
Shaded values exceed ROD concentrations selected from Table 17 of the Portland Harbor Record of Decision (U.S. Environmental Protection Agency Region 10, 2017). Values were selected from remedial action objectives (RAOs) 4 and 8 associated with migration of contaminated groundwater. The following values are used: PCE = 0.24, TCE = 0.6, cis-1,2-DCE = 70, and VC = 0.022. All values in µg/L.

N

0 45 90 180
Feet

Figure 3-3. Port of Portland VOC Concentrations August 2003 through October 2021
Northwest Pipe Company
Portland, Oregon

Jacobs

\\PDXFPP01\PROJ\NORTHWESTPIPECOMPANY\485880PORTHARBSUP\GIS\MAPFILES\2021\MNA WORK PLAN\FIGURE3-3_VOC_CONCENTRATIONS_2003-2021.MXD GGEE 10/8/2021 3:03:53 PM

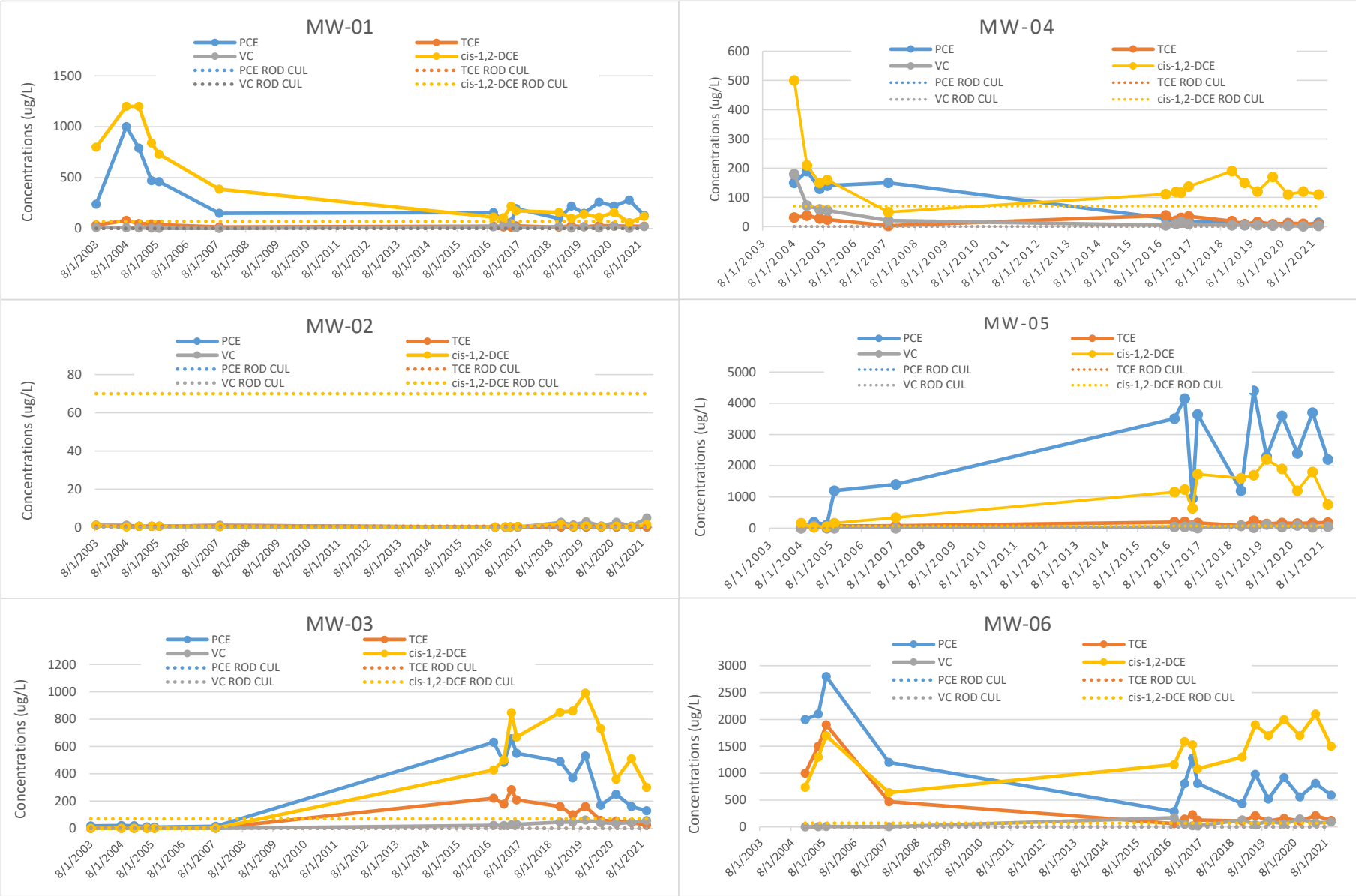


Figure 3-4. VOC Trend Plots in the Southeast Area (2003 - 2021)

Northwest Pipe Company
Portland, Oregon

Figure 3-5. VOC Trend Plots on the Port of Portland Property (2003 - 2021)
Northwest Pipe Company
Portland, Oregon

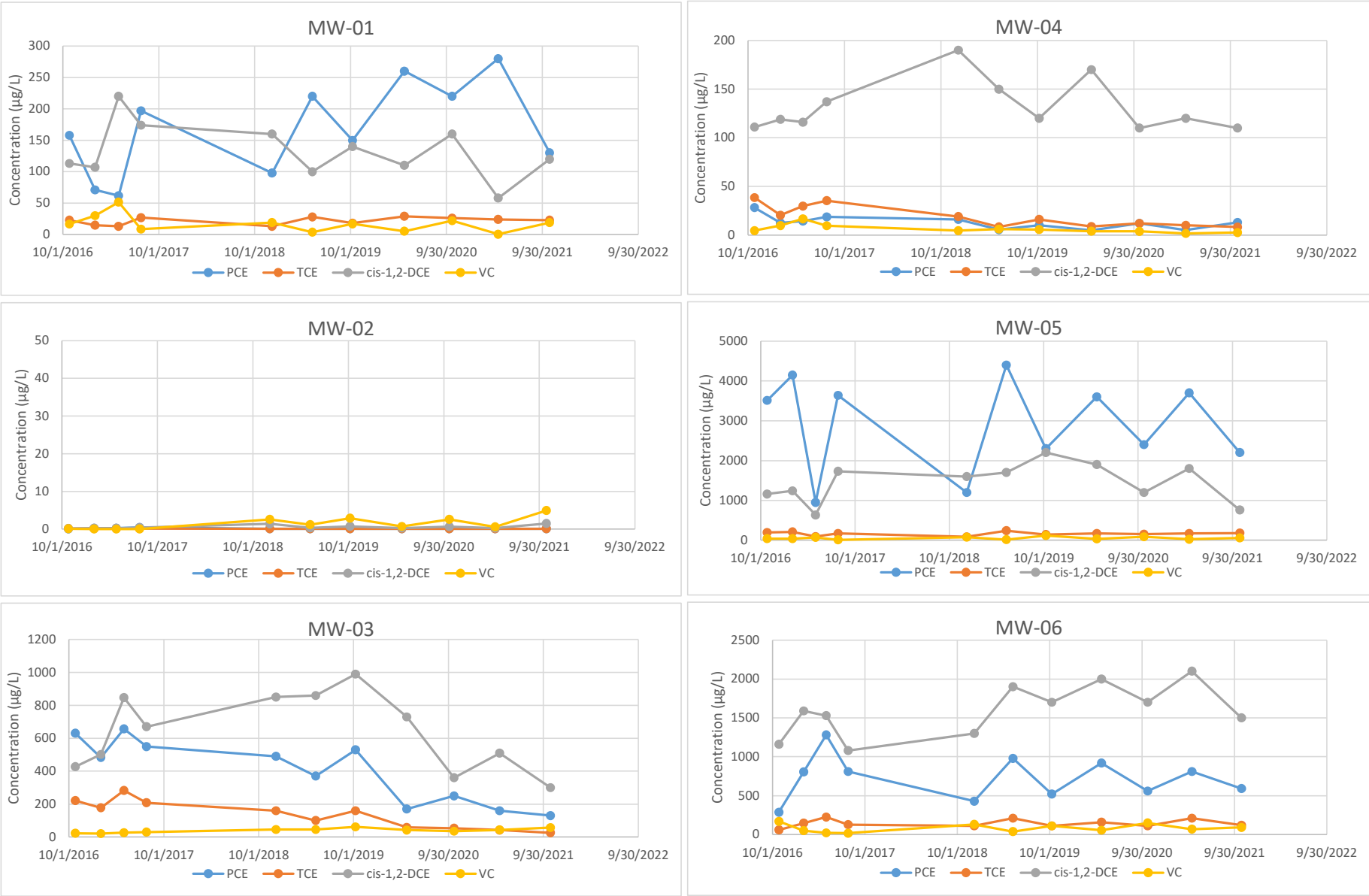


Figure 3-6. VOC Trend Plots in the Southeast Area (2016 - 2021)
Northwest Pipe Company
Portland, Oregon

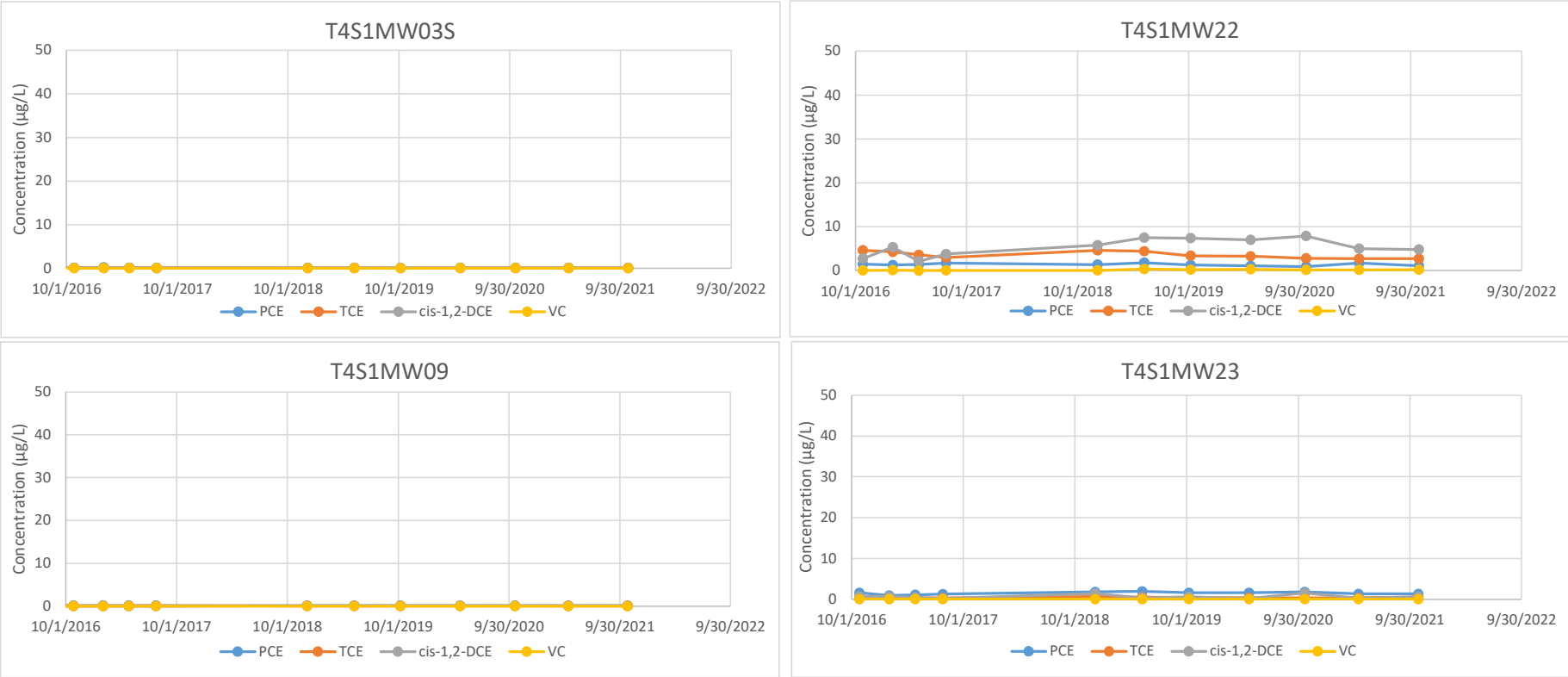
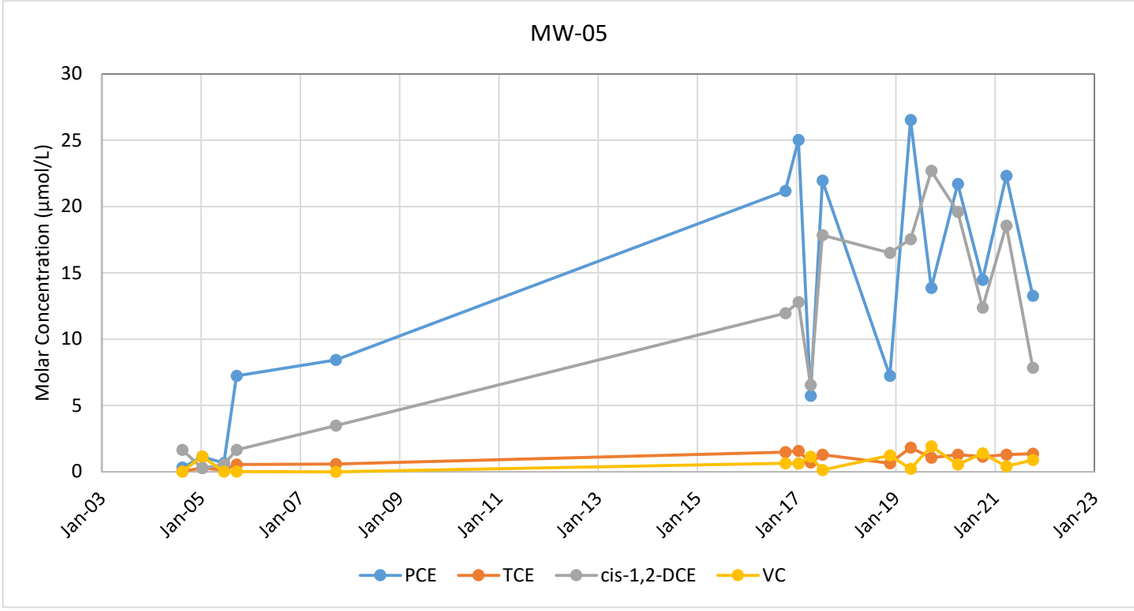
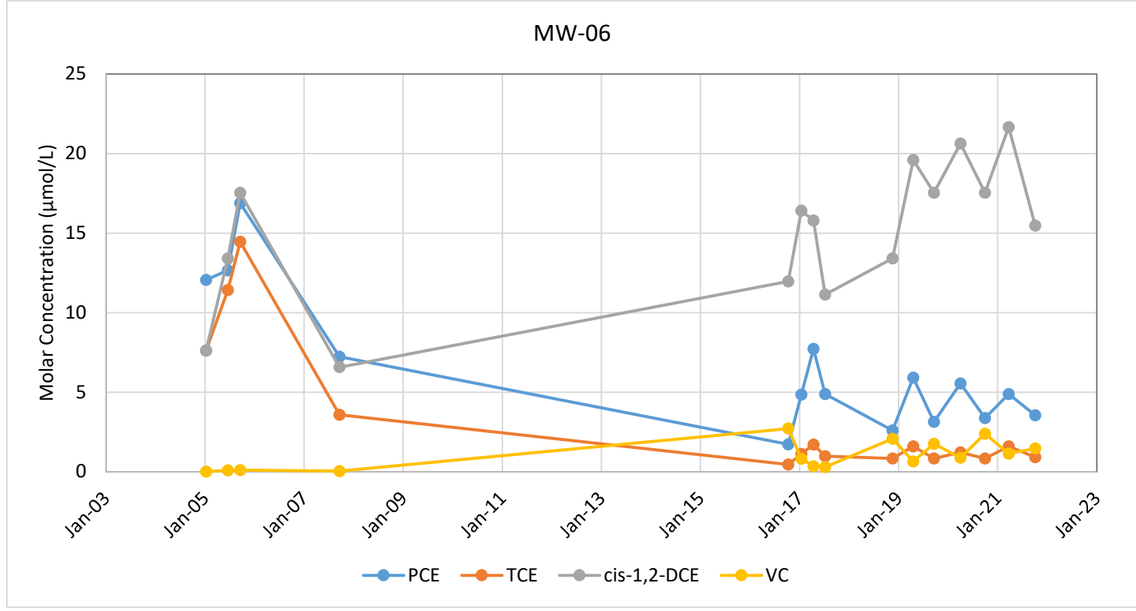
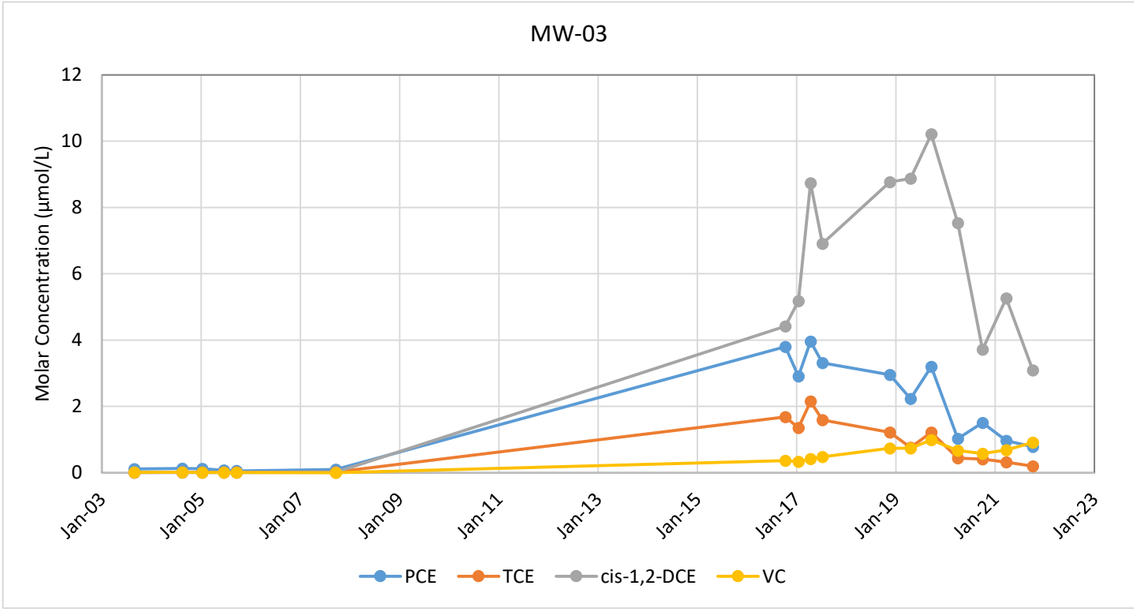


Figure 3-7. VOC Trend Plots on the Port of Portland Property (2016 - 2021)
Northwest Pipe Company
Portland, Oregon







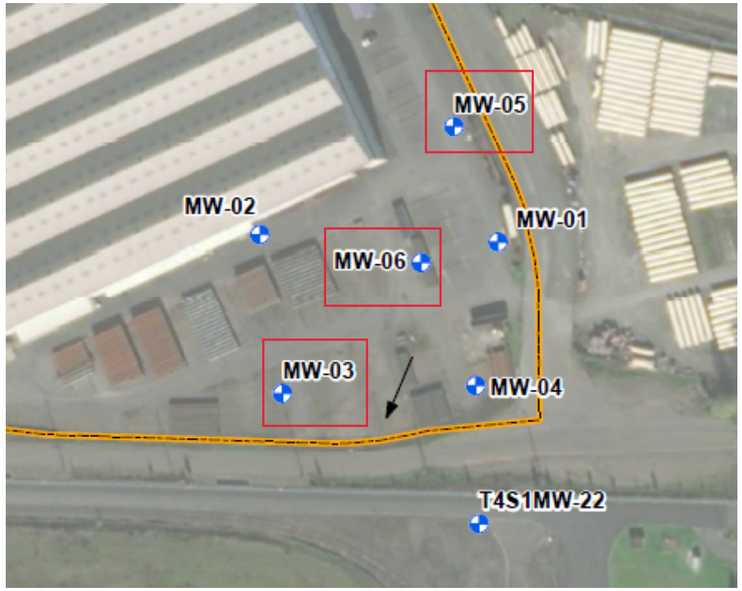
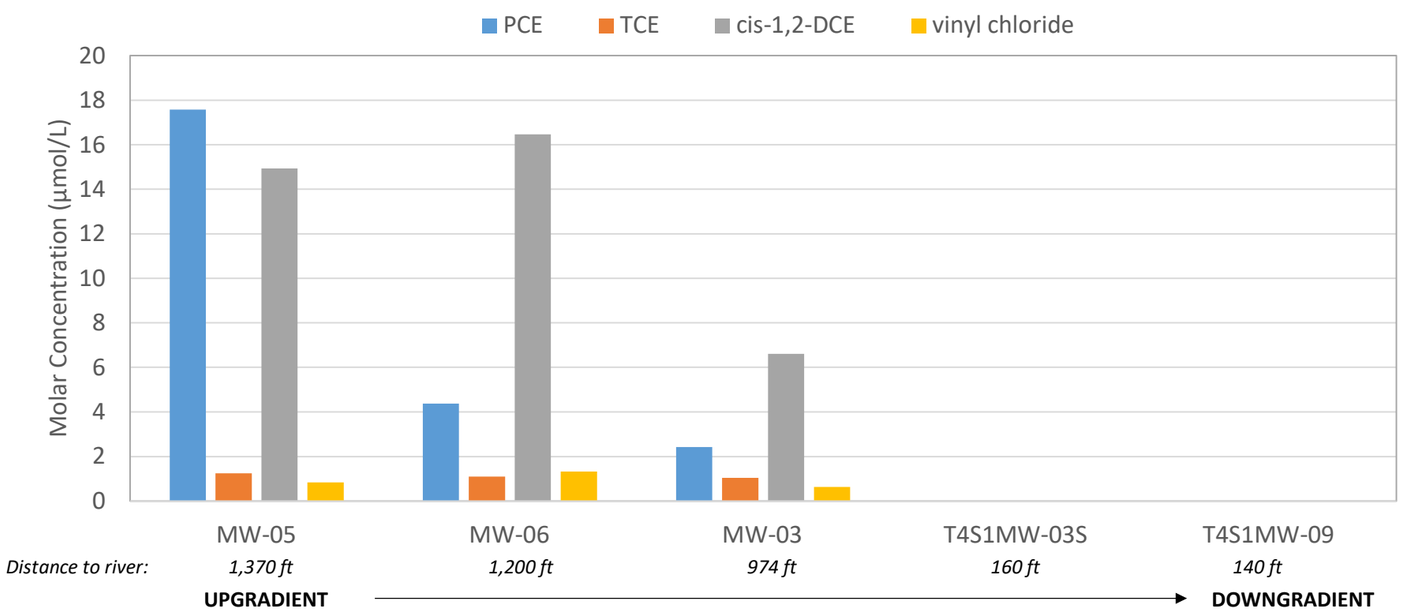


FIGURE LEGEND

- Data Graphed for Selected Well
- Groundwater Monitoring Well
- General Groundwater Flow Direction

Figure 3-8. Molar VOC Concentration Plots for Selected Wells (2003 - 2021)

Northwest Pipe Company
Portland, Oregon



Data displayed:

	Average Molar Concentration (µmol/L)			
	PCE	TCE	cis-1,2-DCE	vinyl chloride
MW-05	17.6	1.2	14.9	0.8
MW-06	4.4	1.1	16.5	1.3
MW-03	2.4	1.0	6.6	0.6
T4S1MW-03S	0.0007	0.0009	0.0012	0.0003
T4S1MW-09	0.0004	0.0009	0.0012	0.0003

FIGURE LEGEND

Selected Well Shown in Graph Above

Groundwater Monitoring Well

General Groundwater Flow Direction

Figure 3-9. Average Molar VOC Concentrations for Selected Wells (2016-2021)

Northwest Pipe Company

Portland, Oregon

LEGEND

Proposed MNA Monitoring Network

- Groundwater Quality Monitoring Well
- Monitoring Well for Water Level Monitoring Only
- New Groundwater Quality Monitoring Well
- Soil Gas Investigation Location
- General Groundwater Flow Direction
- Northwest Pipe Facility Boundary

1897 Surface Water Features

- Historical Waterbody
- Historical Marsh/Mudflat
- Historical Gatton Creek[1]

Note:
[1]The depicted location of historical Gatton Creek is based on its mapped location shown by the U.S. Geological Survey in its 1897 topographic map of the area. However, the historical creek channel may have shifted to the east or west over time, as is common for stream channels, before it was buried by fill placed in the area in the early 1940s.

N

0 75 150 300
Feet

Figure 4-1. Proposed MNA Monitoring Well Network
Northwest Pipe Company
Portland, Oregon

Jacobs

\\PDXFPP01\PROJ\NORTHWESTPIPECOMPANY\485880PORTHARBSUP\GIS\MAPFILES\2021\MNA WORK PLAN\FIGURE4-1_MNAWELLNETWORK_122221.MXD GGEE 4/14/2022 3:40:02 PM

Appendix A
Groundwater Analytical Data Tables

Table 1

Groundwater Quality Analytical Data for Volatile Organic Compounds

Northwest Pipe Company Portland Plant

		Volatile Organic Compounds (µg/L)			
		PCE	TCE	cis-1,2-DCE	VC
Portland Harbor ROD Concentrations (µg/L) [1]		*0.24*	*0.6*	*70*	*0.022*
Northwest Pipe Company Wells					
MW-01	10/26/2016	158	22.8	113	16.7
(1,280 feet to river)	2/2/2017	71.1	14.9	107	29.9
	5/1/2017	61.7	13.0	220	51.6
	7/26/2017	197	26.7	174	8.51
	12/6/2018	98.0	13.0	160	19.0
	5/9/2019	220	28.0	100	3.80
	10/9/2019	150	18.0	140	17.0
	4/23/2020	260	29.0	110	5.2
	10/22/2020	220	26.0	160	22.0
	4/15/2021	280	24.0	58	0.5
	10/28/2021	130	23.0	120	19.0
MW-02	10/26/2016	0.0598	0.15 U	0.15 U	0.0652
(1,140 feet to river)	2/1/2017	0.169	0.15 U	0.200 J	0.0370
	4/27/2017	0.224	0.15 U	0.210 J	0.0115 J
	7/25/2017	0.451	0.15 U	0.410 J	0.0190 J
	12/5/2018	0.1 U	0.1 U	1.40	2.60
	5/8/2019	0.1 U	0.1 U	0.360	1.20
	10/8/2019	0.1 U	0.1 U	0.760	2.90
	4/23/2020	0.1 U	0.1 U	0.290	0.68
	10/21/2020	0.1 U	0.1 U	0.660	2.60
	4/14/2021	0.1 U	0.1 U	0.260	0.60
	10/27/2021	0.1 U	0.1 U	1.5	4.9
MW-03	10/26/2016	630	221	428	22.8
(975 feet to river)	2/2/2017	483	178	502	20.8
	5/1/2017	657	283	847	26.1
	7/27/2017	550	209	670	29.9
	12/7/2018	490	160	850	46.0
	5/9/2019	370	100	860	46.0
	10/9/2019	530	160	990	62.0
	4/23/2020	170	58	730	42.0
	10/22/2020	250	54	360	36.0
	4/15/2021	160	42	510	43.0
	10/28/2021	130	26	300	57.0
MW-04	10/26/2016	28.2	38.4	111	4.45
(1,130 feet to river)	2/1/2017	12.4	20.3	119	9.73
	4/27/2017	14.4	29.7	116	16.6
	7/26/2017	18.5	35.4	137	9.43
	12/6/2018	16.0	19.0	190	4.60
	5/8/2019	5.40	8.40	150	6.10
	10/8/2019	10.0	16.0	120	5.60
	4/22/2020	4.9	8.8	170	4.00
	10/21/2020	12.0	12.0	110	3.70 J
	4/14/2021	5.0	10.0	120	1.70
	10/27/2021	13.0	8.2 J	110	2.50

Table 1
Groundwater Quality Analytical Data for Volatile Organic Compounds
Northwest Pipe Company Portland Plant

		Volatile Organic Compounds (µg/L)			
		PCE	TCE	cis-1,2-DCE	VC
	Portland Harbor ROD Concentrations (µg/L) [1]	*0.24*	*0.6*	*70*	*0.022*
MW-05	10/26/2016	3,510	195	1,160	40.4
(1,370 feet to river)	2/2/2017	4,150	208	1,240	39.5
	5/1/2017	949	92	634	70.7
	7/27/2017	3,640	170	1,730	7.58 J
	12/7/2018	1,200	85	1,600	77.0
	5/9/2019	4,400	240	1,700	14.0
	10/9/2019	2,300	140	2,200	120
	4/23/2020	3,600	170	1,900	34
	10/22/2020	2,400	150	1,200	87
	4/15/2021	3,700	170	1,800	26
	10/28/2021	2,200	180	760	56
MW-06	10/26/2016	287	60.4	1,160	170
(1,200 feet to river)	2/2/2017	805	147	1,590	51.0
	5/1/2017	1,280	225	1,530	21.9
	7/27/2017	810	128	1,080	18.3
	12/7/2018	430	110	1,300	130
	5/9/2019	980	210	1,900	40.0
	10/9/2019	520	110	1,700	110 J
	4/23/2020	920	160	2,000	55
	10/22/2020	560	110	1,700	150
	4/15/2021	810	210	2,100	71
	10/28/2021	590	120	1,500	92
MW-06	10/26/2016	299	70.9	1,130	177
Duplicate	2/2/2017	760	145	1,600	53.9
(1,200 feet to river)	5/1/2017	1,280	228	1,550	20.7
	7/27/2017	728	123	1,080	22.5
	12/7/2018	400	110	1,400	130
	5/9/2019	1,000	220	1,900	44.0
	10/9/2019	600	130	1,800	150 J
	4/23/2020	900	160	2,000	67
	10/22/2020	620	130	1,900	170
	4/15/2021	830	220	2,200	69
	10/28/2021	620	130	1,500	91
Port of Portland Wells (Upgradient to Downgradient)					
T4S1MW-22	10/25/2016	1.46 J	4.60 J	2.77 J	0.0499 J
(1,010 feet to river)	2/1/2017	1.28	4.29	5.36	0.106
	4/27/2017	1.43	3.56	2.11	0.022
	7/26/2017	1.71	3.00	3.78	0.0638
	12/6/2018	1.40	4.60	5.80	0.0760 J
	5/8/2019	1.80	4.40	7.50	0.330
	10/8/2019	1.30	3.40	7.40	0.180
	4/22/2020	1.10	3.30	7.00	0.320
	10/21/2020	0.94	2.80	7.90 J	0.170
	4/14/2021	1.70	2.70	5.00	0.140
	10/27/2021	1.10	2.70	4.80	0.200

Table 1
Groundwater Quality Analytical Data for Volatile Organic Compounds
Northwest Pipe Company Portland Plant

		Volatile Organic Compounds (µg/L)			
		PCE	TCE	cis-1,2-DCE	VC
	Portland Harbor ROD Concentrations (µg/L) [1]	*0.24*	*0.6*	*70*	*0.022*
T4S1MW-23	10/25/2016	1.59 J	0.15 UJ	0.700 J	0.008 UJ
(710 feet to river)	2/1/2017	0.937	0.410 J	0.650	0.0188 J
	4/27/2017	1.07	0.390 J	0.420 J	0.008 U
	7/26/2017	1.21	0.290 J	0.15 U	0.008 U
	12/6/2018	1.80	0.610	1.40	0.0230 J
	5/9/2019	1.90	0.500	0.340	0.02 U
	10/8/2019	1.60	0.400	0.580	0.02 U
	4/22/2020	1.60	0.370	0.180 J	0.02 U
	10/21/2020	1.80	0.330	1.50	0.02 U
	4/14/2021	1.30	0.370	0.23	0.02 U
	10/27/2021	1.30	0.470	0.59	0.02 U
T4S1MW-03S	10/25/2016	0.112 J	0.15 UJ	0.15 UJ	0.008 UJ
(160 feet to river)	2/1/2017	0.230	0.15 U	0.15 U	0.008 U
	4/26/2017	0.117	0.15 U	0.15 U	0.008 U
	7/25/2017	0.0508	0.15 U	0.15 U	0.008 U
	12/5/2018	0.1 U	0.1 U	0.1 U	0.02 U
	5/8/2019	0.1 U	0.1 U	0.1 U	0.02 U
	10/7/2019	0.1 U	0.1 U	0.1 U	0.02 U
	4/21/2020	0.1 U	0.1 U	0.1 U	0.02 U
	10/20/2020	0.1 U	0.1 U	0.1 U	0.02 U
	4/13/2021	0.1 U	0.1 U	0.1 U	0.02 U
	10/26/2021	0.1 U	0.1 U	0.1 U	0.02 U
T4S1MW-09	10/25/2016	0.0191 J	0.15 UJ	0.15 UJ	0.0197 J
(145 feet to river)	2/1/2017	0.0177 J	0.15 U	0.15 U	0.0113 J
	4/26/2017	0.005 U	0.15 U	0.15 U	0.008 U
	7/25/2017	0.0139 J	0.15 U	0.15 U	0.008 U
	12/5/2018	0.1 U	0.1 U	0.1 U	0.02 U
	5/8/2019	0.1 U	0.1 U	0.1 U	0.02 U
	10/7/2019	0.1 U	0.1 U	0.1 U	0.02 U
	4/21/2020	0.1 U	0.1 U	0.1 U	0.02 U
	10/20/2020	0.1 U	0.1 U	0.1 U	0.02 U
	4/13/2021	0.1 U	0.1 U	0.1 U	0.02 U
	10/26/2021	0.1 U	0.1 U	0.1 U	0.02 U

Notes:
µg/L = micrograms per Liter
Shaded values exceed identified ROD concentrations.
[1]ROD concentrations are selected from Table 17 of the Portland Harbor Record of Decision (U.S. Environmental Protection Agency Region 10, 2017). Values were selected from remedial action objectives (RAOs) 4 and 8 associated with migration of contaminated groundwater. Values reflect changes from ROD Errata #1 (EPA 2018) and #2 (EPA 2020).
Distances to the river are direct, instead of along flow paths, which can vary.
J - the analyte was detected, but the analytical laboratory has flagged the associated numerical value as estimated.
U - the analyte was analyzed for but was not detected above the detection limit.
UJ - the analyte was not detected above the detection limit. However, the detection limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

Table 2
Analytical Groundwater Sampling Results
Northwest Pipe Company, Portland, Oregon

Location ID				PW1W	GP-1	GP-2	GP-3	GP-4	GP-5	GP-6	GP-7	GW01	GW02	GW03	GW04	GW05
Sample ID				PW1W	GP1W	GP2W	GP3W	GP4W	GP5W	GP6W	GP7W	GW01-15-08/29/02	GW02-15-08/29/02	GW03-15-08/29/02	GW04-15-08/29/02	GW05-16-08/30/02
Sample Date				09/07/01	09/07/01	09/07/01	09/07/01	09/07/01	09/07/01	09/07/01	09/07/01	08/29/02	08/29/02	08/29/02	08/29/02	08/30/02
Sample Type				N1	N1	N1	N1	N1	N1	N1	N1	N1	N1	N1	N1	N1
Analyte	**Units**	**ROD CULs[1]**	**JSCS SLVs[2]**	*EF*	*EF*	*EF*	*EF*	*EF*	*EF*	*EF*	*EF*	*EF*	*EF*	*EF*	*EF*	*EF*
Field Parameters																
Temperature	(°C)	--	--													
pH		--	--													
Conductivity	(µS/cm)	--	--													
Dissolved Oxygen	mg/L	--	--													
Oxidation Reduction Potential	mV	--	--													
Turbidity	NTU	--	--													
Conventional Parameters																
Alkalinity, Total as CaCO3	mg/L	--	--													
Chloride	mg/L	--	--													
Nitrate ion	mg/L	--	--													
Nitrate-N	mg/L	--	--													
Sulfate	mg/L	--	--													
Total Organic Carbon	mg/L	--	--													
Total Suspended Solids (TSS)	mg/L	--	--													
Metals, Total																
Arsenic	mg/L	0.000018	--													
Cadmium	mg/L	0.000094	--													
Chromium	mg/L	0.011	--													
Copper	mg/L	0.00274	--													
Iron	mg/L	--	--													
Lead	mg/L	0.00054	--													
Manganese	mg/L	0.43	--													
Mercury	mg/L	--	0.00077													
Nickel	mg/L	--	0.016													
Zinc	mg/L	0.0365	--													
Metals, Dissolved																
Arsenic	mg/L	0.000018	--													
Cadmium	mg/L	0.000094	--													
Chromium	mg/L	0.011	--													
Copper	mg/L	0.00274	--													
Iron	mg/L	--	--													
Ferrous Iron[1]	mg/L	--	--													
Lead	mg/L	0.00054	--													
Manganese	mg/L	0.43	--													
Mercury	mg/L	--	0.00077													
Nickel	mg/L	--	0.016													
Zinc	mg/L	0.0365	--													
Polynuclear Aromatic Hydrocabons																
1-Methylnaphthalene	ug/L	--	--													
2-Methylnaphthalene	ug/L	2.1	--													
Acenaphthene	ug/L	23	--													
Acenaphthylene	ug/L	--	0.2													
Anthracene	ug/L	0.73	--													
Benzo(a)anthracene	ug/L	0.0012	--													
Benzo(a)pyrene	ug/L	0.00012	--													
Benzo(b)fluoroanthene	ug/L	0.0012	--													
Benzo(g,h,i)perylene	ug/L	0.4	--													
Benzo(k)fluoranthene	ug/L	0.0013	--													
Chrysene	ug/L	0.0013	--													
Dibenzo(a,h)anthracene	ug/L	0.00012	--													
Fluoranthene	ug/L	6.2	--													
Fluorene	ug/L	3.9	--													
Indeno(1,2,3-c,d)pyrene	ug/L	0.0012	--													
Naphthalene	ug/L	12	--													
Phenanthrene	ug/L	6.3	--													
Pyrene	ug/L	10	--													
Total cPAHs (BaP equivalents)[2]	ug/L	0.00012	--													
Polychlorinated Biphenyls																
Aroclor-1260	ug/L	--	0.034													
Aroclor-1254	ug/L	--	0.033													
Aroclor-1221	ug/L	--	0.034													
Aroclor-1232	ug/L	--	0.034													
Aroclor-1248	ug/L	--	0.034													
Aroclor-1016	ug/L	--	0.96													
Aroclor-1242	ug/L	--	0.034													
Total PCBs[2]	ug/L	0.014	--													
Total Petroleum Hydrocarbons																
Gasoline (TPH-Gx)	mg/L	--	--													
Diesel (TPH-Dx)	mg/L	--	--													
Motor Oil (TPH-Oil)	mg/L	--	--													
Volatile Organic Compounds																
1,1,1,2-Tetrachloroethane	ug/L	--	2.5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,1-Trichloroethane	ug/L	--	11	1.0 U	1.1	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U

Table 2
Analytical Groundwater Sampling Results
Northwest Pipe Company, Portland, Oregon

Location ID				PW1W			GP-1			GP-2			GP-3			GP-4			GP-5			GP-6			GP-7			GW01			GW02			GW03			GW04			GW05		
Sample ID				PW1W			GP1W			GP2W			GP3W			GP4W			GP5W			GP6W			GP7W			GW01-15-			GW02-15-			GW03-15-			GW04-15-			GW05-16-		
Sample Date				09/07/01			09/07/01			09/07/01			09/07/01			09/07/01			09/07/01			09/07/01			09/07/01			08/29/02			08/29/02			08/29/02			08/29/02			08/30/02		
Sample Type				N1			N1			N1			N1			N1			N1			N1			N1			N1			N1			N1			N1			N1		
Analyte	**Units**	**ROD CULs[1]**	**JSCS SLVs[2]**			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*		
Volatile Organic Compounds																																										
1,1,2,2-Tetrachloroethane	ug/L	--	0.33	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,1,2-Trichloroethane	ug/L	--	1.2	1.0	U		1.1			1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		0.5	J	
1,1-Dichloroethane	ug/L	--	47	1.7			1.0	U		1.0	U		1.0	U		1.7			1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		3.7			1.0	U		1.0	U	
1,1-Dichloroethene	ug/L	7	--	1.0	U		3.3			1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		6.6			1.0	U		22.0		*<10*
1,1-Dichloropropene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,2,3-Trichlorobenzene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,2,3-Trichloropropane	ug/L	--	0.0095	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,2,4-Trichlorobenzene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,2,4-Trimethylbenzene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,2-Dibromo-3-Chloropropane	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,2-Dibromoethane	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,2-Dichlorobenzene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,2-Dichloroethane	ug/L	--	0.73	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,2-Dichloroethene	ug/L	--	--																																							
1,2-Dichloropropane	ug/L	--	0.97	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,3,5-Trimethylbenzene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,3-Dichlorobenzene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,3-Dichloropropane	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,4-Dichlorobenzene	ug/L	--	2.8	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
2,2-Dichloropropane	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
2-Butanone	ug/L	--	7100																																							
2-Chloroethyl Vinyl Ether	ug/L	--	--																																							
2-Chlorotoluene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
2-Hexanone	ug/L	--	99																																							
4-Chlorotoluene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
4-Methyl-2-Pentanone	ug/L	--	170																																							
Acetone	ug/L	--	1500																																							
Benzene	ug/L	0.44	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		0.5	J	*<10*	1.0	U		0.8	J	*<10*
Bromobenzene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Bromochloromethane	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Bromodichloromethane	ug/L	--	1.1	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Bromoform	ug/L	--	8.5	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Bromomethane	ug/L	--	8.7	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Carbon Dioxide	ug/L	--	--																																							
Carbon Disulfide	ug/L	--	0.92																																							
Carbon Tetrachloride	ug/L	--	0.51	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Chlorobenzene	ug/L	64	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Chlorodibromomethane	ug/L	--	0.79	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Chloroethane	ug/L	--	23	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Chloroform	ug/L	--	0.17	1.0	U		1.8	*11*		1.1		*<10*	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0		*<10*	1.0	U		1.0	U	
Chlorohexane	ug/L	--	--																																							
Chloromethane	ug/L	--	2.1	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Cis-1,2-Dichloroethene	ug/L	70	--	10.8			960	D	*14*	230	D	*<10*	4.1			56.0			1.3			1.0	U		1.0	U		1.0	U		8.4			1,800	D	*26*	0.7	J		4,200	D	*60*
Cis-1,3-Dichloropropene	ug/L	--	0.055	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Dibromomethane	ug/L	--	61	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Dichlorodifluoromethane	µg/L	--	390	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Ethylbenzene	ug/L	7.3	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Hexachlorobutadiene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Isopropylbenzene	ug/L	--	660	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
m+p-Xylenes	ug/L	--	1.8	2.0	U		2.0	U		2.0	U		2.0	U		2.0	U		2.0	U		2.0	U		2.0	U		2.0	U		2.0	U		2.0	U		2.0	U		2.0	U	
Methane	ug/L	--	--																																							
Methylene Chloride	ug/L	--	8.9	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Methyl-tert-butyl Ether	ug/L	--	37																																							
Naphthalene	ug/L	--	0.2	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
n-Butylbenzene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
n-Propylbenzene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
o-Xylene	ug/L	--	13	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
p-Isopropyltoluene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Sec-Butylbenzene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Styrene	ug/L	--	100	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Tert-Butylbenzene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Tetrachloroethene	ug/L	0.24	--	3.8		*16*	9,800	D	*4.08E+04*	4,300	D	*1.79E+04*	2.1		*<10*	4.6		*19*	2.8		*12*	3.3		*14*	3.1		*13*	3.5		*15*	700	D	*2917*	4,900	D	*2.04E+04*	260	D	*1.08E+03*	1,200	D	*5.00E+03*
Toluene	ug/L	9.8	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Trans-1,2-Dichloroethene	ug/L	--	--	1.0	U		8.4			3.7			1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		4.9			1.0	U		13.0		
Trans-1,3-Dichloropropene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Trichloroethene	ug/L	0.6	--	1.0	U		1,200	D	*2.00E+03*	260	D	*433*	1.1		*<10*	11.0		*18*	1.0	U		1.0	U		1.0	U		1.0	U		53.0		*88*	850	D	*1.42E+03*	13.0		*22*	860	D	*1.43E+03*
Trichlorofluoromethane	ug/L	--	1300	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Vinyl Chloride	ug/L	0.022	--	1.0	U		1.0	U		1.0	U		1.0	U		7.4		*336*	1.0	U		1.5		*68*	1.0	U		1.0	U		1.0	U		2.8		*127*	1.0	U		48.0		*2.18E+03*
Xylenes, Total	ug/L	13	--																																							

Notes:

EF = Exceedance factor (calculated if consistuent exceeded indicated screening level)

D = Dilution

J = Estimated value below reporting limit.

U = Not detected at specified reporting limit.

mg/L = milligrams per Liter

ug/L = micrograms per Liter

-- = Screening level not established (Note: If ROD CUL was available, JSCS SLV is not shown.)

Shaded = detected result exceeded indicated screening value

Sample Type: N = Normal Sample, FD - Field Duplicate

[1]Portland Harbor Record of Decision (ROD) Cleanup Levels (CULs) for groundwater for remedial action objectives 4 and 8 (Table 17 from EPA, 2017).

[2]Joint Source Control Strategy (JSCS) Screening Level Values (SLVs) for groundwater/surface water/stormwater recommended values for initial upland source control screening evaluations for water (Table 3.1 - Revision 7/16/07 from EPA, 2005)

Table 2
Analytical Groundwater Sampling Results
Northwest Pipe Company, Portland, Oregon

Location ID				GW06	GW07	GW08	GW09	GW09	GW10	GW11	GW12	MW-01	MW-02	MW-03	GP-101	GP-102
Sample ID				GW06-16--------	GW07-16--------	GW08-16--------	GW09-16--------	GW09-16--------	GW10-16--------	GW11-16--------	GW12-16--------	MW01--------	MW02--------	MW03--------	GP-101--------	GP-102--------
Sample Date				08/29/02	08/29/02	08/29/02	08/29/02	08/29/02	08/29/02	08/30/02	08/30/02	08/29/03	08/29/03	08/29/03	07/21/04	07/21/04
Sample Type				N1	N1	N1	N1	FD1	N1	N1	N1	N1	N1	N1	N1	N1
Analyte	**Units**	**ROD CULs[1]**	**JSCS SLVs[2]**	*EF*	*EF*	*EF*	*EF*	*EF*	*EF*	*EF*	*EF*	*EF*	*EF*	*EF*	*EF*	*EF*
Field Parameters																
Temperature	(°C)	--	--													
pH		--	--													
Conductivity	(µS/cm)	--	--													
Dissolved Oxygen	mg/L	--	--													
Oxidation Reduction Potential	mV	--	--													
Turbidity	NTU	--	--													
Conventional Parameters																
Alkalinity, Total as CaCO3	mg/L	--	--													
Chloride	mg/L	--	--													
Nitrate ion	mg/L	--	--													
Nitrate-N	mg/L	--	--													
Sulfate	mg/L	--	--													
Total Organic Carbon	mg/L	--	--													
Total Suspended Solids (TSS)	mg/L	--	--													
Metals, Total																
Arsenic	mg/L	0.000018	--													
Cadmium	mg/L	0.000094	--													
Chromium	mg/L	0.011	--													
Copper	mg/L	0.00274	--													
Iron	mg/L	--	--													
Lead	mg/L	0.00054	--													
Manganese	mg/L	0.43	--													
Mercury	mg/L	--	0.00077													
Nickel	mg/L	--	0.016													
Zinc	mg/L	0.0365	--													
Metals, Dissolved																
Arsenic	mg/L	0.000018	--													
Cadmium	mg/L	0.000094	--													
Chromium	mg/L	0.011	--													
Copper	mg/L	0.00274	--													
Iron	mg/L	--	--													
Ferrous Iron[1]	mg/L	--	--													
Lead	mg/L	0.00054	--													
Manganese	mg/L	0.43	--													
Mercury	mg/L	--	0.00077													
Nickel	mg/L	--	0.016													
Zinc	mg/L	0.0365	--													
Polynuclear Aromatic Hydrocabons																
1-Methylnaphthalene	ug/L	--	--													
2-Methylnaphthalene	ug/L	2.1	--													
Acenaphthene	ug/L	23	--													
Acenaphthylene	ug/L	--	0.2													
Anthracene	ug/L	0.73	--													
Benzo(a)anthracene	ug/L	0.0012	--													
Benzo(a)pyrene	ug/L	0.00012	--													
Benzo(b)fluoroanthene	ug/L	0.0012	--													
Benzo(g,h,i)perylene	ug/L	0.4	--													
Benzo(k)fluoranthene	ug/L	0.0013	--													
Chrysene	ug/L	0.0013	--													
Dibenzo(a,h)anthracene	ug/L	0.00012	--													
Fluoranthene	ug/L	6.2	--													
Fluorene	ug/L	3.9	--													
Indeno(1,2,3-c,d)pyrene	ug/L	0.0012	--													
Naphthalene	ug/L	12	--													
Phenanthrene	ug/L	6.3	--													
Pyrene	ug/L	10	--													
Total cPAHs (BaP equivalents)[2]	ug/L	0.00012	--													
Polychlorinated Biphenyls																
Aroclor-1260	ug/L	--	0.034													
Aroclor-1254	ug/L	--	0.033													
Aroclor-1221	ug/L	--	0.034													
Aroclor-1232	ug/L	--	0.034													
Aroclor-1248	ug/L	--	0.034													
Aroclor-1016	ug/L	--	0.96													
Aroclor-1242	ug/L	--	0.034													
Total PCBs[2]	ug/L	0.014	--													
Total Petroleum Hydrocarbons																
Gasoline (TPH-Gx)	mg/L	--	--													
Diesel (TPH-Dx)	mg/L	--	--													
Motor Oil (TPH-Oil)	mg/L	--	--													
Volatile Organic Compounds																
1,1,1,2-Tetrachloroethane	ug/L	--	2.5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,1-Trichloroethane	ug/L	--	11	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.34 J

Table 2
Analytical Groundwater Sampling Results
Northwest Pipe Company, Portland, Oregon

Location ID				GW06			GW07			GW08			GW09			GW09			GW10			GW11			GW12			MW-01			MW-02			MW-03			GP-101			GP-102		
Sample ID				GW06-16-08/29/02			GW07-16-08/29/02			GW08-16-08/29/02			GW09-16-08/29/02			GW09-16-08/29/02			GW10-16-08/29/02			GW11-16-08/30/02			GW12-16-08/30/02			MW01-08/29/03			MW02-08/29/03			MW03-08/29/03			GP-101-07/21/04			GP-102-07/21/04		
Sample Date				08/29/02			08/29/02			08/29/02			08/29/02			08/29/02			08/29/02			08/30/02			08/30/02			08/29/03			08/29/03			08/29/03			07/21/04			07/21/04		
Sample Type				N1			N1			N1			N1			FD1			N1			N1			N1			N1			N1			N1			N1			N1		
Analyte	**Units**	**ROD CULs[1]**	**JSCS SLVs[2]**			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*		
Volatile Organic Compounds																																										
1,1,2,2-Tetrachloroethane	ug/L	--	0.33	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,1,2-Trichloroethane	ug/L	--	1.2	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,1-Dichloroethane	ug/L	--	47	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		0.19	J		0.24	J	
1,1-Dichloroethene	ug/L	7	--	1.0	U		1.0	U		1.0	U		0.6	J		0.5	J		1.0	U		1.0	U		1.0	U		2.7			1.0	U		1.0	U		1.0	U		1.0	U	
1,1-Dichloropropene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,2,3-Trichlorobenzene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,2,3-Trichloropropane	ug/L	--	0.0095	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,2,4-Trichlorobenzene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,2,4-Trimethylbenzene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,2-Dibromo-3-Chloropropane	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		5.0	U		5.0	U	
1,2-Dibromoethane	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,2-Dichlorobenzene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,2-Dichloroethane	ug/L	--	0.73	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,2-Dichloroethene	ug/L	--	--																																							
1,2-Dichloropropane	ug/L	--	0.97	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,3,5-Trimethylbenzene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,3-Dichlorobenzene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,3-Dichloropropane	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,4-Dichlorobenzene	ug/L	--	2.8	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
2,2-Dichloropropane	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
2-Butanone	ug/L	--	7100																																							
2-Chloroethyl Vinyl Ether	ug/L	--	--																																							
2-Chlorotoluene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
2-Hexanone	ug/L	--	99																																							
4-Chlorotoluene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
4-Methyl-2-Pentanone	ug/L	--	170																																							
Acetone	ug/L	--	1500																																							
Benzene	ug/L	0.44	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Bromobenzene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Bromochloromethane	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Bromodichloromethane	ug/L	--	1.1	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Bromoform	ug/L	--	8.5	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Bromomethane	ug/L	--	8.7	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Carbon Dioxide	ug/L	--	--																																							
Carbon Disulfide	ug/L	--	0.92																																							
Carbon Tetrachloride	ug/L	--	0.51	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Chlorobenzene	ug/L	64	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Chlorodibromomethane	ug/L	--	0.79	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Chloroethane	ug/L	--	23	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Chloroform	ug/L	--	0.17	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		2.6		*15*	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Chlorohexane	ug/L	--	--																																							
Chloromethane	ug/L	--	2.1	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Cis-1,2-Dichloroethene	ug/L	70	--	39.0			34.0			11.0			61.0			57.0			50.0			1.0	U		16.0			800	D	*11*	1.0	U		1.0	U		1.0	U		0.4	J	
Cis-1,3-Dichloropropene	ug/L	--	0.055	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U							
Dibromomethane	ug/L	--	61	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Dichlorodifluoromethane	µg/L	--	390	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Ethylbenzene	ug/L	7.3	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Hexachlorobutadiene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Isopropylbenzene	ug/L	--	660	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
m+p-Xylenes	ug/L	--	1.8	1.0	U		2.0	U		2.0	U		2.0	U		2.0	U		2.0	U		2.0	U		2.0	U		2.0	U		1.0	U		2.0	U		1.0	U		1.0	U	
Methane	ug/L	--	--																																							
Methylene Chloride	ug/L	--	8.9	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		2.0	U		2.0	U	
Methyl-tert-butyl Ether	ug/L	--	37																																							
Naphthalene	ug/L	--	0.2	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
n-Butylbenzene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
n-Propylbenzene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
o-Xylene	ug/L	--	13	2.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		2.0	U		1.0	U		1.0	U		1.0	U	
p-Isopropyltoluene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Sec-Butylbenzene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Styrene	ug/L	--	100	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Tert-Butylbenzene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Tetrachloroethene	ug/L	0.24	--	310	D	*1.29E+03*	210	D	*875*	110	D	*458*	120	D	*500*	120	D	*500*	260	D	*1.08E+03*	27.0		*113*	3,300	D	*1.38E+04*	240	D	*1.00E+03*	1.0	U		19.0		*79*	1.0	U		59.0	D	*246*
Toluene	ug/L	9.8	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0			1.0	U		1.0	U	
Trans-1,2-Dichloroethene	ug/L	--	--	1.0	U		1.0	U		1.0	U		0.6	J		0.5	J		1.0	J		1.0	U		1.0	U		5.8			1.0	U		1.0			1.0	U		1.0	U	
Trans-1,3-Dichloropropene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0								
Trichloroethene	ug/L	0.6	--	59.0		*98*	12.0		*20*	20.0		*33*	100	D	*167*	98.0	D	*163*	110	D	*183*	1.3		*<10*	65.0		*108*	34.0		*57*	1.0	U		1.0		*<10*	1.0	U		10.0		*17*
Trichlorofluoromethane	ug/L	--	1300	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Vinyl Chloride	ug/L	0.022	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.7		*77*	1.0	U		1.0	U		10.0		*455*	1.0	U		1.0	U		0.27	J	*12*	1.0	U	
Xylenes, Total	ug/L	13	--																																							

Notes:

EF = Exceedance factor (calculated if consistuent exceeded indicated screening level)

D = Dilution

J = Estimated value below reporting limit.

U = Not detected at specified reporting limit.

mg/L = milligrams per Liter

-- = Screening level not established (Note: If ROD CUL was available, JSCS SLV is not shown.)

Shaded = detected result exceeded indicated screening value

Sample Type: N = Normal Sample, FD - Field Duplicate

[1]Portland Harbor Record of Decision (ROD) Cleanup Levels (CULs) for groundwater for remedial action objectives 4 and 8 (Table 17 from EPA, 2017).

[2]Joint Source Control Strategy (JSCS) Screening Level Values (SLVs) for groundwater/surface water/stormwater recommended values for initial upland source control screening evaluations for water (Table 3.1 - Revision 7/16/07 from EPA, 2005)

Table 2
Analytical Groundwater Sampling Results
Northwest Pipe Company, Portland, Oregon

Location ID				GP-103	GP-104	GP-106	GP-107	GP-108	GP-109	GP-110	GP-111	GP-112	GP-112	MW-01	MW-02	MW-03	MW-03
Sample ID				GP-103-07/21/04	GP-104-07/21/04	GP-106-07/21/04	GP-107-07/21/04	GP-108-07/21/04	GP-109-07/21/04	GP-110-07/21/04	GP-111-07/21/04	GP-112-07/22/04	GP-112-07/22/04	MW01-08/16/04	MW02-08/16/04	MW03-08/16/04	MW03-08/16/04
Sample Date				07/21/04	07/21/04	07/21/04	07/21/04	07/21/04	07/21/04	07/21/04	07/21/04	07/22/04	07/22/04	08/16/04	08/16/04	08/16/04	08/16/04
Sample Type				N1	N1	N1	N1	N1	N1	N1	N1	N1	N1	N1	N1	N1	FD1
Analyte	**Units**	**ROD CULs[1]**	**JSCS SLVs[2]**	*EF*	*EF*	*EF*	*EF*	*EF*	*EF*	*EF*	*EF*	*EF*	*EF*	*EF*	*EF*	*EF*	*EF*
Field Parameters																	
Temperature	(°C)	--	--											15.1	16.5	16.3	
pH		--	--											6.8	7.0	6.8	
Conductivity	(µS/cm)	--	--											366	343	304	
Dissolved Oxygen	mg/L	--	--											0.15	0.16	0.26	
Oxidation Reduction Potential	mV	--	--											-130	-151	-93	
Turbidity	NTU	--	--											4.6	3.2	3.7	
Conventional Parameters																	
Alkalinity, Total as CaCO3	mg/L	--	--														
Chloride	mg/L	--	--														
Nitrate ion	mg/L	--	--														
Nitrate-N	mg/L	--	--														
Sulfate	mg/L	--	--														
Total Organic Carbon	mg/L	--	--														
Total Suspended Solids (TSS)	mg/L	--	--														
Metals, Total																	
Arsenic	mg/L	0.000018	--														
Cadmium	mg/L	0.000094	--														
Chromium	mg/L	0.011	--														
Copper	mg/L	0.00274	--														
Iron	mg/L	--	--														
Lead	mg/L	0.00054	--														
Manganese	mg/L	0.43	--														
Mercury	mg/L	--	0.00077														
Nickel	mg/L	--	0.016														
Zinc	mg/L	0.0365	--														
Metals, Dissolved																	
Arsenic	mg/L	0.000018	--														
Cadmium	mg/L	0.000094	--														
Chromium	mg/L	0.011	--														
Copper	mg/L	0.00274	--														
Iron	mg/L	--	--														
Ferrous Iron[1]	mg/L	--	--														
Lead	mg/L	0.00054	--														
Manganese	mg/L	0.43	--														
Mercury	mg/L	--	0.00077														
Nickel	mg/L	--	0.016														
Zinc	mg/L	0.0365	--														
Polynuclear Aromatic Hydrocabons																	
1-Methylnaphthalene	ug/L	--	--														
2-Methylnaphthalene	ug/L	2.1	--														
Acenaphthene	ug/L	23	--														
Acenaphthylene	ug/L	--	0.2														
Anthracene	ug/L	0.73	--														
Benzo(a)anthracene	ug/L	0.0012	--														
Benzo(a)pyrene	ug/L	0.00012	--														
Benzo(b)fluoroanthene	ug/L	0.0012	--														
Benzo(g,h,i)perylene	ug/L	0.4	--														
Benzo(k)fluoranthene	ug/L	0.0013	--														
Chrysene	ug/L	0.0013	--														
Dibenzo(a,h)anthracene	ug/L	0.00012	--														
Fluoranthene	ug/L	6.2	--														
Fluorene	ug/L	3.9	--														
Indeno(1,2,3-c,d)pyrene	ug/L	0.0012	--														
Naphthalene	ug/L	12	--														
Phenanthrene	ug/L	6.3	--														
Pyrene	ug/L	10	--														
Total cPAHs (BaP equivalents)[2]	ug/L	0.00012	--														
Polychlorinated Biphenyls																	
Aroclor-1260	ug/L	--	0.034														
Aroclor-1254	ug/L	--	0.033														
Aroclor-1221	ug/L	--	0.034														
Aroclor-1232	ug/L	--	0.034														
Aroclor-1248	ug/L	--	0.034														
Aroclor-1016	ug/L	--	0.96														
Aroclor-1242	ug/L	--	0.034														
Total PCBs[2]	ug/L	0.014	--														
Total Petroleum Hydrocarbons																	
Gasoline (TPH-Gx)	mg/L	--	--														
Diesel (TPH-Dx)	mg/L	--	--														
Motor Oil (TPH-Oil)	mg/L	--	--														
Volatile Organic Compounds																	
1,1,1,2-Tetrachloroethane	ug/L	--	2.5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,1-Trichloroethane	ug/L	--	11	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U

Table 2
Analytical Groundwater Sampling Results
Northwest Pipe Company, Portland, Oregon

Location ID				GP-103			GP-104			GP-106			GP-107			GP-108			GP-109			GP-110			GP-111			GP-112			GP-112			MW-01			MW-02			MW-03			MW-03		
Sample ID				GP-103-07/21/04			GP-104-07/21/04			GP-106-07/21/04			GP-107-07/21/04			GP-108-07/21/04			GP-109-07/21/04			GP-110-07/21/04			GP-111-07/21/04			GP-112-07/22/04			GP-112-07/22/04			MW01-08/16/04			MW02-08/16/04			MW03-08/16/04			MW03-08/16/04		
Sample Date				07/21/04			07/21/04			07/21/04			07/21/04			07/21/04			07/21/04			07/21/04			07/21/04			07/22/04			07/22/04			08/16/04			08/16/04			08/16/04			08/16/04		
Sample Type				N1			N1			N1			N1			N1			N1			N1			N1			N1			N1			N1			N1			N1			FD1		
Analyte	**Units**	**ROD CULs[1]**	**JSCS SLVs[2]**			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*		
Volatile Organic Compounds																																													
1,1,2,2-Tetrachloroethane	ug/L	--	0.33	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,1,2-Trichloroethane	ug/L	--	1.2	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,1-Dichloroethane	ug/L	--	47	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		0.25	J		1.0	U		1.0	U		1.0	U		1.0	U		0.48	J		0.39	J		0.21	J		0.23	J	
1,1-Dichloroethene	ug/L	7	--	1.0			0.92	J		1.0	U		0.54	J		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		4.8			1.0	U		1.0	U		1.0	U	
1,1-Dichloropropene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,2,3-Trichlorobenzene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,2,3-Trichloropropane	ug/L	--	0.0095	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,2,4-Trichlorobenzene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,2,4-Trimethylbenzene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,2-Dibromo-3-Chloropropane	ug/L	--	--	5.0	U		5.0	U		5.0	U		5.0	U		5.0	U		5.0	U		5.0	U		5.0	U		5.0	U		5.0	U		5.0	U		5.0	U		5.0	U		5.0	U	
1,2-Dibromoethane	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,2-Dichlorobenzene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,2-Dichloroethane	ug/L	--	0.73	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,2-Dichloroethene	ug/L	--	--																																										
1,2-Dichloropropane	ug/L	--	0.97	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,3,5-Trimethylbenzene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,3-Dichlorobenzene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,3-Dichloropropane	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
1,4-Dichlorobenzene	ug/L	--	2.8	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
2,2-Dichloropropane	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
2-Butanone	ug/L	--	7100																																										
2-Chloroethyl Vinyl Ether	ug/L	--	--																																										
2-Chlorotoluene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
2-Hexanone	ug/L	--	99																																										
4-Chlorotoluene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
4-Methyl-2-Pentanone	ug/L	--	170																																										
Acetone	ug/L	--	1500																																										
Benzene	ug/L	0.44	--	1.0	U		0.18	J		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		0.23	J		1.0	U		1.0	U		1.0	U	
Bromobenzene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Bromochloromethane	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Bromodichloromethane	ug/L	--	1.1	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Bromoform	ug/L	--	8.5	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Bromomethane	ug/L	--	8.7	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Carbon Dioxide	ug/L	--	--																																										
Carbon Disulfide	ug/L	--	0.92																																										
Carbon Tetrachloride	ug/L	--	0.51	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Chlorobenzene	ug/L	64	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Chlorodibromomethane	ug/L	--	0.79	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Chloroethane	ug/L	--	23	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Chloroform	ug/L	--	0.17	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Chlorohexane	ug/L	--	--																																										
Chloromethane	ug/L	--	2.1	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Cis-1,2-Dichloroethene	ug/L	70	--	200	D	*<10*	120	D	*<10*	15.0			170	D	*<10*	7.6			1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1,200	D	*17*	0.17	D		1.0	U		1.0	U	
Cis-1,3-Dichloropropene	ug/L	--	0.055																																					1.0	U		1.0	U	
Dibromomethane	ug/L	--	61	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Dichlorodifluoromethane	µg/L	--	390	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Ethylbenzene	ug/L	7.3	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Hexachlorobutadiene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Isopropylbenzene	ug/L	--	660	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
m+p-Xylenes	ug/L	--	1.8	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Methane	ug/L	--	--																																										
Methylene Chloride	ug/L	--	8.9	2.0	U		2.0	U		0.11	J		2.0	U		2.0	U		2.0	U		2.0	U		2.0	U		2.0	U		2.0	U		2.0	U		2.0	U		2.0	U		2.0	U	
Methyl-tert-butyl Ether	ug/L	--	37																																					1.0	U		1.0	U	
Naphthalene	ug/L	--	0.2	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
n-Butylbenzene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
n-Propylbenzene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
o-Xylene	ug/L	--	13	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
p-Isopropyltoluene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Sec-Butylbenzene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Styrene	ug/L	--	100	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Tert-Butylbenzene	ug/L	--	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Tetrachloroethene	ug/L	0.24	--	66.0	D	*275*	260	D	*1.08E+03*	1.3		*<10*	66.0	D	*275*	21.0		*88*	0.75	J	*<10*	3.3		*14*	0.66	J	*<10*	1.0	U		1.0	U		1,000	D	*4.17E+03*	0.47	J	*<10*	21.0		*88*	11.0		*46*
Toluene	ug/L	9.8	--	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		0.12	J		1.0	U		1.0	U	
Trans-1,2-Dichloroethene	ug/L	--	--	1.5			2.8			1.0	U		0.87	J		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		16.0			1.0	U		1.0	U		1.0	U	
Trans-1,3-Dichloropropene	ug/L	--	--																																					1.0	U		1.0	U	
Trichloroethene	ug/L	0.6	--	38.0	D	*63*	170	D	*283*	3.8		*<10*	40.0		*67*	5.6		*<10*	0.22	J		1.0	U		0.6	J	*<10*	1.0	U		1.0	U		80.0	D	*133*	1.0	U		2.0		*<10*	1.9		*<10*
Trichlorofluoromethane	ug/L	--	1300	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U	
Vinyl Chloride	ug/L	0.022	--	0.88	J	*40*	0.78	J	*35*	4.0		*182*	5.0		*227*	0.18	J	*<10*	1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		8.5		*386*	1.0	U		1.0	U		1.0	U	
Xylenes, Total	ug/L	13	--																																										

Notes:

EF = Exceedance factor (calculated if consistuent exceeded indicated screening level)

D = Dilution

J = Estimated value below reporting limit.

U = Not detected at specified reporting limit.

mg/L = milligrams per Liter

-- = Screening level not established (Note: If ROD CUL was available, JSCS SLV is not shown.)

Shaded = detected result exceeded indicated screening value

Sample Type: N = Normal Sample, FD - Field Duplicate

[1]Portland Harbor Record of Decision (ROD) Cleanup Levels (CULs) for groundwater for remedial action objectives 4 and 8 (Table 17 from EPA, 2017).

[2]Joint Source Control Strategy (JSCS) Screening Level Values (SLVs) for groundwater/surface water/stormwater recommended values for initial upland source control screening evaluations for water (Table 3.1 - Revision 7/16/07 from EPA, 2005)

Table 2
Analytical Groundwater Sampling Results
Northwest Pipe Company, Portland, Oregon

Location ID				MW-04		MW-04		MW-05		MW-01		MW-02		MW-03		MW-04		MW-05		MW-06		MW-06		MW-01		MW-02		MW-03	
Sample ID				MW04-08/16/04		MW04-08/16/04		MW05-08/16/04		MW01-01/11/05		MW02-01/11/05		MW03-01/11/05		MW04-01/11/05		MW05-01/11/05		MW06-01/11/05		MW06-01/11/05		MW01-06/21/05		MW02-06/21/05		MW03-06/21/05	
Sample Date				08/16/04		08/16/04		08/16/04		01/11/05		01/11/05		01/11/05		01/11/05		01/11/05		01/11/05		01/11/05		06/21/05		06/21/05		06/21/05	
Sample Type				N1		FD1		N1		N1		N1		N1		N1		N1		N1		FD1		N1		N1		N1	
Analyte	**Units**	**ROD CULs[1]**	**JSCS SLVs[2]**		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*
Field Parameters																													
Temperature	(°C)	--	--	15.3				15.1																					
pH		--	--	6.5				6.8																					
Conductivity	(µS/cm)	--	--	429				284																					
Dissolved Oxygen	mg/L	--	--	0.14				0.13																					
Oxidation Reduction Potential	mV	--	--	-103				-130																					
Turbidity	NTU	--	--	1.0				0.8																					
Conventional Parameters																													
Alkalinity, Total as CaCO3	mg/L	--	--																					155		170		140	
Chloride	mg/L	--	--																					2.4		1.7		4.4	
Nitrate ion	mg/L	--	--																										
Nitrate-N	mg/L	--	--																					0.1	U	0.1	U	0.17	
Sulfate	mg/L	--	--																					2.0		0.15		15	
Total Organic Carbon	mg/L	--	--																					1.4		2.3		1.6	
Total Suspended Solids (TSS)	mg/L	--	--																										
Metals, Total																													
Arsenic	mg/L	0.000018	--																										
Cadmium	mg/L	0.000094	--																										
Chromium	mg/L	0.011	--																										
Copper	mg/L	0.00274	--																										
Iron	mg/L	--	--																										
Lead	mg/L	0.00054	--																										
Manganese	mg/L	0.43	--																					2.6	*<10*	2.7	*<10*	1.2	*<10*
Mercury	mg/L	--	0.00077																										
Nickel	mg/L	--	0.016																										
Zinc	mg/L	0.0365	--																										
Metals, Dissolved																													
Arsenic	mg/L	0.000018	--																										
Cadmium	mg/L	0.000094	--																										
Chromium	mg/L	0.011	--																										
Copper	mg/L	0.00274	--																										
Iron	mg/L	--	--																										
Ferrous Iron[1]	mg/L	--	--																					16		15		6.5	
Lead	mg/L	0.00054	--																										
Manganese	mg/L	0.43	--																										
Mercury	mg/L	--	0.00077																										
Nickel	mg/L	--	0.016																										
Zinc	mg/L	0.0365	--																										
Polynuclear Aromatic Hydrocabons																													
1-Methylnaphthalene	ug/L	--	--																										
2-Methylnaphthalene	ug/L	2.1	--																										
Acenaphthene	ug/L	23	--																										
Acenaphthylene	ug/L	--	0.2																										
Anthracene	ug/L	0.73	--																										
Benzo(a)anthracene	ug/L	0.0012	--																										
Benzo(a)pyrene	ug/L	0.00012	--																										
Benzo(b)fluoroanthene	ug/L	0.0012	--																										
Benzo(g,h,i)perylene	ug/L	0.4	--																										
Benzo(k)fluoranthene	ug/L	0.0013	--																										
Chrysene	ug/L	0.0013	--																										
Dibenzo(a,h)anthracene	ug/L	0.00012	--																										
Fluoranthene	ug/L	6.2	--																										
Fluorene	ug/L	3.9	--																										
Indeno(1,2,3-c,d)pyrene	ug/L	0.0012	--																										
Naphthalene	ug/L	12	--																										
Phenanthrene	ug/L	6.3	--																										
Pyrene	ug/L	10	--																										
Total cPAHs (BaP equivalents)[2]	ug/L	0.00012	--																										
Polychlorinated Biphenyls																													
Aroclor-1260	ug/L	--	0.034																										
Aroclor-1254	ug/L	--	0.033																										
Aroclor-1221	ug/L	--	0.034																										
Aroclor-1232	ug/L	--	0.034																										
Aroclor-1248	ug/L	--	0.034																										
Aroclor-1016	ug/L	--	0.96																										
Aroclor-1242	ug/L	--	0.034																										
Total PCBs[3]	ug/L	0.014	--																										
Total Petroleum Hydrocarbons																													
Gasoline (TPH-Gx)	mg/L	--	--																										
Diesel (TPH-Dx)	mg/L	--	--																										
Motor Oil (TPH-Oil)	mg/L	--	--																										
Volatile Organic Compounds																													
1,1,1,2-Tetrachloroethane	ug/L	--	2.5	1.0	U	1.0	U	1.0	U																				
1,1,1-Trichloroethane	ug/L	--	11	1.0	U	1.0	U	1.0	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	1.1	U	0.5	U	0.5	U

Table 2
Analytical Groundwater Sampling Results
Northwest Pipe Company, Portland, Oregon

Location ID				MW-04		MW-04		MW-05		MW-01		MW-02		MW-03		MW-04		MW-05		MW-06		MW-06		MW-01		MW-02		MW-03	
Sample ID				MW04-		MW04-		MW05-		MW01-		MW02-		MW03-		MW04-		MW05-		MW06-		MW06-		MW01-		MW02-		MW03-	
Sample Date				08/16/04		08/16/04		08/16/04		01/11/05		01/11/05		01/11/05		01/11/05		01/11/05		01/11/05		01/11/05		06/21/05		06/21/05		06/21/05	
Sample Type				N1		FD1		N1		N1		N1		N1		N1		N1		N1		FD1		N1		N1		N1	
Analyte	**Units**	**ROD CULs[1]**	**JSCS SLVs[2]**		*EF*		*EF*		*EF*		*EF*				*EF*		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*
Volatile Organic Compounds																													
1,1,2,2-Tetrachloroethane	ug/L	--	0.33	1.0 U		1.0 U		1.0 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		1.1 U		0.5 U		0.5 U	
1,1,2-Trichloroethane	ug/L	--	1.2	1.0 U		1.0 U		1.0 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		1.1 U		0.5 U		0.5 U	
1,1-Dichloroethane	ug/L	--	47	0.26 J		0.21 J		0.22 J		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		1.1 U		0.5 U		0.5 U	
1,1-Dichloroethene	ug/L	7	--	0.91 J		0.75 J		0.58 J		4.0		0.5 U		0.5 U		0.56		0.5 U		2.5		2.7		2.4		0.5 U		0.5 U	
1,1-Dichloropropene	ug/L	--	--	1.0 U		1.0 U		1.0 U																					
1,2,3-Trichlorobenzene	ug/L	--	--	1.0 U		1.0 U		1.0 U																					
1,2,3-Trichloropropane	ug/L	--	0.0095	1.0 U		1.0 U		1.0 U																					
1,2,4-Trichlorobenzene	ug/L	--	--	1.0 U		1.0 U		1.0 U																					
1,2,4-Trimethylbenzene	ug/L	--	--	1.0 U		1.0 U		1.0 U																					
1,2-Dibromo-3-Chloropropane	ug/L	--	--	5.0 U		5.0 U		5.0 U																					
1,2-Dibromoethane	ug/L	--	--	1.0 U		1.0 U		1.0 U																					
1,2-Dichlorobenzene	ug/L	--	--	1.0 U		1.0 U		1.0 U																					
1,2-Dichloroethane	ug/L	--	0.73	1.0 U		1.0 U		1.0 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		1.1 U		0.5 U		0.5 U	
1,2-Dichloroethene	ug/L	--	--							1,100		0.5 U		0.68		200		27.0		690		710		630		0.5 U		1.0	
1,2-Dichloropropane	ug/L	--	0.97	1.0 U		1.0 U		1.0 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		1.1 U		0.5 U		0.5 U	
1,3,5-Trimethylbenzene	ug/L	--	--	1.0 U		1.0 U		1.0 U																					
1,3-Dichlorobenzene	ug/L	--	--	1.0 U		1.0 U		1.0 U																					
1,3-Dichloropropane	ug/L	--	--	1.0 U		1.0 U		1.0 U																					
1,4-Dichlorobenzene	ug/L	--	2.8	1.0 U		1.0 U		1.0 U																					
2,2-Dichloropropane	ug/L	--	--	1.0 U		1.0 U		1.0 U																					
2-Butanone	ug/L	--	7100							1.0 U		1.0 U		1.0 U		1.0 U		1.0 U		1.0 U		1.0 U		11.0 U		5.0 U		5.0 U	
2-Chloroethyl Vinyl Ether	ug/L	--	--																										
2-Chlorotoluene	ug/L	--	--	1.0 U		1.0 U		1.0 U																					
2-Hexanone	ug/L	--	99							1.0 U		1.0 U		1.0 U		1.0 U		1.0 U		1.0 U		1.0 U		11.0 U		5.0 U		5.0 U	
4-Chlorotoluene	ug/L	--	--	1.0 U		1.0 U		1.0 U																					
4-Methyl-2-Pentanone	ug/L	--	170							1.0 U		1.0 U		1.0 U		1.0 U		1.0 U		1.0 U		1.0 U		2.2 U		1.0 U		1.0 U	
Acetone	ug/L	--	1500							1.0 U		1.0 U		1.0 U		1.0 U		1.0 U		1.8		1.6		2.2 U		1.0 U		1.0 U	
Benzene	ug/L	0.44	--	0.13 J		1.0 U		1.0 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		1.1 U		0.5 U		0.5 U	
Bromobenzene	ug/L	--	--	1.0 U		1.0 U		1.0 U																					
Bromochloromethane	ug/L	--	--	1.0 U		1.0 U		1.0 U																					
Bromodichloromethane	ug/L	--	1.1	1.0 U		1.0 U		1.0 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		1.1 U		0.5 U		0.5 U	
Bromoform	ug/L	--	8.5	1.0 U		1.0 U		1.0 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		1.1 U		0.5 U		0.5 U	
Bromomethane	ug/L	--	8.7	1.0 U		1.0 U		1.0 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		1.1 U		0.5 U		0.5 U	
Carbon Dioxide	ug/L	--	--																					72,000		42,000		49,000	
Carbon Disulfide	ug/L	--	0.92							1.0 U		1.0 U		1.0 U		1.0 U		1.0 U		1.0 U		1.0 U		2.2 U		1.0 U		1.0 U	
Carbon Tetrachloride	ug/L	--	0.51	1.0 U		1.0 U		1.0 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		1.1 U		0.5 U		0.5 U	
Chlorobenzene	ug/L	64	--	1.0 U		1.0 U		1.0 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		1.1 U		0.5 U		0.5 U	
Chlorodibromomethane	ug/L	--	0.79	1.0 U		1.0 U		1.0 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		1.1 U		0.5 U		0.5 U	
Chloroethane	ug/L	--	23	1.0 U		1.0 U		1.0 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		1.1 U		0.5 U		0.5 U	
Chloroform	ug/L	--	0.17	1.0 U		1.0 U		1.0 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		1.7	*10*	1.6	*<10*	1.1 U		0.5 U		0.5 U	
Chlorohexane	ug/L	--	--																										
Chloromethane	ug/L	--	2.1	0.36 J		1.0 U		1.0 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		1.1 U		0.5 U		0.5 U	
Cis-1,2-Dichloroethene	ug/L	70	--	500 D	*<10*	310 D	*<10*	160 D	*<10*	1,200 D	*17*	0.5 U		0.68		210 D	*<10*	27.0		740 D	*11*	720 D	*10*	840 D	*12*	0.5 U		1.0	
Cis-1,3-Dichloropropene	ug/L	--	0.055							0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		1.1 U		0.5 U		0.5 U	
Dibromomethane	ug/L	--	61	1.0 U		1.0 U		1.0 U																					
Dichlorodifluoromethane	µg/L	--	390	1.0 U		1.0 U		1.0 U																					
Ethylbenzene	ug/L	7.3	--	1.0 U		1.0 U		1.0 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		1.1 U		0.5 U		0.5 U	
Hexachlorobutadiene	ug/L	--	--	1.0 U		1.0 U		1.0 U																					
Isopropylbenzene	ug/L	--	660	1.0 U		1.0 U		1.0 U																					
m+p-Xylenes	ug/L	--	1.8	1.0 U		1.0 U		1.0 U		2.0 U		2.0 U		2.0 U		2.0 U		2.0 U		2.0 U		2.0 U		4.4 U		2.0 U		2.0 U	
Methane	ug/L	--	--																					5,200		9,800		1,200	
Methylene Chloride	ug/L	--	8.9	2.0 U		2.0 U		2.0 U		1.0 U		1.0 U		1.0 U		1.0 U		1.0 U		1.0 U		1.0 U		1.1 U		0.5 U		0.5 U	
Methyl-tert-butyl Ether	ug/L	--	37																										
Naphthalene	ug/L	--	0.2	1.0 U		1.0 U		1.0 U																					
n-Butylbenzene	ug/L	--	--	1.0 U		1.0 U		1.0 U																					
n-Propylbenzene	ug/L	--	--	1.0 U		1.0 U		1.0 U																					
o-Xylene	ug/L	--	13	1.0 U		1.0 U		1.0 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		1.1 U		0.5 U		0.5 U	
p-Isopropyltoluene	ug/L	--	--	1.0 U		1.0 U		1.0 U																					
Sec-Butylbenzene	ug/L	--	--	1.0 U		1.0 U		1.0 U																					
Styrene	ug/L	--	100	1.0 U		1.0 U		1.0 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		1.1 U		0.5 U		0.5 U	
Tert-Butylbenzene	ug/L	--	--	1.0 U		1.0 U		1.0 U																					
Tetrachloroethene	ug/L	0.24	--	150 D	*625*	74.0 D	*308*	52.0 D	*217*	790 D	*3.29E+03*	0.5 U		20.0	*83*	190 D	*792*	110 D	*458*	2,000 D	*8.33E+03*	1,900 D	*7.92E+03*	470 D	*1.96E+03*	0.5 U		5.0	*21*
Toluene	ug/L	9.8	--	0.18 J		0.14 J		1.0 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		1.1 U		0.5 U		0.5 U	
Trans-1,2-Dichloroethene	ug/L	--	--	4.5		3.7		1.5		6.7		0.5 U		0.5 U		1.9		0.5 U		4.3		4.4		5.2		0.5 U		0.5 U	
Trans-1,3-Dichloropropene	ug/L	--	--							0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		0.5 U		1.1 U		0.5 U		0.5 U	
Trichloroethene	ug/L	0.6	--	31.0	*52*	25.0	*42*	5.6	*<10*	49.0	*82*	0.5 U		1.9	*<10*	38.0	*63*	8.5	*14*	1,000 D	*1.67E+03*	960 D	*1.60E+03*	45.0	*75*	0.5 U		1.8	*<10*
Trichlorofluoromethane	ug/L	--	1300	1.0 U		1.0 U		1.0 U																					
Vinyl Chloride	ug/L	0.022	--	180 D	*8.18E+03*	120 D	*5.46E+03*	0.54 J	*25*	5.8	*264*	0.5 U		0.5 U		72.0	*3.27E+03*	0.5 U		0.93	*42*	0.95	*43*	4.3	*195*	0.5 U		0.5 U	
Xylenes, Total	ug/L	13	--							0.6 U		0.6 U		0.6 U		0.6 U		0.6 U		0.6 U		0.6 U		1.3 U		0.6 U		0.6 U	

Notes:
EF = Exceedance factor (calculated if consistuent exceeded indicated screening level)
D = Dilution
J = Estimated value below reporting limit.
U = Not detected at specified reporting limit.
mg/L = milligrams per Liter

-- = Screening level not established (Note: If ROD CUL was available, JSCS SLV is not shown.)
Shaded = detected result exceeded indicated screening value
Sample Type: N = Normal Sample, FD - Field Duplicate
[1]Portland Harbor Record of Decision (ROD) Cleanup Levels (CULs) for groundwater for remedial action objectives 4 and 8 (Table 17 from EPA, 2017).
[2]Joint Source Control Strategy (JSCS) Screening Level Values (SLVs) for groundwater/surface water/stormwater recommended values for initial upland source control screening evaluations for water (Table 3.1 - Revision 7/16/07 from EPA, 2005)

Table 2
Analytical Groundwater Sampling Results
Northwest Pipe Company, Portland, Oregon

Location ID				MW-03			MW-04			MW-05			MW-06			MW-01			MW-02			MW-03			MW-03			MW-04			MW-05			MW-06			MW-01			MW-02		
Sample ID				MW03-060521			MW04-060521			MW05-060521			MW06-060521			MW1-092105			MW2-092105			MW3-092105			MW3-092105			MW4-092105			MW5-092105			MW6-092105			MW-1-092407			MW-2-092407		
Sample Date				06/21/05			06/21/05			06/21/05			06/21/05			09/21/05			09/21/05			09/21/05			09/21/05			09/21/05			09/21/05			09/21/05			09/24/07			09/24/07		
Sample Type				FD1			N1			N1			N1			N1			N1			N1			FD1			N1			N1			N1			N1			N1		
Analyte	**Units**	**ROD CULs[1]**	**JSCS SLVs[2]**			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*		
Field Parameters																																										
Temperature	(°C)	--	--										14.7																													
pH		--	--										6.1																													
Conductivity	(µS/cm)	--	--										376.9																													
Dissolved Oxygen	mg/L	--	--										0.2																													
Oxidation Reduction Potential	mV	--	--										-33.7																													
Turbidity	NTU	--	--										4.0																													
Conventional Parameters																																										
Alkalinity, Total as CaCO3	mg/L	--	--	150			190			120			150			160			160			150			130			180			120			150								
Chloride	mg/L	--	--	4.3			3.4			1.6			5.8			2.9			2.0			4.3			4.2			3.5			2.9			6.5								
Nitrate ion	mg/L	--	--													0.1	U		0.1	U		0.23			0.3			0.2			1.0			0.1	U							
Nitrate-N	mg/L	--	--	0.14			0.12			0.1	U		0.1	U																												
Sulfate	mg/L	--	--	13			10			6.6			22			4.4			0.11			15			17			13			17			25								
Total Organic Carbon	mg/L	--	--	1.6			1.9			1.9			2.7			1.2			2.1			1.5			1.5			1.5			2.4			1.8								
Total Suspended Solids (TSS)	mg/L	--	--																																							
Metals, Total																																										
Arsenic	mg/L	0.000018	--																																							
Cadmium	mg/L	0.000094	--																																							
Chromium	mg/L	0.011	--																																							
Copper	mg/L	0.00274	--																																							
Iron	mg/L	--	--																																							
Lead	mg/L	0.00054	--																																							
Manganese	mg/L	0.43	--	0.98		*<10*	1.8		*<10*	1.6		*<10*	2.6		*<10*	2.5		*<10*	2.5		*<10*	0.93		*<10*	1.7		*<10*	1.5		*<10*	1.7		*<10*	2.1		*<10*						
Mercury	mg/L	--	0.00077																																							
Nickel	mg/L	--	0.016																																							
Zinc	mg/L	0.0365	--																																							
Metals, Dissolved																																										
Arsenic	mg/L	0.000018	--																																							
Cadmium	mg/L	0.000094	--																																							
Chromium	mg/L	0.011	--																																							
Copper	mg/L	0.00274	--																																							
Iron	mg/L	--	--																																							
Ferrous Iron[1]	mg/L	--	--	4.2			11			7.7			13			16			15			3.0			12			7.6			4.3			12								
Lead	mg/L	0.00054	--																																							
Manganese	mg/L	0.43	--																																							
Mercury	mg/L	--	0.00077																																							
Nickel	mg/L	--	0.016																																							
Zinc	mg/L	0.0365	--																																		0.0050	U		0.0078		
Polynuclear Aromatic Hydrocabons																																										
1-Methylnaphthalene	ug/L	--	--																																							
2-Methylnaphthalene	ug/L	2.1	--																																							
Acenaphthene	ug/L	23	--																																		0.00133	U		0.0016	J	
Acenaphthylene	ug/L	--	0.2																																							
Anthracene	ug/L	0.73	--																																		0.003	J		0.0037	J	
Benzo(a)anthracene	ug/L	0.0012	--																																		0.0017	J	*<10*	0.0014	J	*<10*
Benzo(a)pyrene	ug/L	0.00012	--																																							
Benzo(b)fluoroanthene	ug/L	0.0012	--																																							
Benzo(g,h,i)perylene	ug/L	0.4	--																																							
Benzo(k)fluoranthene	ug/L	0.0013	--																																							
Chrysene	ug/L	0.0013	--																																		0.0018	J	*<10*	0.00131	U	
Dibenzo(a,h)anthracene	ug/L	0.00012	--																																							
Fluoranthene	ug/L	6.2	--																																							
Fluorene	ug/L	3.9	--																																		0.00135	U		0.0013	J	
Indeno(1,2,3-c,d)pyrene	ug/L	0.0012	--																																							
Naphthalene	ug/L	12	--																																		0.0045	J		0.0048	J	
Phenanthrene	ug/L	6.3	--																																		0.002	J		0.0037	J	
Pyrene	ug/L	10	--																																		0.0058	J		0.00395	U	
Total cPAHs (BaP equivalents)[2]	ug/L	0.00012	--																																		0.0035		29	0.0014		12
Polychlorinated Biphenyls																																										
Aroclor-1260	ug/L	--	0.034																																							
Aroclor-1254	ug/L	--	0.033																																							
Aroclor-1221	ug/L	--	0.034																																							
Aroclor-1232	ug/L	--	0.034																																							
Aroclor-1248	ug/L	--	0.034																																							
Aroclor-1016	ug/L	--	0.96																																							
Aroclor-1242	ug/L	--	0.034																																							
Total PCBs[2]	ug/L	0.014	--																																							
Total Petroleum Hydrocarbons																																										
Gasoline (TPH-Gx)	mg/L	--	--																																		0.060	J		0.032	J	
Diesel (TPH-Dx)	mg/L	--	--																																		0.0404	U		0.0547	U	
Motor Oil (TPH-Oil)	mg/L	--	--																																							
Volatile Organic Compounds																																										
1,1,1,2-Tetrachloroethane	ug/L	--	2.5																																		1.0	U		1.0	U	
1,1,1-Trichloroethane	ug/L	--	11	0.5	U		0.5	U		0.5	U		5.0	U		1.1	U		0.5	U		0.5	U		0.5	U		0.5	U		0.5	U		5.0	U		1.0	U		1.0	U	

Table 2
Analytical Groundwater Sampling Results
Northwest Pipe Company, Portland, Oregon

Location ID				MW-03			MW-04			MW-05			MW-06			MW-01			MW-02			MW-03			MW-03			MW-04			MW-05			MW-06			MW-01			MW-02		
Sample ID				MW03-			MW04-			MW05-			MW06-			MW1-			MW2-			MW3-			MW3-			MW4-			MW5-			MW6-			MW-1-092407			MW-2-092407		
Sample Date				06/21/05			06/21/05			06/21/05			06/21/05			09/21/05			09/21/05			09/21/05			09/21/05			09/21/05			09/21/05			09/21/05			09/24/07			09/24/07		
Sample Type				FD1			N1			N1			N1			N1			N1			N1			FD1			N1			N1			N1			N1			N1		
Analyte	**Units**	**ROD CULs[1]**	**JSCS SLVs[2]**		*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*
Volatile Organic Compounds																																										
1,1,2,2-Tetrachloroethane	ug/L	--	0.33	0.5	U		0.5	U		0.5	U		5.0	U		1.1	U		0.5	U		0.5	U		0.5	U		0.5	U		0.5	U		5.0	U		1.0	U		1.0	U	
1,1,2-Trichloroethane	ug/L	--	1.2	0.5	U		0.5	U		0.5	U		5.0	U		1.1	U		0.5	U		0.5	U		0.5	U		0.5	U		0.5	U		5.0	U		1.0	U		1.0	U	
1,1-Dichloroethane	ug/L	--	47	0.5	U		0.5	U		0.5	U		5.0	U		1.1	U		0.5	U		0.5	U		0.5	U		0.5	U		0.5	U		5.0	U		1.0	U		1.0	U	
1,1-Dichloroethene	ug/L	7	--	0.5	U		0.5	U		0.5	U		5.0	U		2.5			0.5	U		0.5	U		0.5	U		0.5	U		0.5	U		6.2			1.3			1.0	U	
1,1-Dichloropropene	ug/L	--	--																																		1.0	U		1.0	U	
1,2,3-Trichlorobenzene	ug/L	--	--																																		1.0	U		1.0	U	
1,2,3-Trichloropropane	ug/L	--	0.0095																																		1.0	U		1.0	U	
1,2,4-Trichlorobenzene	ug/L	--	--																																		1.0	U		1.0	U	
1,2,4-Trimethylbenzene	ug/L	--	--																																		1.0	U		1.0	U	
1,2-Dibromo-3-Chloropropane	ug/L	--	--																																		1.0	U		1.0	U	
1,2-Dibromoethane	ug/L	--	--																																		1.0	U		1.0	U	
1,2-Dichlorobenzene	ug/L	--	--																																		1.0	U		1.0	U	
1,2-Dichloroethane	ug/L	--	0.73	0.5	U		0.5	U		0.5	U		5.0	U		1.1	U		0.5	U		0.5	U		0.5	U		0.5	U		0.5	U		5.0	U		1.0	U		1.0	U	
1,2-Dichloroethene	ug/L	--	--	0.5	U		150			53.0			1,300			690			0.5	U		0.79			0.79			140			150			1,600								
1,2-Dichloropropane	ug/L	--	0.97	0.5	U		0.5	U		0.5	U		5.0	U		1.1	U		0.5	U		0.5	U		0.5	U		0.5	U		0.5	U		5.0	U		1.0	U		1.0	U	
1,3,5-Trimethylbenzene	ug/L	--	--																																		1.0	U		1.0	U	
1,3-Dichlorobenzene	ug/L	--	--																																		1.0	U		1.0	U	
1,3-Dichloropropane	ug/L	--	--																																		1.0	U		1.0	U	
1,4-Dichlorobenzene	ug/L	--	2.8																																		1.0	U		1.0	U	
2,2-Dichloropropane	ug/L	--	--																																		1.0	U		1.0	U	
2-Butanone	ug/L	--	7100	5.0	U		5.0	U		5.0	U		50.0	U		11.0	U		5.0	U		5.0	U		5.0	U		5.0	U		5.0	U		50.0	U		1.0	U		1.0	U	
2-Chloroethyl Vinyl Ether	ug/L	--	--																																							
2-Chlorotoluene	ug/L	--	--																																		1.0	U		1.0	U	
2-Hexanone	ug/L	--	99	5.0	U		5.0	U		5.0	U		50.0	U		11.0	U		5.0	U		5.0	U		5.0	U		5.0	U		5.0	U		50.0	U							
4-Chlorotoluene	ug/L	--	--																																		1.0	U		1.0	U	
4-Methyl-2-Pentanone	ug/L	--	170	1.0	U		1.0	U		1.0	U		10.0	U		2.2	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		10.0	U		1.0	U		1.0	U	
Acetone	ug/L	--	1500	1.0	U		1.0	U		1.0	U		10.0	U		2.2	U		8.6			11.0			4.8			1.0	U		3.7			10.0	U		1.0	U		1.0	U	
Benzene	ug/L	0.44	--	0.5	U		0.5	U		0.5	U		5.0	U		1.1	U		0.5	U		0.5	U		0.5	U		0.5	U		0.5	U		5.0	U		0.11	J		1.0	U	
Bromobenzene	ug/L	--	--																																		1.0	U		1.0	U	
Bromochloromethane	ug/L	--	--																																		1.0	U		1.0	U	
Bromodichloromethane	ug/L	--	1.1	0.5	U		0.5	U		0.5	U		5.0	U		1.1	U		0.5	U		0.5	U		0.5	U		0.5	U		0.5	U		5.0	U		1.0	U		1.0	U	
Bromoform	ug/L	--	8.5	0.5	U		0.5	U		0.5	U		5.0	U		1.1	U		0.5	U		0.5	U		0.5	U		0.5	U		0.5	U		5.0	U		1.0	U		1.0	U	
Bromomethane	ug/L	--	8.7	0.5	U		0.5	U		0.5	U		5.0	U		1.1	U		0.5	U		0.5	U		0.5	U		0.5	U		0.5	U		5.0	U		1.0	U		1.0	U	
Carbon Dioxide	ug/L	--	--	49,000			110,000			42,000			110,000			57,000			43,000			63,000			31,000			110,000			40,000			98,000								
Carbon Disulfide	ug/L	--	0.92	1.0	U		1.0	U		1.0	U		10.0	U		2.2	U		1.0	U		1.0	U		1.0	U		1.0	U		1.0	U		10.0	U							
Carbon Tetrachloride	ug/L	--	0.51	0.5	U		0.5	U		0.5	U		5.0	U		1.1	U		0.5	U		0.5	U		0.5	U		0.5	U		0.5	U		5.0	U		1.0	U		1.0	U	
Chlorobenzene	ug/L	64	--	0.5	U		0.5	U		0.5	U		5.0	U		1.1	U		0.5	U		0.5	U		0.5	U		0.5	U		0.5	U		5.0	U		1.0	U		1.0	U	
Chlorodibromomethane	ug/L	--	0.79	0.5	U		0.5	U		0.5	U		5.0	U		1.1	U		0.5	U		0.5	U		0.5	U		0.5	U		0.5	U		5.0	U		1.0	U		1.0	U	
Chloroethane	ug/L	--	23	0.5	U		0.5	U		0.5	U		5.0	U		1.1	U		0.5	U		0.5	U		0.5	U		0.5	U		0.5	U		5.0	U		1.0	U		1.0	U	
Chloroform	ug/L	--	0.17	0.5	U		0.5	U		0.5	U		5.0	U		1.1	U		0.5	U		0.5	U		0.5	U		0.5	U		0.5	U		5.0	U		1.0	U		1.0	U	
Chlorohexane	ug/L	--	--																																		1.0	U		1.0	U	
Chloromethane	ug/L	--	2.1	0.5	U		0.5	U		0.5	U		5.0	U		1.1	U		0.5	U		0.5	U		0.5	U		0.5	U		0.5	U		5.0	U		1.0	U		1.0	U	
Cis-1,2-Dichloroethene	ug/L	70	--	0.5	U		150	D	*<10*	53.0		*<10*	1,300	D	*19*	730	D	*10*	0.5	U		0.79			0.79			160		*<10*	160		*<10*	1,700		*24*	386	D	*<10*	0.37	J	
Cis-1,3-Dichloropropene	ug/L	--	0.055	0.5	U		0.5	U		0.5	U		5.0	U		1.1	U		0.5	U		0.5	U		0.5	U		0.5	U		0.5	U		5.0	U		1.0	U		1.0	U	
Dibromomethane	ug/L	--	61																																		1.0	U		1.0	U	
Dichlorodifluoromethane	µg/L	--	390																																		1.0	U		1.0	U	
Ethylbenzene	ug/L	7.3	--	0.5	U		0.5	U		0.5	U		5.0	U		1.1	U		0.5	U		0.5	U		0.5	U		0.5	U		0.5	U		5.0	U		1.0	U		1.0	U	
Hexachlorobutadiene	ug/L	--	--																																		1.0	U		1.0	U	
Isopropylbenzene	ug/L	--	660																																		1.0	U		1.0	U	
m+p-Xylenes	ug/L	--	1.8	2.0	U		2.0	U		2.0	U		20.0	U		1.1	U		0.5	U		0.5	U		0.5	U		0.5	U		0.5	U		5.0	U		1.0	U		1.0	U	
Methane	ug/L	--	--	940			8,600			3,000			1,800			3,900			13,000			7,700			720			6,100			2,600			3,000								
Methylene Chloride	ug/L	--	8.9	0.5	U		0.5	U		0.5	U		5.0	U		1.1	U		0.5	U		0.5	U		0.5	U		0.5	U		0.5	U		5.0	U		1.0	U		1.0	U	
Methyl-tert-butyl Ether	ug/L	--	37																																		1.0	U		1.0	U	
Naphthalene	ug/L	--	0.2																																		1.0	U		1.0	U	
n-Butylbenzene	ug/L	--	--																																		1.0	U		1.0	U	
n-Propylbenzene	ug/L	--	--																																		1.0	U		1.0	U	
o-Xylene	ug/L	--	13	0.5	U		0.5	U		0.5	U		5.0	U		1.1	U		0.5	U		0.5	U		0.5	U		0.5	U		0.5	U		5.0	U		1.0	U		1.0	U	
p-Isopropyltoluene	ug/L	--	--																																		1.0	U		1.0	U	
Sec-Butylbenzene	ug/L	--	--																																		1.0	U		1.0	U	
Styrene	ug/L	--	100	0.5	U		0.5	U		0.5	U		5.0	U		1.1	U		0.5	U		0.5	U		0.5	U		0.5	U		0.5	U		5.0	U		1.0	U		1.0	U	
Tert-Butylbenzene	ug/L	--	--																																		1.0	U		1.0	U	
Tetrachloroethene	ug/L	0.24	--	12.0		*50*	130	D	*542*	110	D	*458*	2,100	D	*8.75E+03*	460	D	*1.92E+03*	0.5	U		9.0		*38*	9.7		*40*	140	D	*583*	1,200	D	*5.00E+03*	2,800	D	*1.17E+04*	146	D	*608*	0.34	J	*<10*
Toluene	ug/L	9.8	--	0.5	U		0.5	U		0.5	U		5.0	U		1.1	U		0.5	U		0.5	U		0.5	U		0.5	U		0.5	U		5.0	U		1.0	U		1.0	U	
Trans-1,2-Dichloroethene	ug/L	--	--	0.5	U		1.9			0.5	U		9.9			5.0			0.5	U		0.5	U		0.5	U		1.9			0.93			12.0			3.1			1.0	U	
Trans-1,3-Dichloropropene	ug/L	--	--	0.5	U		0.5	U		0.5	U		5.0	U		1.1	U		0.5	U		0.5	U		0.5	U		0.5	U		0.5	U		5.0	U		1.0	U		1.0	U	
Trichloroethene	ug/L	0.6	--	2.1		*<10*	28.0		*47*	18.0		*30*	1,500	D	*2.50E+03*	38.0		*63*	0.5	U		1.7		*<10*	1.8		*<10*	24.0	D	*40*	72.0	D	*120*	1,900	D	*3.17E+03*	14.7		*25*	1.0	U	
Trichlorofluoromethane	ug/L	--	1300																																		1.0	U		1.0	U	
Vinyl Chloride	ug/L	0.022	--	0.5	U		59.0		*2.68E+03*	0.5	U		5.7		*259*	2.9		*132*	0.5	U		0.5	U		0.5	U		55.0		*2.50E+03*	0.5	U		6.7		*305*	6.6		*300*	1.0	U	
Xylenes, Total	ug/L	13	--	0.6	U		0.6	U		0.6	U		6.0	U		1.3	U		0.6	U		0.6	U		0.6	U		0.6	U		0.6	U		6.0	U							

Notes:
EF = Exceedance factor (calculated if consistuent exceeded indicated screening level)
D = Dilution
J = Estimated value below reporting limit.
U = Not detected at specified reporting limit.
mg/L = milligrams per Liter

-- = Screening level not established (Note: If ROD CUL was available, JSCS SLV is not shown.)
Shaded = detected result exceeded indicated screening value
Sample Type: N = Normal Sample, FD - Field Duplicate
[1]Portland Harbor Record of Decision (ROD) Cleanup Levels (CULs) for groundwater for remedial action objectives 4 and 8 (Table 17 from EPA, 2017).
[2]Joint Source Control Strategy (JSCS) Screening Level Values (SLVs) for groundwater/surface water/stormwater recommended values for initial upland source control screening evaluations for water (Table 3.1 - Revision 7/16/07 from EPA, 2005)

Table 2
Analytical Groundwater Sampling Results
Northwest Pipe Company, Portland, Oregon

Location ID				MW-03		MW-04		MW-05		MW-06		GP-201		GP-202		GP-203		GP-203		GP-204		GP-205		GP-206		GP-207		GP-208		GP-209	
Sample ID				MW-3-092407		MW-4-092407		MW-5-092407		MW-6-092407		GP201-W-0		GP202-W-0		GP203-W-0		GP203-W-1		GP204-W-0		GP205-W-0		GP206-W-0		GP207-W-0		GP208-W-0		GP209-W-0	
Sample Date				09/24/07		09/24/07		09/24/07		09/24/07		09/26/07		09/26/07		09/26/07		09/26/07		09/26/07		09/26/07		09/26/07		09/26/07		09/27/07		09/27/07	
Sample Type				N1		N1		N1		N1		N1		N1		N1		FD1		N1		N1		N1		N1		N1		N1	
Analyte	**Units**	**ROD CULs[1]**	**JSCS SLVs[2]**		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*
Field Parameters																															
Temperature	(°C)	--	--																												
pH		--	--																												
Conductivity	(µS/cm)	--	--																												
Dissolved Oxygen	mg/L	--	--																												
Oxidation Reduction Potential	mV	--	--																												
Turbidity	NTU	--	--																												
Conventional Parameters																															
Alkalinity, Total as CaCO3	mg/L	--	--																												
Chloride	mg/L	--	--																												
Nitrate ion	mg/L	--	--																												
Nitrate-N	mg/L	--	--																												
Sulfate	mg/L	--	--																												
Total Organic Carbon	mg/L	--	--																												
Total Suspended Solids (TSS)	mg/L	--	--																												
Metals, Total																															
Arsenic	mg/L	0.000018	--																												
Cadmium	mg/L	0.000094	--																												
Chromium	mg/L	0.011	--																												
Copper	mg/L	0.00274	--																												
Iron	mg/L	--	--																												
Lead	mg/L	0.00054	--																												
Manganese	mg/L	0.43	--																												
Mercury	mg/L	--	0.00077																												
Nickel	mg/L	--	0.016																												
Zinc	mg/L	0.0365	--																												
Metals, Dissolved																															
Arsenic	mg/L	0.000018	--																												
Cadmium	mg/L	0.000094	--																												
Chromium	mg/L	0.011	--																												
Copper	mg/L	0.00274	--																												
Iron	mg/L	--	--																												
Ferrous Iron[1]	mg/L	--	--																												
Lead	mg/L	0.00054	--																												
Manganese	mg/L	0.43	--																												
Mercury	mg/L	--	0.00077																												
Nickel	mg/L	--	0.016																												
Zinc	mg/L	0.0365	--	0.0050	U	0.0064		0.0050	U	0.0050	U	0.0064		0.0066		0.0051		0.0061		0.011		0.0073		0.0050	U	0.0096		0.0059		0.0072	
Polynuclear Aromatic Hydrocabons																															
1-Methylnaphthalene	ug/L	--	--																												
2-Methylnaphthalene	ug/L	2.1	--																												
Acenaphthene	ug/L	23	--	0.00127	U	0.00127	U	0.00135	U	0.00134	U																				
Acenaphthylene	ug/L	--	0.2																												
Anthracene	ug/L	0.73	--	0.0035	J	0.0042	J	0.0039	J	0.006	J																				
Benzo(a)anthracene	ug/L	0.0012	--	0.00126	U	0.00125	U	0.00134	U	0.00133	U																				
Benzo(a)pyrene	ug/L	0.00012	--																												
Benzo(b)fluoroanthene	ug/L	0.0012	--																												
Benzo(g,h,i)perylene	ug/L	0.4	--																												
Benzo(k)fluoranthene	ug/L	0.0013	--																												
Chrysene	ug/L	0.0013	--	0.00131	U	0.00131	U	0.0014	U	0.00138	U																				
Dibenzo(a,h)anthracene	ug/L	0.00012	--																												
Fluoranthene	ug/L	6.2	--																												
Fluorene	ug/L	3.9	--	0.00129	U	0.00129	U	0.00138	U	0.00137	U																				
Indeno(1,2,3-c,d)pyrene	ug/L	0.0012	--																												
Naphthalene	ug/L	12	--	0.0038	J	0.0045	J	0.0072	J	0.0057	J																				
Phenanthrene	ug/L	6.3	--	0.00154	U	0.0017	J	0.00165	U	0.00164	U																				
Pyrene	ug/L	10	--	0.00395	U	0.00395	U	0.00421	U	0.00418	U																				
Total cPAHs (BaP equivalents)[2]	ug/L	0.00012	--																												
Polychlorinated Biphenyls																															
Aroclor-1260	ug/L	--	0.034																												
Aroclor-1254	ug/L	--	0.033																												
Aroclor-1221	ug/L	--	0.034																												
Aroclor-1232	ug/L	--	0.034																												
Aroclor-1248	ug/L	--	0.034																												
Aroclor-1016	ug/L	--	0.96																												
Aroclor-1242	ug/L	--	0.034																												
Total PCBs[2]	ug/L	0.014	--																												
Total Petroleum Hydrocarbons																															
Gasoline (TPH-Gx)	mg/L	--	--	0.034	J	0.069	J	0.30		0.44		0.031	J	0.027	J	0.77		0.66		0.040	J	0.028	J	0.032	J	0.11		0.10	U	0.10	U
Diesel (TPH-Dx)	mg/L	--	--	0.0435	U	0.044	U	0.0447	U	0.0496	U	0.0665		0.0996		1.05		0.982		0.0908		0.112		0.0188	J	5.67		0.0383	U	0.0412	U
Motor Oil (TPH-Oil)	mg/L	--	--																												
Volatile Organic Compounds																															
1,1,1,2-Tetrachloroethane	ug/L	--	2.5	1.0	U	1.0	U	1.0	U	5.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1,1-Trichloroethane	ug/L	--	11	1.0	U	1.0	U	0.15	J	5.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U

Table 2
Analytical Groundwater Sampling Results
Northwest Pipe Company, Portland, Oregon

Location ID				MW-03	MW-04	MW-05	MW-06	GP-201	GP-202	GP-203	GP-203	GP-204	GP-205	GP-206	GP-207	GP-208	GP-209
Sample ID				MW-3-092407	MW-4-092407	MW-5-092407	MW-6-092407	GP201-W-0	GP202-W-0	GP203-W-0	GP203-W-1	GP204-W-0	GP205-W-0	GP206-W-0	GP207-W-0	GP208-W-0	GP209-W-0
Sample Date				09/24/07	09/24/07	09/24/07	09/24/07	09/26/07	09/26/07	09/26/07	09/26/07	09/26/07	09/26/07	09/26/07	09/26/07	09/27/07	09/27/07
Sample Type				N1	N1	N1	N1	N1	N1	N1	FD1	N1	N1	N1	N1	N1	N1
Analyte	**Units**	**ROD CULs[1]**	**JSCS SLVs[2]**		*EF*	*EF*	*EF*	*EF*	*EF*	*EF*	*EF*	*EF*	*EF*	*EF*	*EF*	*EF*	*EF*
Volatile Organic Compounds																	
1,1,2,2-Tetrachloroethane	ug/L	--	0.33	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-Trichloroethane	ug/L	--	1.2	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethane	ug/L	--	47	0.12 J	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	0.20 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.6	0.15 J
1,1-Dichloroethene	ug/L	7	--	1.0 U	0.32 J	0.98 J	2.4 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloropropene	ug/L	--	--	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-Trichlorobenzene	ug/L	--	--	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-Trichloropropane	ug/L	--	0.0095	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-Trichlorobenzene	ug/L	--	--	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-Trimethylbenzene	ug/L	--	--	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	0.37 J	0.38 J	1.0 U	1.0 U	1.0 U	2.2	1.0 U	1.0 U
1,2-Dibromo-3-Chloropropane	ug/L	--	--	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dibromoethane	ug/L	--	--	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichlorobenzene	ug/L	--	--	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethane	ug/L	--	0.73	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethene	ug/L	--	--														
1,2-Dichloropropane	ug/L	--	0.97	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3,5-Trimethylbenzene	ug/L	--	--	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	2.9	2.8	1.0 U	1.0 U	1.0 U	0.72 J	1.0 U	1.0 U
1,3-Dichlorobenzene	ug/L	--	--	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.07 J	1.0 U	1.0 U	0.42 J
1,3-Dichloropropane	ug/L	--	--	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-Dichlorobenzene	ug/L	--	2.8	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.27 J	0.78 J	1.0 U	4.8 *<10*
2,2-Dichloropropane	ug/L	--	--	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-Butanone	ug/L	--	7100	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-Chloroethyl Vinyl Ether	ug/L	--	--														
2-Chlorotoluene	ug/L	--	--	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-Hexanone	ug/L	--	99														
4-Chlorotoluene	ug/L	--	--	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
4-Methyl-2-Pentanone	ug/L	--	170	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Acetone	ug/L	--	1500	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Benzene	ug/L	0.44	--	1.0 U	0.10 J	0.20 J	5.0 U	1.0 U	1.0 U	0.55 J *<10*	0.57 J *<10*	1.0 U	1.0 U	1.0 U	0.10 J	1.0 U	1.0 U
Bromobenzene	ug/L	--	--	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromochloromethane	ug/L	--	--	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromodichloromethane	ug/L	--	1.1	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromoform	ug/L	--	8.5	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromomethane	ug/L	--	8.7	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Carbon Dioxide	ug/L	--	--														
Carbon Disulfide	ug/L	--	0.92														
Carbon Tetrachloride	ug/L	--	0.51	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chlorobenzene	ug/L	64	--	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.2
Chlorodibromomethane	ug/L	--	0.79	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloroethane	ug/L	--	23	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloroform	ug/L	--	0.17	1.0 U	1.0 U	0.33 J *<10*	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chlorohexane	ug/L	--	--	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloromethane	ug/L	--	2.1	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.19 J	0.35 J	1.0 U
Cis-1,2-Dichloroethene	ug/L	70	--	1.7	49.8	337 D *<10*	638 D *<10*	1.0 U	0.31 J	1.0 U	1.0 U	0.56 J	0.14 J	0.34 J	0.71 J	0.50 J	0.24 J
Cis-1,3-Dichloropropene	ug/L	--	0.055	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dibromomethane	ug/L	--	61	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dichlorodifluoromethane	µg/L	--	390	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Ethylbenzene	ug/L	7.3	--	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	0.64 J	0.55 J	1.0 U	1.0 U	1.0 U	0.17 J	1.0 U	1.0 U
Hexachlorobutadiene	ug/L	--	--	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Isopropylbenzene	ug/L	--	660	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	23.9	24.1	1.0 U	1.0 U	1.0 U	0.48 J	1.0 U	1.0 U
m+p-Xylenes	ug/L	--	1.8	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.4	1.4	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methane	ug/L	--	--														
Methylene Chloride	ug/L	--	8.9	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methyl-tert-butyl Ether	ug/L	--	37	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Naphthalene	ug/L	--	0.2	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	0.12 J	1.0 U	1.0 U	1.0 U	1.0 U	11.9 *60*	1.0 U	1.0 U
n-Butylbenzene	ug/L	--	--	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	15.7	15.5	1.0 U	1.0 U	1.0 U	0.19 J	1.0 U	1.0 U
n-Propylbenzene	ug/L	--	--	1.0 U	1.0 U	1.0 U	5.0 U	0.08 J	1.0 U	35.7	35.8	0.08 J	1.0 U	1.0 U	0.96 J	1.0 U	1.0 U
o-Xylene	ug/L	--	13	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	0.11 J	0.11 J	1.0 U	1.0 U	1.0 U	0.09 J	1.0 U	0.10 J
p-Isopropyltoluene	ug/L	--	--	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Sec-Butylbenzene	ug/L	--	--	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	3.4	3.5	1.0 U	1.0 U	1.0 U	0.12 J	1.0 U	1.0 U
Styrene	ug/L	--	100	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tert-Butylbenzene	ug/L	--	--	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tetrachloroethene	ug/L	0.24	--	15.6 *65*	147 D *613*	1,420 D *5.92E+03*	1,210 D *5.04E+03*	0.32 J *<10*	0.37 J *<10*	0.35 J *<10*	0.17 J	0.24 J *<10*	0.17 J	0.14 J	0.30 J *<10*	1.0 U	1.0 U
Toluene	ug/L	9.8	--	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	0.39 J	0.38 J	1.0 U	1.0 U	1.0 U	0.22 J	1.0 U	0.13 J
Trans-1,2-Dichloroethene	ug/L	--	--	1.0 U	0.97 J	2.3	4.2 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trans-1,3-Dichloropropene	ug/L	--	--	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethene	ug/L	0.6	--	3.0 *<10*	43.8 *73*	78.2 *130*	466 *777*	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.22 J	1.0 U	1.0 U
Trichlorofluoromethane	ug/L	--	1300	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Vinyl Chloride	ug/L	0.022	--	1.0 U	20.9 *950*	0.28 J *13*	3.1 J *141*	1.0 U	0.16 J *<10*	1.0 U	1.0 U	1.5 *68*	0.38 J *17*	0.68 J *31*	0.31 J *14*	0.19 J *<10*	0.58 J *26*
Xylenes, Total	ug/L	13	--														

Notes:

EF = Exceedance factor (calculated if consistuent exceeded indicated screening level)

D = Dilution

J = Estimated value below reporting limit.

U = Not detected at specified reporting limit.

mg/L = milligrams per Liter

-- = Screening level not established (Note: If ROD CUL was available, JSCS SLV is not shown.)

Shaded = detected result exceeded indicated screening value

Sample Type: N = Normal Sample, FD - Field Duplicate

[1]Portland Harbor Record of Decision (ROD) Cleanup Levels (CULs) for groundwater for remedial action objectives 4 and 8 (Table 17 from EPA, 2017).

[2]Joint Source Control Strategy (JSCS) Screening Level Values (SLVs) for groundwater/surface water/stormwater recommended values for initial upland source control screening evaluations for water (Table 3.1 - Revision 7/16/07 from EPA, 2005)

Table 2
Analytical Groundwater Sampling Results
Northwest Pipe Company, Portland, Oregon

Location ID				GP-210		GP-211		GP-211		GP-212		GP-213		GP-214		MW-7		MW-7		MW-8		MW-8		MW-9		MW-9		MW-01		MW-01	
Sample ID				GP210-W-0		GP211-W-0		GP211-W-1		GP212-W-0		GP213-W-0		GP214-W-0		MW-7-61512		MW-7-53113		MW-8-61512		MW-8-53113		MW-9-61512		MW-9-53113		MW-01-102616		MW-01-020217	
Sample Date				09/27/07		09/27/07		09/27/07		09/27/07		09/27/07		09/27/07		06/15/12		05/31/13		06/15/12		05/31/13		06/15/12		05/31/13		10/26/16		02/02/17	
Sample Type				N1		N1		FD1		N1		N1		N1		N		N		N		N		N		N		N		N	
Analyte	**Units**	**ROD CULs[1]**	**JSCS SLVs[2]**		*EF*				*EF*				*EF*				*EF*				*EF*				*EF*				*EF*		
Field Parameters																															
Temperature	(°C)	--	--													14.4		13.2		15.3		14.2		15.9		15.2		15.9		16.0	
pH		--	--													6.69		6.80		6.95		6.60		6.83		6.60		6.42		6.64	
Conductivity	(µS/cm)	--	--													353		130		312		250		360		242		352		385	
Dissolved Oxygen	mg/L	--	--																									0.26		0.01	
Oxidation Reduction Potential	mV	--	--													-100		-93		-134		-34		-128		-31		6		-36	
Turbidity	NTU	--	--													11.4		8.81		10.3		0.52		2.8		3.0		6.8		3.1	
Conventional Parameters																															
Alkalinity, Total as CaCO3	mg/L	--	--																												
Chloride	mg/L	--	--																									2.46		3.69	
Nitrate ion	mg/L	--	--																												
Nitrate-N	mg/L	--	--																									0.37	J	0.061	
Sulfate	mg/L	--	--																									10.1		4.71	
Total Organic Carbon	mg/L	--	--																									1.00		0.84	
Total Suspended Solids (TSS)	mg/L	--	--													11.3				18.7				27							
Metals, Total																															
Arsenic	mg/L	0.000018	--													0.00531		295	0.0033		183	0.00154		86	0.00179		99	0.00312		173	0.00631		351					
Cadmium	mg/L	0.000094	--													0.000076	J		0.00003	U		0.000044	J		0.00003	U		0.000042	J		0.00003	U						
Chromium	mg/L	0.011	--													0.00073	U		0.00073	U		0.00073	U		0.00073	U		0.00073	U		0.00073	U						
Copper	mg/L	0.00274	--													0.0033	J	<10	0.00249	J		0.00158	U		0.00158	U		0.00158	U		0.00158	U						
Iron	mg/L	--	--																												
Lead	mg/L	0.00054	--													0.00341	J	<10	0.00146	U		0.00146	U		0.00146	U		0.00146	U		0.00146	U						
Manganese	mg/L	0.43	--													2.2		<10	0.919		<10	1.2		<10	0.713		<10	2.11		<10	1.9		<10					
Mercury	mg/L	--	0.00077													0.000031	J		0.000015	U		0.000029	J		0.000015	U		0.000045	J		0.000015	U						
Nickel	mg/L	--	0.016													0.00948	J		0.0038	U		0.0038	U		0.0038	U		0.0038	U		0.0038	U						
Zinc	mg/L	0.0365	--													0.00704	J		0.00178	U		0.00317	J		0.00297	J		0.00264	J		0.00225	J						
Metals, Dissolved																															
Arsenic	mg/L	0.000018	--													0.00533		296	0.00312		173	0.00144		80	0.00154		86	0.00309		172	0.00704		391					
Cadmium	mg/L	0.000094	--													0.000073	J		0.00003	U		0.000059	J		0.00003	U		0.000062	J		0.00003	U						
Chromium	mg/L	0.011	--													0.00075	J		0.00073	U		0.00073	U		0.00073	U		0.00073	U		0.00073	U						
Copper	mg/L	0.00274	--													0.00158	U		0.00158	U		0.00158	U		0.00158	U		0.00158	U		0.00158	U						
Iron	mg/L	--	--																												
Ferrous Iron[1]	mg/L	--	--																									1.59		3.01	
Lead	mg/L	0.00054	--													0.00419	J	<10	0.00161	J	<10	0.00248	J	<10	0.00188	J	<10	0.00302	J	<10	0.00146	U						
Manganese	mg/L	0.43	--													2.2		<10	0.879		<10	1.26		<10	0.828		<10	2.13		<10	1.96		<10					
Mercury	mg/L	--	0.00077													0.000028	U		0.000015	U		0.000098	J		0.000015	U		0.000061	J		0.000015	U						
Nickel	mg/L	--	0.016													0.0101	J		0.004	U		0.0038	U		0.004	U		0.0038	U		0.0038	U						
Zinc	mg/L	0.0365	--	0.0050	U	0.0061		0.0053		0.0053		0.0058		0.0058		0.00581	J		0.00178	U		0.00363	J		0.00273	J		0.00396	J		0.00178	U						
Polynuclear Aromatic Hydrocabons																															
1-Methylnaphthalene	ug/L	--	--													39.2			89.9			14			17			0.051	J		0.035	J						
2-Methylnaphthalene	ug/L	2.1	--													22.5		11	4.68	U		0.25	U		1.03	J	<10	0.027	U		0.012	U						
Acenaphthene	ug/L	23	--													701		30	2,000		87	200		<10	231		10	6.65			2.91							
Acenaphthylene	ug/L	--	0.2													19.4		97	53.4		267	3.06		15	6.44		32	0.084	J		0.086							
Anthracene	ug/L	0.73	--													45.2		62	188		258	2.57		<10	1.93		<10	0.19			0.26							
Benzo(a)anthracene	ug/L	0.0012	--													8.96	J	7467	197		1.64E+05	0.2	U		0.37	U		0.021	U		0.012	J	10					
Benzo(a)pyrene	ug/L	0.00012	--													2.83	U		100		8.33E+05	0.27	U		0.49	U		0.028	U		0.012	U						
Benzo(b)fluoroanthene	ug/L	0.0012	--													3.34	U		48		4.00E+04	0.31	U		0.58	U		0.033	U		0.014	U						
Benzo(g,h,i)perylene	ug/L	0.4	--													2.61	U		6.6	J	17	0.24	U		0.45	U		0.028	J		0.011	U						
Benzo(k)fluoranthene	ug/L	0.0013	--													3.78	U		71.9		5.53E+04	0.36	U		0.65	U		0.037	U		0.016	U						
Chrysene	ug/L	0.0013	--													5.39	J	4146	159		1.22E+05	0.25	U		0.46	U		0.026	U		0.011	U						
Dibenzo(a,h)anthracene	ug/L	0.00012	--													3.74	U		87.1		7.26E+05	0.35	U		0.65	U		0.037	U		0.016	U						
Fluoranthene	ug/L	6.2	--													97.5		16	2,010		324	1.31		<10	0.62	U		0.17			0.024	J						
Fluorene	ug/L	3.9	--													171		44	701		180	37.9		<10	35.7		<10	0.16			0.025	J						
Indeno(1,2,3-c,d)pyrene	ug/L	0.0012	--													2.12	U		83.7		6.98E+04	0.2	U		0.37	U		0.021	U		0.0092	U						
Naphthalene	ug/L	12	--													61.9		<10	27.3		<10	0.42	U		0.78	U		0.047	J		0.029	J						
Phenanthrene	ug/L	6.3	--													259		41	2,650	B	421	17.6		<10	21.5	B	<10	0.48		<10	0.16	B						
Pyrene	ug/L	10	--													73.6		<10	1,670		167	0.79	J	<10	0.72	U		0.18			0.11							
Total cPAHs (BaP equivalents)[2]	ug/L	0.00012	--													14.35		119583	746.7		6.22E+06										0.012		100					
Polychlorinated Biphenyls																															
Aroclor-1260	ug/L	--	0.034													0.0062	U					0.0062	U					0.006	U										
Aroclor-1254	ug/L	--	0.033													0.0075	U					0.0075	U					0.0073	U										
Aroclor-1221	ug/L	--	0.034													0.017	U					0.017	U					0.017	U										
Aroclor-1232	ug/L	--	0.034													0.017	U					0.017	U					0.016	U										
Aroclor-1248	ug/L	--	0.034													0.0083	U					0.0083	U					0.008	U										
Aroclor-1016	ug/L	--	0.96													0.015	U					0.015	U					0.015	U										
Aroclor-1242	ug/L	--	0.034													0.02	U					0.02	U					0.019	U										
Total PCBs[2]	ug/L	0.014	--																												
Total Petroleum Hydrocarbons																															
Gasoline (TPH-Gx)	mg/L	--	--	0.10	U	0.10	U	0.10	U	0.96		0.10	U	0.10	U																
Diesel (TPH-Dx)	mg/L	--	--	0.0933		0.0209	UJ	0.0185	UJ	2.81		0.0782	U	0.0768	U	8.32			3.06			0.99			1.2			0.78			0.48							
Motor Oil (TPH-Oil)	mg/L	--	--													1.21			15.3			0.22	J		0.41	J		0.55			0.54							
Volatile Organic Compounds																															
1,1,1,2-Tetrachloroethane	ug/L	--	2.5	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U																
1,1,1-Trichloroethane	ug/L	--	11	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U																

Table 2
Analytical Groundwater Sampling Results
Northwest Pipe Company, Portland, Oregon

Location ID				GP-210			GP-211		GP-211		GP-212			GP-213			GP-214			MW-7			MW-7			MW-8			MW-8			MW-9			MW-9			MW-01			MW-01		
Sample ID				GP210-W-0			GP211-W-0		GP211-W-1		GP212-W-0			GP213-W-0			GP214-W-0			MW-7-61512			MW-7-53113			MW-8-61512			MW-8-53113			MW-9-61512			MW-9-53113			MW-01-102616			MW-01-020217		
Sample Date				09/27/07			09/27/07		09/27/07		09/27/07			09/27/07			09/27/07			06/15/12			05/31/13			06/15/12			05/31/13			06/15/12			05/31/13			10/26/16			02/02/17		
Sample Type				N1			N1		FD1		N1			N1			N1			N			N			N			N			N			N			N			N		
Analyte	**Units**	**ROD CULs[1]**	**JSCS SLVs[2]**		*EF*							*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*		
Volatile Organic Compounds																																											
1,1,2,2-Tetrachloroethane	ug/L	--	0.33	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
1,1,2-Trichloroethane	ug/L	--	1.2	1.0	U		1.0	U	1.0	U	0.15	J		1.0	U		1.0	U																									
1,1-Dichloroethane	ug/L	--	47	0.63	J		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
1,1-Dichloroethene	ug/L	7	--	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
1,1-Dichloropropene	ug/L	--	--	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
1,2,3-Trichlorobenzene	ug/L	--	--	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
1,2,3-Trichloropropane	ug/L	--	0.0095	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
1,2,4-Trichlorobenzene	ug/L	--	--	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
1,2,4-Trimethylbenzene	ug/L	--	--	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
1,2-Dibromo-3-Chloropropane	ug/L	--	--	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
1,2-Dibromoethane	ug/L	--	--	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
1,2-Dichlorobenzene	ug/L	--	--	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
1,2-Dichloroethane	ug/L	--	0.73	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
1,2-Dichloroethene	ug/L	--	--																																								
1,2-Dichloropropane	ug/L	--	0.97	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
1,3,5-Trimethylbenzene	ug/L	--	--	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
1,3-Dichlorobenzene	ug/L	--	--	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
1,3-Dichloropropane	ug/L	--	--	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
1,4-Dichlorobenzene	ug/L	--	2.8	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
2,2-Dichloropropane	ug/L	--	--	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
2-Butanone	ug/L	--	7100	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
2-Chloroethyl Vinyl Ether	ug/L	--	--																																								
2-Chlorotoluene	ug/L	--	--	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
2-Hexanone	ug/L	--	99																																								
4-Chlorotoluene	ug/L	--	--	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
4-Methyl-2-Pentanone	ug/L	--	170	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
Acetone	ug/L	--	1500	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
Benzene	ug/L	0.44	--	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
Bromobenzene	ug/L	--	--	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
Bromochloromethane	ug/L	--	--	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
Bromodichloromethane	ug/L	--	1.1	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
Bromoform	ug/L	--	8.5	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
Bromomethane	ug/L	--	8.7	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
Carbon Dioxide	ug/L	--	--																																			81,000			68,200		
Carbon Disulfide	ug/L	--	0.92																																								
Carbon Tetrachloride	ug/L	--	0.51	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
Chlorobenzene	ug/L	64	--	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
Chlorodibromomethane	ug/L	--	0.79	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
Chloroethane	ug/L	--	23	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
Chloroform	ug/L	--	0.17	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
Chlorohexane	ug/L	--	--	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
Chloromethane	ug/L	--	2.1	0.47	J		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
Cis-1,2-Dichloroethene	ug/L	70	--	0.62	J		1.0	U	1.0	U	6.6			4.8			0.41	J																				113		*<10*	107		*<10*
Cis-1,3-Dichloropropene	ug/L	--	0.055	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
Dibromomethane	ug/L	--	61	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
Dichlorodifluoromethane	µg/L	--	390	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
Ethylbenzene	ug/L	7.3	--	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
Hexachlorobutadiene	ug/L	--	--	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
Isopropylbenzene	ug/L	--	660	1.0	U		1.0	U	1.0	U	5.8			1.0	U		1.0	U																									
m+p-Xylenes	ug/L	--	1.8	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
Methane	ug/L	--	--																																			1,250			1,740		
Methylene Chloride	ug/L	--	8.9	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
Methyl-tert-butyl Ether	ug/L	--	37	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
Naphthalene	ug/L	--	0.2	1.0	U		1.0	U	1.0	U	0.81	J	*<10*	1.0	U		1.0	U																									
n-Butylbenzene	ug/L	--	--	1.0	U		1.0	U	1.0	U	7.9			1.0	U		1.0	U																									
n-Propylbenzene	ug/L	--	--	1.0	U		1.0	U	1.0	U	13.1			1.0	U		1.0	U																									
o-Xylene	ug/L	--	13	1.0	U		1.0	U	1.0	U	0.15	J		1.0	U		1.0	U																									
p-Isopropyltoluene	ug/L	--	--	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
Sec-Butylbenzene	ug/L	--	--	1.0	U		1.0	U	1.0	U	10.2			1.0	U		1.0	U																									
Styrene	ug/L	--	100	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
Tert-Butylbenzene	ug/L	--	--	1.0	U		1.0	U	1.0	U	0.85	J		1.0	U		1.0	U																									
Tetrachloroethene	ug/L	0.24	--	0.11	J		1.0	U	1.0	U	0.34	J	*<10*	1.4		*<10*	0.60	J	*<10*																			158		*658*	71.1		*296*
Toluene	ug/L	9.8	--	1.0	U		1.0	U	1.0	U	0.14	J		1.0	U		1.0	U																									
Trans-1,2-Dichloroethene	ug/L	--	--	1.0	U		1.0	U	1.0	U	0.36	J		1.0	U		1.0	U																									
Trans-1,3-Dichloropropene	ug/L	--	--	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
Trichloroethene	ug/L	0.6	--	0.14	J		1.0	U	1.0	U	1.0	U		0.94	J	*<10*	0.72	J	*<10*																			22.8		*38*	14.9		*25*
Trichlorofluoromethane	ug/L	--	1300	1.0	U		1.0	U	1.0	U	1.0	U		1.0	U		1.0	U																									
Vinyl Chloride	ug/L	0.022	--	0.67	J	*30*	1.0	U	1.0	U	3.4		*155*	1.0	U		1.0	U																									
Xylenes, Total	ug/L	13	--																																								

Notes:

EF = Exceedance factor (calculated if consistuent exceeded indicated screening level)

D = Dilution

J = Estimated value below reporting limit.

U = Not detected at specified reporting limit.

mg/L = milligrams per Liter

-- = Screening level not established (Note: If ROD CUL was available, JSCS SLV is not shown.)

Shaded = detected result exceeded indicated screening value

Sample Type: N = Normal Sample, FD - Field Duplicate

[1]Portland Harbor Record of Decision (ROD) Cleanup Levels (CULs) for groundwater for remedial action objectives 4 and 8 (Table 17 from EPA, 2017).

[2]Joint Source Control Strategy (JSCS) Screening Level Values (SLVs) for groundwater/surface water/stormwater recommended values for initial upland source control screening evaluations for water (Table 3.1 - Revision 7/16/07 from EPA, 2005)

Table 2
Analytical Groundwater Sampling Results
Northwest Pipe Company, Portland, Oregon

Location ID				MW-01			MW-01			MW-01			MW-01			MW-01			MW-02			MW-02			MW-02			MW-02			MW-02			MW-02			MW-03			MW-03			MW-03			MW-03		
Sample ID				MW-01-050117			MW-01-072617			MW-01-120618			MW-01-050919			MW-01-100919			MW-02-102616			MW-02-020117			MW-02-042717			MW-02-072517			MW-02-120518			MW-02-050819			MW-02-100819			MW-03-102616			MW-03-020217			MW-03-050117			MW-03-072717		
Sample Date				05/01/17			07/26/17			12/06/18			05/09/19			10/09/19			10/26/16			02/01/17			04/27/17			07/25/17			12/05/18			05/08/19			10/08/19			10/26/16			02/02/17			05/01/17			07/27/17		
Sample Type				N			N			N			N			N			N			N			N			N			N			N			N			N			N			N			N		
Analyte	**Units**	**ROD CULs[1]**	**JSCS SLVs[2]**			*EF*			*EF*			*EF*			*EF*			*EF*													*EF*			*EF*			*EF*			*EF*			*EF*			*EF*		
Field Parameters																																																		
Temperature	(°C)	--	--	15.5			17.2			15.0			16.4			11.7			16.8			15.4			15.0			20.1			15.8			17.1			13.7			16.4			15.9			15.5			17.0		
pH		--	--	6.56			6.46			6.61			6.48			6.46			6.90			6.97			7.11			6.74			7.10			7.03			6.87			6.61			6.76			6.56			6.55		
Conductivity	(µS/cm)	--	--	423			513			460			889			458			197			202			240			244			265			501			246			281			321			334			360		
Dissolved Oxygen	mg/L	--	--	0.12			0.08			0.47			0.92			0.32			0.24			0.09			0.20			0.07			0.36			0.52			0.26			0.32			0.26			0.07			0.08		
Oxidation Reduction Potential	mV	--	--	36			66			-32			93			-16			-138			-136			-142			-141			-167			-136			-106			-88			-68			-43			-69		
Turbidity	NTU	--	--	3.0			1.0			1.0			1.7			1.9			0.7			8.2			8.1			1.0			1.6			4.6			0.9			2.6			3.2			3.5			2.6		
Conventional Parameters																																																		
Alkalinity, Total as CaCO3	mg/L	--	--																																															
Chloride	mg/L	--	--	4			5.29			2.50			2.7			2.5			1.98			2.50			2.47			3.14			2.9			2.9	U		2.9	J		3.61			3.92			5.47			5.19		
Nitrate ion	mg/L	--	--																																															
Nitrate-N	mg/L	--	--	0.029			4.22			0.20			0.5	U		0.6			0.023	J		0.39			0.31			0.27			0.02	U		0.044	J		0.02	U		0.018	J		0.018			0.0028	U		0.011		
Sulfate	mg/L	--	--	3.57			29.3			8.50			12			11			4.15			8.09			5.37			5.88			2.5			0.92	J		1.5	J		10.2			10.4			12.1			9.48		
Total Organic Carbon	mg/L	--	--	1.34			1.28			1.20			1.2			1.3			1.48			1.23			1.6			1.52			1.6			1.3			1.4			1.27			0.93			1.27			1.33		
Total Suspended Solids (TSS)	mg/L	--	--																																															
Metals, Total																																																		
Arsenic	mg/L	0.000018	--																																															
Cadmium	mg/L	0.000094	--																																															
Chromium	mg/L	0.011	--																																															
Copper	mg/L	0.00274	--																																															
Iron	mg/L	--	--																																															
Lead	mg/L	0.00054	--																																															
Manganese	mg/L	0.43	--																																															
Mercury	mg/L	--	0.00077																																															
Nickel	mg/L	--	0.016																																															
Zinc	mg/L	0.0365	--																																															
Metals, Dissolved																																																		
Arsenic	mg/L	0.000018	--																																															
Cadmium	mg/L	0.000094	--																																															
Chromium	mg/L	0.011	--																																															
Copper	mg/L	0.00274	--																																															
Iron	mg/L	--	--	1.53			0.01												5.45			5.39			1.34			5.91												6.14			4.46			3.32			6.31		
Ferrous Iron[1]	mg/L	--	--							4.72			0.08			2.69															4.94			3.64			2.52														
Lead	mg/L	0.00054	--																																															
Manganese	mg/L	0.43	--																																															
Mercury	mg/L	--	0.00077																																															
Nickel	mg/L	--	0.016																																															
Zinc	mg/L	0.0365	--																																															
Polynuclear Aromatic Hydrocabons																																																		
1-Methylnaphthalene	ug/L	--	--																																															
2-Methylnaphthalene	ug/L	2.1	--																																															
Acenaphthene	ug/L	23	--																																															
Acenaphthylene	ug/L	--	0.2																																															
Anthracene	ug/L	0.73	--																																															
Benzo(a)anthracene	ug/L	0.0012	--																																															
Benzo(a)pyrene	ug/L	0.00012	--																																															
Benzo(b)fluoroanthene	ug/L	0.0012	--																																															
Benzo(g,h,i)perylene	ug/L	0.4	--																																															
Benzo(k)fluoranthene	ug/L	0.0013	--																																															
Chrysene	ug/L	0.0013	--																																															
Dibenzo(a,h)anthracene	ug/L	0.00012	--																																															
Fluoranthene	ug/L	6.2	--																																															
Fluorene	ug/L	3.9	--																																															
Indeno(1,2,3-c,d)pyrene	ug/L	0.0012	--																																															
Naphthalene	ug/L	12	--																																															
Phenanthrene	ug/L	6.3	--																																															
Pyrene	ug/L	10	--																																															
Total cPAHs (BaP equivalents)[2]	ug/L	0.00012	--																																															
Polychlorinated Biphenyls																																																		
Aroclor-1260	ug/L	--	0.034																																															
Aroclor-1254	ug/L	--	0.033																																															
Aroclor-1221	ug/L	--	0.034																																															
Aroclor-1232	ug/L	--	0.034																																															
Aroclor-1248	ug/L	--	0.034																																															
Aroclor-1016	ug/L	--	0.96																																															
Aroclor-1242	ug/L	--	0.034																																															
Total PCBs[2]	ug/L	0.014	--																																															
Total Petroleum Hydrocarbons																																																		
Gasoline (TPH-Gx)	mg/L	--	--																																															
Diesel (TPH-Dx)	mg/L	--	--																																															
Motor Oil (TPH-Oil)	mg/L	--	--																																															
Volatile Organic Compounds																																																		
1,1,1,2-Tetrachloroethane	ug/L	--	2.5																																															
1,1,1-Trichloroethane	ug/L	--	11																																															

Table 2
Analytical Groundwater Sampling Results
Northwest Pipe Company, Portland, Oregon

Location ID				MW-01	MW-01	MW-01	MW-01	MW-01	MW-02	MW-02	MW-02	MW-02	MW-02	MW-02	MW-02	MW-03	MW-03	MW-03	MW-03
Sample ID				MW-01-050117	MW-01-072617	MW-01-120618	MW-01-050919	MW-01-100919	MW-02-102616	MW-02-020117	MW-02-042717	MW-02-072517	MW-02-120518	MW-02-050819	MW-02-100819	MW-03-102616	MW-03-020217	MW-03-050117	MW-03-072717
Sample Date				05/01/17	07/26/17	12/06/18	05/09/19	10/09/19	10/26/16	02/01/17	04/27/17	07/25/17	12/05/18	05/08/19	10/08/19	10/26/16	02/02/17	05/01/17	07/27/17
Sample Type				N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Analyte	**Units**	**ROD CULs[1]**	**JSCS SLVs[2]**		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*
Volatile Organic Compounds																			
1,1,2,2-Tetrachloroethane	ug/L	--	0.33																
1,1,2-Trichloroethane	ug/L	--	1.2																
1,1-Dichloroethane	ug/L	--	47																
1,1-Dichloroethene	ug/L	7	--																
1,1-Dichloropropene	ug/L	--	--																
1,2,3-Trichlorobenzene	ug/L	--	--																
1,2,3-Trichloropropane	ug/L	--	0.0095																
1,2,4-Trichlorobenzene	ug/L	--	--																
1,2,4-Trimethylbenzene	ug/L	--	--																
1,2-Dibromo-3-Chloropropane	ug/L	--	--																
1,2-Dibromoethane	ug/L	--	--																
1,2-Dichlorobenzene	ug/L	--	--																
1,2-Dichloroethane	ug/L	--	0.73																
1,2-Dichloroethene	ug/L	--	--																
1,2-Dichloropropane	ug/L	--	0.97																
1,3,5-Trimethylbenzene	ug/L	--	--																
1,3-Dichlorobenzene	ug/L	--	--																
1,3-Dichloropropane	ug/L	--	--																
1,4-Dichlorobenzene	ug/L	--	2.8																
2,2-Dichloropropane	ug/L	--	--																
2-Butanone	ug/L	--	7100																
2-Chloroethyl Vinyl Ether	ug/L	--	--																
2-Chlorotoluene	ug/L	--	--																
2-Hexanone	ug/L	--	99																
4-Chlorotoluene	ug/L	--	--																
4-Methyl-2-Pentanone	ug/L	--	170																
Acetone	ug/L	--	1500																
Benzene	ug/L	0.44	--																
Bromobenzene	ug/L	--	--																
Bromochloromethane	ug/L	--	--																
Bromodichloromethane	ug/L	--	1.1																
Bromoform	ug/L	--	8.5																
Bromomethane	ug/L	--	8.7																
Carbon Dioxide	ug/L	--	--	82,600	10,300	50,000	95,000	80,000	29,600	17,600	15,600	19,300	34,000	40,000	30,000	53,600	44,100	53,900	57,600
Carbon Disulfide	ug/L	--	0.92																
Carbon Tetrachloride	ug/L	--	0.51																
Chlorobenzene	ug/L	64	--																
Chlorodibromomethane	ug/L	--	0.79																
Chloroethane	ug/L	--	23																
Chloroform	ug/L	--	0.17																
Chlorohexane	ug/L	--	--																
Chloromethane	ug/L	--	2.1																
Cis-1,2-Dichloroethene	ug/L	70	--	220	*<10*	174	*<10*	160	*<10*	100	*<10*	140	*<10*	0.15 U	0.20 J	0.21 J	0.41 J	1.4	0.36	0.76	428	*<10*	502	*<10*	847	*12*	670	*<10*
Cis-1,3-Dichloropropene	ug/L	--	0.055																
Dibromomethane	ug/L	--	61																
Dichlorodifluoromethane	µg/L	--	390																
Ethylbenzene	ug/L	7.3	--																
Hexachlorobutadiene	ug/L	--	--																
Isopropylbenzene	ug/L	--	660																
m+p-Xylenes	ug/L	--	1.8																
Methane	ug/L	--	--	3,120	177	620	310	990	3,680	3,300	3,420	5,330	7,300	7,200	7,700	1,480	734	748	2,670
Methylene Chloride	ug/L	--	8.9																
Methyl-tert-butyl Ether	ug/L	--	37																
Naphthalene	ug/L	--	0.2																
n-Butylbenzene	ug/L	--	--																
n-Propylbenzene	ug/L	--	--																
o-Xylene	ug/L	--	13																
p-Isopropyltoluene	ug/L	--	--																
Sec-Butylbenzene	ug/L	--	--																
Styrene	ug/L	--	100																
Tert-Butylbenzene	ug/L	--	--																
Tetrachloroethene	ug/L	0.24	--	61.7	*257*	197	*821*	98	*408*	220	*917*	150	*625*	0.0598	0.169	0.224	0.451	*<10* 0.1 U	0.1 U	0.1 U	630	*2,625*	483	*2,013*	657	*2,738*	550	*2,292*
Toluene	ug/L	9.8	--																
Trans-1,2-Dichloroethene	ug/L	--	--																
Trans-1,3-Dichloropropene	ug/L	--	--																
Trichloroethene	ug/L	0.6	--	13	*22*	26.7	*45*	13	*22*	28	*47*	18	*30*	0.15 U	0.15 U	0.15 U	0.15 U	0.1 U	0.1 U	0.1 U	221	*368*	178	*297*	283	*472*	209	*348*
Trichlorofluoromethane	ug/L	--	1300																
Vinyl Chloride	ug/L	0.022	--	51.6	*2,345*	8.51	*387*	19	*864*	3.8	*173*	17	*773*	0.0652	0.0370	0.0115 J	0.0190 J	2.6	*118* 1.2	*55* 2.9	*132* 22.8	*1,036*	20.8	*945*	26.1	*1,186*	29.9	*1,359*
Xylenes, Total	ug/L	13	--																

Notes:
EF = Exceedance factor (calculated if consistuent exceeded indicated screening level)
D = Dilution
J = Estimated value below reporting limit.
U = Not detected at specified reporting limit.
mg/L = milligrams per Liter

-- = Screening level not established (Note: If ROD CUL was available, JSCS SLV is not shown.)
Shaded = detected result exceeded indicated screening value
Sample Type: N = Normal Sample, FD - Field Duplicate
[1]Portland Harbor Record of Decision (ROD) Cleanup Levels (CULs) for groundwater for remedial action objectives 4 and 8 (Table 17 from EPA, 2017).
[2]Joint Source Control Strategy (JSCS) Screening Level Values (SLVs) for groundwater/surface water/stormwater recommended values for initial upland source control screening evaluations for water (Table 3.1 - Revision 7/16/07 from EPA, 2005)

Table 2
Analytical Groundwater Sampling Results
Northwest Pipe Company, Portland, Oregon

Location ID				MW-03			MW-03			MW-03			MW-04			MW-04			MW-04			MW-04			MW-04			MW-04			MW-04			MW-05			MW-05			MW-05			MW-05		
Sample ID				MW-03-120718			MW-03-050919			MW-03-100919			MW-04-102616			MW-04-020117			MW-04-042717			MW-04-072617			MW-04-120618			MW-04-050819			MW-04-100819			MW-05-102616			MW-05-020217			MW-05-050117			MW-05-072717		
Sample Date				12/07/18			05/09/19			10/09/19			10/26/16			02/01/17			04/27/17			07/26/17			12/06/18			05/08/19			10/08/19			10/26/16			02/02/17			05/01/17			07/27/17		
Sample Type				N			N			N			N			N			N			N			N			N			N			N			N			N			N		
Analyte	**Units**	**ROD CULs[1]**	**JSCS SLVs[2]**			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*		
Field Parameters																																													
Temperature	(°C)	--	--	14.6			15.8			12.2			14.8			14.3			13.0			15.1			14.3			14.5			11.7			15.5			15.7			15.4			18.0		
pH		--	--	6.74			6.67			6.49			6.34			6.39			6.60			6.42			6.53			6.47			6.19			6.50			6.59			6.60			6.46		
Conductivity	(µS/cm)	--	--	372			691			342			323			440			337			374			403			777			418			375			426			360			390		
Dissolved Oxygen	mg/L	--	--	1.02			0.44			0.80			0.28			0.32			0.22			0.13			0.53			0.92			0.24			0.17			0.33			0.11			0.11		
Oxidation Reduction Potential	mV	--	--	-43			-37			-33			-59			-45			-59			-66			-48			-30			-26			-52			77			-40			19		
Turbidity	NTU	--	--	5.8			6.3			4.6			4.1			1.3			5.0			8.1			1.3			1.4			0.5			1.2			1.8			0.5			2.2		
Conventional Parameters																																													
Alkalinity, Total as CaCO3	mg/L	--	--																																										
Chloride	mg/L	--	--	3.8			4.3			4.2			3.0			4.9			4.52			4.1			3.3			3.4	U		3.2			5.36			7.03			4.87			6.53		
Nitrate ion	mg/L	--	--																																										
Nitrate-N	mg/L	--	--	0.02	U		0.2	U		0.031	J		0.043	J		0.0028	U		0.011			0.023			0.046	J		0.058	J		0.053	J		0.34	J		0.57			0.0028	U		1.05		
Sulfate	mg/L	--	--	10			9.4			10			5.7			4.42			2.35			2.55			4.1			3.7			3.9			20.5			29.7			11.9			20.9		
Total Organic Carbon	mg/L	--	--	1.5			1.3			1.6			1.21			1.09			1.40			0.72			1.7			1.3			1.5			1.67			1.5			1.33			1.28		
Total Suspended Solids (TSS)	mg/L	--	--																																										
Metals, Total																																													
Arsenic	mg/L	0.000018	--																																										
Cadmium	mg/L	0.000094	--																																										
Chromium	mg/L	0.011	--																																										
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Iron	mg/L	--	--																																										
Lead	mg/L	0.00054	--																																										
Manganese	mg/L	0.43	--																																										
Mercury	mg/L	--	0.00077																																										
Nickel	mg/L	--	0.016																																										
Zinc	mg/L	0.0365	--																																										
Metals, Dissolved																																													
Arsenic	mg/L	0.000018	--																																										
Cadmium	mg/L	0.000094	--																																										
Chromium	mg/L	0.011	--																																										
Copper	mg/L	0.00274	--																																										
Iron	mg/L	--	--										12.9			9.75			9.83			10.0												4.46			0.0137	U		4.17			2.14		
Ferrous Iron[1]	mg/L	--	--	2.96			2.72			3.12															2.96			10.08			2.95														
Lead	mg/L	0.00054	--																																										
Manganese	mg/L	0.43	--																																										
Mercury	mg/L	--	0.00077																																										
Nickel	mg/L	--	0.016																																										
Zinc	mg/L	0.0365	--																																										
Polynuclear Aromatic Hydrocabons																																													
1-Methylnaphthalene	ug/L	--	--																																										
2-Methylnaphthalene	ug/L	2.1	--																																										
Acenaphthene	ug/L	23	--																																										
Acenaphthylene	ug/L	--	0.2																																										
Anthracene	ug/L	0.73	--																																										
Benzo(a)anthracene	ug/L	0.0012	--																																										
Benzo(a)pyrene	ug/L	0.00012	--																																										
Benzo(b)fluoroanthene	ug/L	0.0012	--																																										
Benzo(g,h,i)perylene	ug/L	0.4	--																																										
Benzo(k)fluoranthene	ug/L	0.0013	--																																										
Chrysene	ug/L	0.0013	--																																										
Dibenzo(a,h)anthracene	ug/L	0.00012	--																																										
Fluoranthene	ug/L	6.2	--																																										
Fluorene	ug/L	3.9	--																																										
Indeno(1,2,3-c,d)pyrene	ug/L	0.0012	--																																										
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Phenanthrene	ug/L	6.3	--																																										
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Total cPAHs (BaP equivalents)[2]	ug/L	0.00012	--																																										
Polychlorinated Biphenyls																																													
Aroclor-1260	ug/L	--	0.034																																										
Aroclor-1254	ug/L	--	0.033																																										
Aroclor-1221	ug/L	--	0.034																																										
Aroclor-1232	ug/L	--	0.034																																										
Aroclor-1248	ug/L	--	0.034																																										
Aroclor-1016	ug/L	--	0.96																																										
Aroclor-1242	ug/L	--	0.034																																										
Total PCBs[2]	ug/L	0.014	--																																										
Total Petroleum Hydrocarbons																																													
Gasoline (TPH-Gx)	mg/L	--	--																																										
Diesel (TPH-Dx)	mg/L	--	--																																										
Motor Oil (TPH-Oil)	mg/L	--	--																																										
Volatile Organic Compounds																																													
1,1,1,2-Tetrachloroethane	ug/L	--	2.5																																										
1,1,1-Trichloroethane	ug/L	--	11																																										

Table 2
Analytical Groundwater Sampling Results
Northwest Pipe Company, Portland, Oregon

Location ID				MW-03		MW-03		MW-03		MW-04		MW-04		MW-04		MW-04		MW-04		MW-04		MW-04		MW-05		MW-05		MW-05		MW-05	
Sample ID				MW-03-120718		MW-03-050919		MW-03-100919		MW-04-102616		MW-04-020117		MW-04-042717		MW-04-072617		MW-04-120618		MW-04-050819		MW-04-100819		MW-05-102616		MW-05-020217		MW-05-050117		MW-05-072717	
Sample Date				12/07/18		05/09/19		10/09/19		10/26/16		02/01/17		04/27/17		07/26/17		12/06/18		05/08/19		10/08/19		10/26/16		02/02/17		05/01/17		07/27/17	
Sample Type				N		N		N		N		N		N		N		N		N		N		N		N		N		N	
Analyte	**Units**	**ROD CULs[1]**	**JSCS SLVs[2]**		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*
Volatile Organic Compounds																															
1,1,2,2-Tetrachloroethane	ug/L	--	0.33																												
1,1,2-Trichloroethane	ug/L	--	1.2																												
1,1-Dichloroethane	ug/L	--	47																												
1,1-Dichloroethene	ug/L	7	--																												
1,1-Dichloropropene	ug/L	--	--																												
1,2,3-Trichlorobenzene	ug/L	--	--																												
1,2,3-Trichloropropane	ug/L	--	0.0095																												
1,2,4-Trichlorobenzene	ug/L	--	--																												
1,2,4-Trimethylbenzene	ug/L	--	--																												
1,2-Dibromo-3-Chloropropane	ug/L	--	--																												
1,2-Dibromoethane	ug/L	--	--																												
1,2-Dichlorobenzene	ug/L	--	--																												
1,2-Dichloroethane	ug/L	--	0.73																												
1,2-Dichloroethene	ug/L	--	--																												
1,2-Dichloropropane	ug/L	--	0.97																												
1,3,5-Trimethylbenzene	ug/L	--	--																												
1,3-Dichlorobenzene	ug/L	--	--																												
1,3-Dichloropropane	ug/L	--	--																												
1,4-Dichlorobenzene	ug/L	--	2.8																												
2,2-Dichloropropane	ug/L	--	--																												
2-Butanone	ug/L	--	7100																												
2-Chloroethyl Vinyl Ether	ug/L	--	--																												
2-Chlorotoluene	ug/L	--	--																												
2-Hexanone	ug/L	--	99																												
4-Chlorotoluene	ug/L	--	--																												
4-Methyl-2-Pentanone	ug/L	--	170																												
Acetone	ug/L	--	1500																												
Benzene	ug/L	0.44	--																												
Bromobenzene	ug/L	--	--																												
Bromochloromethane	ug/L	--	--																												
Bromodichloromethane	ug/L	--	1.1																												
Bromoform	ug/L	--	8.5																												
Bromomethane	ug/L	--	8.7																												
Carbon Dioxide	ug/L	--	--	45,000		60,000		60,000		104,000		98,400		82,000		82,900		80,000		85,000		150,000		75,100		74,900		50,500		63,800	
Carbon Disulfide	ug/L	--	0.92																												
Carbon Tetrachloride	ug/L	--	0.51																												
Chlorobenzene	ug/L	64	--																												
Chlorodibromomethane	ug/L	--	0.79																												
Chloroethane	ug/L	--	23																												
Chloroform	ug/L	--	0.17																												
Chlorohexane	ug/L	--	--																												
Chloromethane	ug/L	--	2.1																												
Cis-1,2-Dichloroethene	ug/L	70	--	850	*12*	860	*12*	990	*14*	111	*<10*	119	*<10*	116	*<10*	137	*<10*	190	*<10*	150	*<10*	120	*<10*	1,160	*17*	1,240	*18*	634	*<10*	1,730	*25*
Cis-1,3-Dichloropropene	ug/L	--	0.055																												
Dibromomethane	ug/L	--	61																												
Dichlorodifluoromethane	µg/L	--	390																												
Ethylbenzene	ug/L	7.3	--																												
Hexachlorobutadiene	ug/L	--	--																												
Isopropylbenzene	ug/L	--	660																												
m+p-Xylenes	ug/L	--	1.8																												
Methane	ug/L	--	--	2,200		2,300		2,600		1,460		1,860		1,210		1,780		2,900		1,400		2,700		1,160		887		2,310		1,190	
Methylene Chloride	ug/L	--	8.9																												
Methyl-tert-butyl Ether	ug/L	--	37																												
Naphthalene	ug/L	--	0.2																												
n-Butylbenzene	ug/L	--	--																												
n-Propylbenzene	ug/L	--	--																												
o-Xylene	ug/L	--	13																												
p-Isopropyltoluene	ug/L	--	--																												
Sec-Butylbenzene	ug/L	--	--																												
Styrene	ug/L	--	100																												
Tert-Butylbenzene	ug/L	--	--																												
Tetrachloroethene	ug/L	0.24	--	490	*2,042*	370	*1,542*	530	*2,208*	28.2	*118*	12.4	*52*	14.4	*60*	18.5	*77*	16	*67*	5.4	*23*	10.0	*42*	3,510	*1.46E+04*	4,150	*1.73E+04*	949	*3.95E+03*	3,640	*1.52E+04*
Toluene	ug/L	9.8	--																												
Trans-1,2-Dichloroethene	ug/L	--	--																												
Trans-1,3-Dichloropropene	ug/L	--	--																												
Trichloroethene	ug/L	0.6	--	160	*267*	100	*167*	160	*267*	38.4	*64*	20.3	*34*	29.7	*50*	35.4	*59*	19	*32*	8.4	*14*	16	*27*	195	*325*	208	*347*	92	*153*	170	*283*
Trichlorofluoromethane	ug/L	--	1300																												
Vinyl Chloride	ug/L	0.022	--	46	*2,091*	46	*2,091*	62	*2,818*	4.45	*202*	9.73	*442*	16.6	*755*	9.43	*429*	4.6	*209*	6.1	*277*	5.6	*255*	40.4	*1,836*	39.5	*1,795*	70.7	*3,214*	7.58 J	*345*
Xylenes, Total	ug/L	13	--																												

Notes:

EF = Exceedance factor (calculated if consistuent exceeded indicated screening level)

D = Dilution

J = Estimated value below reporting limit.

U = Not detected at specified reporting limit.

mg/L = milligrams per Liter

-- = Screening level not established (Note: If ROD CUL was available, JSCS SLV is not shown.)

Shaded = detected result exceeded indicated screening value

Sample Type: N = Normal Sample, FD - Field Duplicate

[1]Portland Harbor Record of Decision (ROD) Cleanup Levels (CULs) for groundwater for remedial action objectives 4 and 8 (Table 17 from EPA, 2017).

[2]Joint Source Control Strategy (JSCS) Screening Level Values (SLVs) for groundwater/surface water/stormwater recommended values for initial upland source control screening evaluations for water (Table 3.1 - Revision 7/16/07 from EPA, 2005)

Table 2
Analytical Groundwater Sampling Results
Northwest Pipe Company, Portland, Oregon

Location ID				MW-05			MW-05			MW-05			MW-06			MW-06			MW-06			MW-06			MW-06			MW-06			MW-06			MW-06			MW-06		
Sample ID				MW-05-120718			MW-05-050919			MW-05-100919			MW-06-10/26/16			MW-06-020217			MW-06-05/01/17			MW-06-07/27/17			MW-06-12/07/18			MW-06-5/9/19			MW-06-10/09/19			MW-06-10/26/16			MW-06-02/01/17		
Sample Date				12/07/18			05/09/19			10/09/19			10/26/16			02/02/17			05/01/17			07/27/17			12/07/18			05/09/19			10/09/19			10/26/16			02/01/17		
Sample Type				N			N			N			N			N			N			N			N			N			N			FD			FD		
Analyte	**Units**	**ROD CULs[1]**	**JSCS SLVs[2]**			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*			*EF*		
Field Parameters																																							
Temperature	(°C)	--	--	13.5			16.7			12.7			15.9			15.5			15.7			16.6			14.3			17.8			12.0								
pH		--	--	6.71			6.39			6.42			6.47			6.54			6.35			6.27			6.61			6.42			6.38								
Conductivity	(µS/cm)	--	--	386			748			394			266			299			310			322			395			712			339								
Dissolved Oxygen	mg/L	--	--	0.62			0.79			0.31			0.15			0.20			0.13			0.07			0.66			0.70			0.14								
Oxidation Reduction Potential	mV	--	--	-7			97			-19			-76			-47			20			-9			-49			31			-36								
Turbidity	NTU	--	--	1.0			1.2			0.3			2.7			2.8			4.4			10.7			13.4			36.1			2.1								
Conventional Parameters																																							
Alkalinity, Total as CaCO3	mg/L	--	--																																				
Chloride	mg/L	--	--	3.5			4.8			5.2			5.07			6.12			6.2			5.18			5.2			5.8			5.5			5.05			5.95		
Nitrate ion	mg/L	--	--																																				
Nitrate-N	mg/L	--	--	0.02	U		1.00			0.15	J		0.016	J		0.0028	U		0.0028	U		0.0084	J		0.02	U		0.13	U		0.039	J		0.017	J		0.003	J	
Sulfate	mg/L	--	--	7.1			17			12			5.17			9.27			13.9			13.7			8.7			17			9.4			5.36			9.09		
Total Organic Carbon	mg/L	--	--	1.6			1.5			1.9			1.25			1.15			1.27			1.05			1.5			1.5			1.8			1.15			1.12		
Total Suspended Solids (TSS)	mg/L	--	--																																				
Metals, Total																																							
Arsenic	mg/L	0.000018	--																																				
Cadmium	mg/L	0.000094	--																																				
Chromium	mg/L	0.011	--																																				
Copper	mg/L	0.00274	--																																				
Iron	mg/L	--	--																																				
Lead	mg/L	0.00054	--																																				
Manganese	mg/L	0.43	--																																				
Mercury	mg/L	--	0.00077																																				
Nickel	mg/L	--	0.016																																				
Zinc	mg/L	0.0365	--																																				
Metals, Dissolved																																							
Arsenic	mg/L	0.000018	--																																				
Cadmium	mg/L	0.000094	--																																				
Chromium	mg/L	0.011	--																																				
Copper	mg/L	0.00274	--																																				
Iron	mg/L	--	--										7.29			6.10			3.53			3.24												7.4			6.09		
Ferrous Iron[1]	mg/L	--	--	1.85			0.05			3.78															1.87			1.41			4.4								
Lead	mg/L	0.00054	--																																				
Manganese	mg/L	0.43	--																																				
Mercury	mg/L	--	0.00077																																				
Nickel	mg/L	--	0.016																																				
Zinc	mg/L	0.0365	--																																				
Polynuclear Aromatic Hydrocabons																																							
1-Methylnaphthalene	ug/L	--	--																																				
2-Methylnaphthalene	ug/L	2.1	--																																				
Acenaphthene	ug/L	23	--																																				
Acenaphthylene	ug/L	--	0.2																																				
Anthracene	ug/L	0.73	--																																				
Benzo(a)anthracene	ug/L	0.0012	--																																				
Benzo(a)pyrene	ug/L	0.00012	--																																				
Benzo(b)fluoroanthene	ug/L	0.0012	--																																				
Benzo(g,h,i)perylene	ug/L	0.4	--																																				
Benzo(k)fluoranthene	ug/L	0.0013	--																																				
Chrysene	ug/L	0.0013	--																																				
Dibenzo(a,h)anthracene	ug/L	0.00012	--																																				
Fluoranthene	ug/L	6.2	--																																				
Fluorene	ug/L	3.9	--																																				
Indeno(1,2,3-c,d)pyrene	ug/L	0.0012	--																																				
Naphthalene	ug/L	12	--																																				
Phenanthrene	ug/L	6.3	--																																				
Pyrene	ug/L	10	--																																				
Total cPAHs (BaP equivalents)[2]	ug/L	0.00012	--																																				
Polychlorinated Biphenyls																																							
Aroclor-1260	ug/L	--	0.034																																				
Aroclor-1254	ug/L	--	0.033																																				
Aroclor-1221	ug/L	--	0.034																																				
Aroclor-1232	ug/L	--	0.034																																				
Aroclor-1248	ug/L	--	0.034																																				
Aroclor-1016	ug/L	--	0.96																																				
Aroclor-1242	ug/L	--	0.034																																				
Total PCBs[2]	ug/L	0.014	--																																				
Total Petroleum Hydrocarbons																																							
Gasoline (TPH-Gx)	mg/L	--	--																																				
Diesel (TPH-Dx)	mg/L	--	--																																				
Motor Oil (TPH-Oil)	mg/L	--	--																																				
Volatile Organic Compounds																																							
1,1,1,2-Tetrachloroethane	ug/L	--	2.5																																				
1,1,1-Trichloroethane	ug/L	--	11																																				

Table 2
Analytical Groundwater Sampling Results
Northwest Pipe Company, Portland, Oregon

Location ID				MW-05		MW-05		MW-05		MW-06		MW-06		MW-06		MW-06		MW-06		MW-06		MW-06		MW-06		MW-06		MW-06		MW-06	
Sample ID				MW-05-120718		MW-05-050919		MW-05-100919		MW-06-100616		MW-06-020217		MW-06-050117		MW-06-072717		MW-06-120718		MW-06-5/9/19		MW-06-100919		MW-06-102616		MW-06-020117	
Sample Date				12/07/18		05/09/19		10/09/19		10/26/16		02/02/17		05/01/17		07/27/17		12/07/18		05/09/19		10/09/19		10/26/16		02/01/17	
Sample Type				N		N		N		N		N		N		N		N		N		N		FD		FD	
Analyte	**Units**	**ROD CULs[1]**	**JSCS SLVs[2]**		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*		*EF*
Volatile Organic Compounds																															
1,1,2,2-Tetrachloroethane	ug/L	--	0.33																												
1,1,2-Trichloroethane	ug/L	--	1.2																												
1,1-Dichloroethane	ug/L	--	47																												
1,1-Dichloroethene	ug/L	7	--																												
1,1-Dichloropropene	ug/L	--	--																												
1,2,3-Trichlorobenzene	ug/L	--	--																												
1,2,3-Trichloropropane	ug/L	--	0.0095																												
1,2,4-Trichlorobenzene	ug/L	--	--																												
1,2,4-Trimethylbenzene	ug/L	--	--																												
1,2-Dibromo-3-Chloropropane	ug/L	--	--																												
1,2-Dibromoethane	ug/L	--	--																												
1,2-Dichlorobenzene	ug/L	--	--																												
1,2-Dichloroethane	ug/L	--	0.73																												
1,2-Dichloroethene	ug/L	--	--																												
1,2-Dichloropropane	ug/L	--	0.97																												
1,3,5-Trimethylbenzene	ug/L	--	--																												
1,3-Dichlorobenzene	ug/L	--	--																												
1,3-Dichloropropane	ug/L	--	--																												
1,4-Dichlorobenzene	ug/L	--	2.8																												
2,2-Dichloropropane	ug/L	--	--																												
2-Butanone	ug/L	--	7100																												
2-Chloroethyl Vinyl Ether	ug/L	--	--																												
2-Chlorotoluene	ug/L	--	--																												
2-Hexanone	ug/L	--	99																												
4-Chlorotoluene	ug/L	--	--																												
4-Methyl-2-Pentanone	ug/L	--	170																												
Acetone	ug/L	--	1500																												
Benzene	ug/L	0.44	--																												
Bromobenzene	ug/L	--	--																												
Bromochloromethane	ug/L	--	--																												
Bromodichloromethane	ug/L	--	1.1																												
Bromoform	ug/L	--	8.5																												
Bromomethane	ug/L	--	8.7																												
Carbon Dioxide	ug/L	--	--	40,000		60,000		65,000		57,100		60,500		81,800		78,600		55,000		90,000		80,000		59,500		62,300	
Carbon Disulfide	ug/L	--	0.92																												
Carbon Tetrachloride	ug/L	--	0.51																												
Chlorobenzene	ug/L	64	--																												
Chlorodibromomethane	ug/L	--	0.79																												
Chloroethane	ug/L	--	23																												
Chloroform	ug/L	--	0.17																												
Chlorohexane	ug/L	--	--																												
Chloromethane	ug/L	--	2.1																												
Cis-1,2-Dichloroethene	ug/L	70	--	1,600	*23*	1,700	*24*	2,200	*31*	1,160	*17*	1,590	*23*	1,530	*22*	1,080	*15*	1,300	*19*	1,900	*27*	1,700	*24*	1,130	*16*	1,600	*23*
Cis-1,3-Dichloropropene	ug/L	--	0.055																												
Dibromomethane	ug/L	--	61																												
Dichlorodifluoromethane	µg/L	--	390																												
Ethylbenzene	ug/L	7.3	--																												
Hexachlorobutadiene	ug/L	--	--																												
Isopropylbenzene	ug/L	--	660																												
m+p-Xylenes	ug/L	--	1.8																												
Methane	ug/L	--	--	1,700		170		3,000		2,280		623		206		214	J	3,500		370		3100		2,040		666	
Methylene Chloride	ug/L	--	8.9																												
Methyl-tert-butyl Ether	ug/L	--	37																												
Naphthalene	ug/L	--	0.2																												
n-Butylbenzene	ug/L	--	--																												
n-Propylbenzene	ug/L	--	--																												
o-Xylene	ug/L	--	13																												
p-Isopropyltoluene	ug/L	--	--																												
Sec-Butylbenzene	ug/L	--	--																												
Styrene	ug/L	--	100																												
Tert-Butylbenzene	ug/L	--	--																												
Tetrachloroethene	ug/L	0.24	--	1,200	*5.00E+03*	4,400	*1.83E+04*	2,300	*9.58E+03*	287	*1.20E+03*	805	*3.35E+03*	1,280	*5.33E+03*	810	*3.38E+03*	430	*1.79E+03*	980	*4.08E+03*	520	*2.17E+03*	299	*1.25E+03*	760	*3.17E+03*
Toluene	ug/L	9.8	--																												
Trans-1,2-Dichloroethene	ug/L	--	--																												
Trans-1,3-Dichloropropene	ug/L	--	--																												
Trichloroethene	ug/L	0.6	--	85	*142*	240	*400*	140	*233*	60.4	*101*	147	*245*	225	*375*	128	*213*	110	*183*	210	*350*	110	*183*	70.9	*118*	145	*242*
Trichlorofluoromethane	ug/L	--	1300																												
Vinyl Chloride	ug/L	0.022	--	77	*3.50E+03*	14	*636*	120	*5,455*	170	*7.73E+03*	51	*2.32E+03*	21.9	*995*	18.3	*832*	130	*5.91E+03*	40	*1.82E+03*	110	J *5.00E+03*	177	*8.05E+03*	53.9	*2.45E+03*
Xylenes, Total	ug/L	13	--																												

Notes:

EF = Exceedance factor (calculated if consistuent exceeded indicated screening level)

D = Dilution

J = Estimated value below reporting limit.

U = Not detected at specified reporting limit.

mg/L = milligrams per Liter

-- = Screening level not established (Note: If ROD CUL was available, JSCS SLV is not shown.)

Shaded = detected result exceeded indicated screening value

Sample Type: N = Normal Sample, FD - Field Duplicate

[1]Portland Harbor Record of Decision (ROD) Cleanup Levels (CULs) for groundwater for remedial action objectives 4 and 8 (Table 17 from EPA, 2017).

[2]Joint Source Control Strategy (JSCS) Screening Level Values (SLVs) for groundwater/surface water/stormwater recommended values for initial upland source control screening evaluations for water (Table 3.1 - Revision 7/16/07 from EPA, 2005)

Table 2
Analytical Groundwater Sampling Results
Northwest Pipe Company, Portland, Oregon

Location ID				MW-06			MW-06			MW-06			MW-06			MW-06		
Sample ID				MW-06-050117			MW-06-07272017			MW-06-121818			MW-06-050919			MW-06-100919		
Sample Date				05/01/17			07/27/17			12/07/18			05/09/19			10/09/19		
Sample Type				FD			FD			FD			FD			FD		
Analyte	**Units**	**ROD CULs[1]**	**JSCS SLVs[2]**			*EF*			*EF*			*EF*			*EF*			*EF*
Field Parameters																		
Temperature	(°C)	--	--													12.04		
pH		--	--													6.38		
Conductivity	(µS/cm)	--	--													339		
Dissolved Oxygen	mg/L	--	--													0.14		
Oxidation Reduction Potential	mV	--	--													-36.3		
Turbidity	NTU	--	--													2.14		
Conventional Parameters																		
Alkalinity, Total as CaCO3	mg/L	--	--															
Chloride	mg/L	--	--	6.21			5.21			5.2			5.7			5.5		
Nitrate ion	mg/L	--	--															
Nitrate-N	mg/L	--	--	0.0028	U		0.01			0.02	U		0.14	U		0.035	J	
Sulfate	mg/L	--	--	14			13.6			8.8			17			9.7		
Total Organic Carbon	mg/L	--	--	1.4			1.16			1.5			1.6			2.1		
Total Suspended Solids (TSS)	mg/L	--	--															
Metals, Total																		
Arsenic	mg/L	0.000018	--															
Cadmium	mg/L	0.000094	--															
Chromium	mg/L	0.011	--															
Copper	mg/L	0.00274	--															
Iron	mg/L	--	--															
Lead	mg/L	0.00054	--															
Manganese	mg/L	0.43	--															
Mercury	mg/L	--	0.00077															
Nickel	mg/L	--	0.016															
Zinc	mg/L	0.0365	--															
Metals, Dissolved																		
Arsenic	mg/L	0.000018	--															
Cadmium	mg/L	0.000094	--															
Chromium	mg/L	0.011	--															
Copper	mg/L	0.00274	--															
Iron	mg/L	--	--	3.6			3.22											
Ferrous Iron[1]	mg/L	--	--							1.87			1.41			4.4		
Lead	mg/L	0.00054	--															
Manganese	mg/L	0.43	--															
Mercury	mg/L	--	0.00077															
Nickel	mg/L	--	0.016															
Zinc	mg/L	0.0365	--															
Polynuclear Aromatic Hydrocabons																		
1-Methylnaphthalene	ug/L	--	--															
2-Methylnaphthalene	ug/L	2.1	--															
Acenaphthene	ug/L	23	--															
Acenaphthylene	ug/L	--	0.2															
Anthracene	ug/L	0.73	--															
Benzo(a)anthracene	ug/L	0.0012	--															
Benzo(a)pyrene	ug/L	0.00012	--															
Benzo(b)fluoroanthene	ug/L	0.0012	--															
Benzo(g,h,i)perylene	ug/L	0.4	--															
Benzo(k)fluoranthene	ug/L	0.0013	--															
Chrysene	ug/L	0.0013	--															
Dibenzo(a,h)anthracene	ug/L	0.00012	--															
Fluoranthene	ug/L	6.2	--															
Fluorene	ug/L	3.9	--															
Indeno(1,2,3-c,d)pyrene	ug/L	0.0012	--															
Naphthalene	ug/L	12	--															
Phenanthrene	ug/L	6.3	--															
Pyrene	ug/L	10	--															
Total cPAHs (BaP equivalents)[2]	ug/L	0.00012	--															
Polychlorinated Biphenyls																		
Aroclor-1260	ug/L	--	0.034															
Aroclor-1254	ug/L	--	0.033															
Aroclor-1221	ug/L	--	0.034															
Aroclor-1232	ug/L	--	0.034															
Aroclor-1248	ug/L	--	0.034															
Aroclor-1016	ug/L	--	0.96															
Aroclor-1242	ug/L	--	0.034															
Total PCBs[2]	ug/L	0.014	--															
Total Petroleum Hydrocarbons																		
Gasoline (TPH-Gx)	mg/L	--	--															
Diesel (TPH-Dx)	mg/L	--	--															
Motor Oil (TPH-Oil)	mg/L	--	--															
Volatile Organic Compounds																		
1,1,1,2-Tetrachloroethane	ug/L	--	2.5															
1,1,1-Trichloroethane	ug/L	--	11															

Table 2
Analytical Groundwater Sampling Results
Northwest Pipe Company, Portland, Oregon

Location ID				MW-06			MW-06			MW-06			MW-06			MW-06		
Sample ID				MW-06-050117			MW-06-070717			MW-06-121818			MW-06-050919			MW-06-100919		
Sample Date				05/01/17			07/27/17			12/07/18			05/09/19			10/09/19		
Sample Type				FD			FD			FD			FD			FD		
Analyte	**Units**	**ROD CULs[1]**	**JSCS SLVs[2]**			*EF*			*EF*			*EF*			*EF*			*EF*
Volatile Organic Compounds																		
1,1,2,2-Tetrachloroethane	ug/L	--	0.33															
1,1,2-Trichloroethane	ug/L	--	1.2															
1,1-Dichloroethane	ug/L	--	47															
1,1-Dichloroethene	ug/L	7	--															
1,1-Dichloropropene	ug/L	--	--															
1,2,3-Trichlorobenzene	ug/L	--	--															
1,2,3-Trichloropropane	ug/L	--	0.0095															
1,2,4-Trichlorobenzene	ug/L	--	--															
1,2,4-Trimethylbenzene	ug/L	--	--															
1,2-Dibromo-3-Chloropropane	ug/L	--	--															
1,2-Dibromoethane	ug/L	--	--															
1,2-Dichlorobenzene	ug/L	--	--															
1,2-Dichloroethane	ug/L	--	0.73															
1,2-Dichloroethene	ug/L	--	--															
1,2-Dichloropropane	ug/L	--	0.97															
1,3,5-Trimethylbenzene	ug/L	--	--															
1,3-Dichlorobenzene	ug/L	--	--															
1,3-Dichloropropane	ug/L	--	--															
1,4-Dichlorobenzene	ug/L	--	2.8															
2,2-Dichloropropane	ug/L	--	--															
2-Butanone	ug/L	--	7100															
2-Chloroethyl Vinyl Ether	ug/L	--	--															
2-Chlorotoluene	ug/L	--	--															
2-Hexanone	ug/L	--	99															
4-Chlorotoluene	ug/L	--	--															
4-Methyl-2-Pentanone	ug/L	--	170															
Acetone	ug/L	--	1500															
Benzene	ug/L	0.44	--															
Bromobenzene	ug/L	--	--															
Bromochloromethane	ug/L	--	--															
Bromodichloromethane	ug/L	--	1.1															
Bromoform	ug/L	--	8.5															
Bromomethane	ug/L	--	8.7															
Carbon Dioxide	ug/L	--	--	82,300			80,000			55,000			90,000			80,000		
Carbon Disulfide	ug/L	--	0.92															
Carbon Tetrachloride	ug/L	--	0.51															
Chlorobenzene	ug/L	64	--															
Chlorodibromomethane	ug/L	--	0.79															
Chloroethane	ug/L	--	23															
Chloroform	ug/L	--	0.17															
Chlorohexane	ug/L	--	--															
Chloromethane	ug/L	--	2.1															
Cis-1,2-Dichloroethene	ug/L	70	--	1,550		*22*	1,080		*15*	1,400		*20*	1,900		*27*	1,800		*26*
Cis-1,3-Dichloropropene	ug/L	--	0.055															
Dibromomethane	ug/L	--	61															
Dichlorodifluoromethane	µg/L	--	390															
Ethylbenzene	ug/L	7.3	--															
Hexachlorobutadiene	ug/L	--	--															
Isopropylbenzene	ug/L	--	660															
m+p-Xylenes	ug/L	--	1.8															
Methane	ug/L	--	--	265			382	J		4,100			350			2,900		
Methylene Chloride	ug/L	--	8.9															
Methyl-tert-butyl Ether	ug/L	--	37															
Naphthalene	ug/L	--	0.2															
n-Butylbenzene	ug/L	--	--															
n-Propylbenzene	ug/L	--	--															
o-Xylene	ug/L	--	13															
p-Isopropyltoluene	ug/L	--	--															
Sec-Butylbenzene	ug/L	--	--															
Styrene	ug/L	--	100															
Tert-Butylbenzene	ug/L	--	--															
Tetrachloroethene	ug/L	0.24	--	1,280		*5.33E+03*	728		*3.03E+03*	400		*1.67E+03*	1,000		*4.17E+03*	600		*2.50E+03*
Toluene	ug/L	9.8	--															
Trans-1,2-Dichloroethene	ug/L	--	--															
Trans-1,3-Dichloropropene	ug/L	--	--															
Trichloroethene	ug/L	0.6	--	228		*380*	123		*205*	110		*183*	220		*367*	130		*217*
Trichlorofluoromethane	ug/L	--	1300															
Vinyl Chloride	ug/L	0.022	--	20.7		*941*	22.5		*1.02E+03*	130		*5.91E+03*	44		*2.00E+03*	150	J	*6.82E+03*
Xylenes, Total	ug/L	13	--															

Notes:
EF = Exceedance factor (calculated if consistuent exceeded indicated screening level)
D = Dilution
J = Estimated value below reporting limit.
U = Not detected at specified reporting limit.
mg/L = milligrams per Liter

-- = Screening level not established (Note: If ROD CUL was available, JSCS SLV is not shown.)
Shaded = detected result exceeded indicated screening value
Sample Type: N = Normal Sample, FD - Field Duplicate
[1]Portland Harbor Record of Decision (ROD) Cleanup Levels (CULs) for groundwater for remedial action objectives 4 and 8 (Table 17 from EPA, 2017).
[2]Joint Source Control Strategy (JSCS) Screening Level Values (SLVs) for groundwater/surface water/stormwater recommended values for initial upland source control screening evaluations for water (Table 3.1 - Revision 7/16/07 from EPA, 2005)

Table 3
Analytical Groundwater Sampling Results
for Port of Portland Wells
Northwest Pipe Company, Portland, Oregon

Location ID		T4S1MW-01S		T4S1MW-02S		T4S1MW-02S		T4S1MW-02S		T4S1MW-02S		T4S1MW-03S		T4S1MW-03S		T4S1MW-03S		T4S1MW-03S		T4S1MW-03S		T4S1MW-03S		T4S1MW-03S		T4S1MW-03S		T4S1MW-03S	
Sample Date		04/21/04		04/20/04		09/02/04		02/02/05		05/05/05		04/21/04		08/30/04		01/31/05		05/05/05		10/25/16		02/01/17		04/26/17		07/25/17		12/05/18	
Analyte	**Units**																												
Field Parameters																													
Temperature	(°C)																			14.2		14.3		13.2		16.0		13.4	
pH																				6.4		6.7		6.6		6.5		6.5	
Conductivity	(µS/cm)																			245		111		87		164		203	
Dissolved Oxygen	mg/L																			0.9		5.2		9.0		4.5		0.6	
Oxidation Reduction Potential	mV																			72		145		167		115		161	
Turbidity	NTU																			0.5		0.8		1.6		0.3		0.2	
Conventional Parameters																													
Chloride	mg/L																			5.1	J	0.9		0.7		1.9		1.6	
Nitrate-N	mg/L																			5.2	J	1.2		0.4		3.8		1.2	
Sulfate	mg/L																			24.7	J	4.5		2.6		12.4		13.0	
Total Organic Carbon	mg/L																			0.9	J	0.4	J	0.5		0.6		0.8	J
Metals, Dissolved																													
Iron	mg/L																			0.034	J	0.01	U	0.01	U	0.01	U		
Ferrous Iron	mg/L																											0	
Volatile Organic Compounds																													
1,1,1-Trichloroethane (TCA)	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U										
1,1-Dichloroethane (1,1-DCA)	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U										
1,1-Dichloroethene (1,1-DCE)	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.37	J	0.5	U	0.5	U										
1,2,4-Trimethylbenzene	µg/L	2	U	2	U	2	U	2	U	2	UJ	2	U	2	U	2		2	UJ										
1,3-Dichlorobenzene	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U										
1,4-Dichlorobenzene	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U										
2-Butanone (MEK)	µg/L	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U										
Acetone	µg/L	20	U	20	U	20	U	20	U	17	J	20	U	20	U	20	U	20	U										
Benzene	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U										
Carbon Dioxide	µg/L																			26,200		13,900		9,600		18,100		37,500	
Carbon Disulfide	µg/L	0.27	J	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U										
Chlorobenzene	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U										
Chloroform	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.23	J	0.5	U	0.19	J	0.48	J										
cis-1,2-Dichloroethene	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	2.3		89		15		7.6		0.15	UJ	0.15	U	0.15	U	0.15	U	0.1	U
Ethylbenzene	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U										
Isopropylbenzene	µg/L	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U										
Methane	µg/L																			29.1	J	10.1	J	5.15	U	4.95	U	100	U
m,p-Xylenes	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U										
Naphthalene	µg/L	2	U	2	U	2	U	2	UJ	2	U	2	U	2	U	2	U	2	U										
n-Butylbenzene	µg/L	2	U	2	U	2	U	2	U	2	UJ	2	U	2	U	2		2	UJ										
n-Propylbenzene	µg/L	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U										
o-Xylene	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U										
sec-Butylbenzene	µg/L	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U										
Tetrachloroethene (PCE)	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.77		1.8		14		1.9		0.112	J	0.23		0.117		0.0508		0.1	U
Toluene	µg/L	0.1	J	0.13	J	0.5	U	0.92		0.5	U	0.23	J	0.5	U	0.48	J	0.12	J										
trans-1,2-Dichloroethene	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.78		0.5	U	0.2	J										
Trichloroethene (TCE)	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.29	J	1.3		3.5		0.42	J	0.15	UJ	0.15	U	0.15	U	0.15	U	0.1	U
Vinyl Chloride	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	5.4		1.3		0.5	U	0.008	UJ	0.008	U	0.008	U	0.008	U	0.02	U

Notes:

D = Dilution

J = Estimated value.

U = The analyte was analyzed for, but not detected.

-- = Not Established

°C = degrees Celsius

mg/L = milligrams per Liter

mV = millivolts

µS/cm = microsiemens per centimeter

ug/L = micrograms per Liter

NTU = Nephelometric Turbidity Units

Table 3
Analytical Groundwater Sampling Results
for Port of Portland Wells
Northwest Pipe Company, Portland, Oregon

Location ID		T4S1MW-03S		T4S1MW-03S		T4S1MW-04S		T4S1MW-04S		T4S1MW-04S		T4S1MW-04S		T4S1MW-07		T4S1MW-07		T4S1MW-07		T4S1MW-07		T4S1MW-08		T4S1MW-08		T4S1MW-08		T4S1MW-08		T4S1MW-09	
Sample Date		05/08/19		10/07/19		04/19/04		08/31/04		02/08/05		05/09/05		04/20/04		08/27/04		02/02/05		05/04/05		04/21/04		08/30/04		02/03/05		05/04/05		04/20/04	
Analyte	**Units**																														
Field Parameters																															
Temperature	(°C)	14.5		11.2																											
pH		6.6		6.3																											
Conductivity	(µS/cm)	338		171																											
Dissolved Oxygen	mg/L	2.3		0.5																											
Oxidation Reduction Potential	mV	145		47																											
Turbidity	NTU	0.3		0.3																											
Conventional Parameters																															
Chloride	mg/L	1.5	U	1.2																											
Nitrate-N	mg/L	1.4		1.2																											
Sulfate	mg/L	6.9		8.6																											
Total Organic Carbon	mg/L	0.6		0.8																											
Metals, Dissolved																															
Iron	mg/L																														
Ferrous Iron	mg/L	0.05		0.01																											
Volatile Organic Compounds																															
1,1,1-Trichloroethane (TCA)	µg/L					0.5	U	0.5	U	0.5	U	0.12	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
1,1-Dichloroethane (1,1-DCA)	µg/L					0.5	U	0.5	U	0.5	U	0.11	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
1,1-Dichloroethene (1,1-DCE)	µg/L					0.5	U	0.5	U	0.5	U	0.13	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
1,2,4-Trimethylbenzene	µg/L					2	U	2	U	2	U	3.1		2	U	2	U	2	U	2	UJ	2	U	2	U	2	U	2	UJ	2	U
1,3-Dichlorobenzene	µg/L					0.5	U	0.5	U	0.5	U	0.11	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
1,4-Dichlorobenzene	µg/L					0.5	U	0.5	U	0.5	U	0.12	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
2-Butanone (MEK)	µg/L					20	U	20	U	20	U	2	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Acetone	µg/L					20	U	20	U	20	U	4.1	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Benzene	µg/L					0.5	U	0.5	U	0.5	U	0.14	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Carbon Dioxide	µg/L	24,000		24,000																											
Carbon Disulfide	µg/L					0.41		0.38	J	0.17	J	0.41	J	0.5	U	0.94		0.5	U	0.5	U	0.2	J	0.72		0.5	U	0.5	U	0.5	U
Chlorobenzene	µg/L					0.5	U	0.5	U	0.5	U	0.14	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Chloroform	µg/L					0.5	U	0.5	U	0.5	U	0.14	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
cis-1,2-Dichloroethene	µg/L	0.1	U	0.1	U	0.5	U	0.5	U	0.5	U	0.12	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Ethylbenzene	µg/L					0.5	U	0.5	U	0.5	U	0.29	J	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Isopropylbenzene	µg/L					2	U	2	U	2	U	0.11	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U
Methane	µg/L	0.25	U	160	U																										
m,p-Xylenes	µg/L					0.5	U	0.5	U	0.27	J	1.5		0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Naphthalene	µg/L					2	U	2	U	2	U	1.6	J	2	U	2	U	2	UJ	2	U	2	U	2	U	2	U	2	U	2	U
n-Butylbenzene	µg/L					2	U	2	U	2	U	0.23	UJ	2	U	2	U	2	U	2	UJ	2	U	2	U	2	U	2	UJ	2	U
n-Propylbenzene	µg/L					2	U	2	U	2	U	0.34	J	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U
o-Xylene	µg/L					0.5	U	0.5	U	0.12	J	0.76		0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
sec-Butylbenzene	µg/L					2	U	2	U	2	U	0.13	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U
Tetrachloroethene (PCE)	µg/L	0.1	U	0.1	U	0.5	U	0.5	U	0.5	U	0.13	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.15	
Toluene	µg/L					0.26	J	0.5	U	0.35	J	0.36	J	0.13	J	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.11	J	0.5	U
trans-1,2-Dichloroethene	µg/L					0.5	U	0.5	U	0.5	U	0.15	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Trichloroethene (TCE)	µg/L	0.1	U	0.1	U	0.5	U	0.5	U	0.5	U	0.14	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Vinyl Chloride	µg/L	0.02	U	0.02	U	0.5	U	0.5	U	0.5	U	0.22	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U

Notes:

D = Dilution

J = Estimated value.

U = The analyte was analyzed for, but not detected.

-- = Not Established

°C = degrees Celsi °C = degrees Celsius

mg/L = milligrams mg/L = milligrams per Liter

mV = millivolts mV = millivolts

uS/cm = microsier uS/cm = microsiemens per centimeter

ug/L = micrograms ug/L = micrograms per Liter

NTU = Nephelome NTU = Nephelometric Turbidity Units

Table 3
Analytical Groundwater Sampling Results
for Port of Portland Wells
Northwest Pipe Company, Portland, Oregon

Location ID		T4S1MW-09		T4S1MW-09		T4S1MW-09		T4S1MW-09		T4S1MW-09		T4S1MW-09		T4S1MW-09		T4S1MW-09		T4S1MW-09		T4S1MW-10		T4S1MW-10		T4S1MW-10		T4S1MW-10	
Sample Date		09/01/04		02/09/05		05/09/05		10/25/16		02/01/17		04/26/17		07/25/17		12/05/18		05/08/19		10/07/19		04/19/04		09/01/04		02/04/05		05/09/05	
Analyte	**Units**																												
Field Parameters																													
Temperature	(°C)							14.9		14.9		14.3		16.0		14.8		14.4		12.1									
pH								6.5		6.7		6.5		6.5		6.8		6.3		6.5									
Conductivity	(µS/cm)							278		234		200		216		176		393		201									
Dissolved Oxygen	mg/L							3.3		2.9		1.0		1.8		1.5		5.5		1.4									
Oxidation Reduction Potential	mV							-53		-41		-20		96		187		194		64									
Turbidity	NTU							1.6		0.9		4.2		1.8		0.5		1.2		0.5									
Conventional Parameters																													
Chloride	mg/L							2.76	J	1.7		1.65		2.34		1.8		1.6	U	1	J								
Nitrate-N	mg/L							1.23	J	2.94		1.87		1.94		1.2		1.8		1.3									
Sulfate	mg/L							5.97	J	5.66		5.95		7.16		5.6		7		6.3	J								
Total Organic Carbon	mg/L							1.09	J	0.61		0.7		0.69		0.66	J	0.53		0.55									
Metals, Dissolved																													
Iron	mg/L							7.62		4.41		2		0.321	J														
Ferrous Iron	mg/L															0		0.08		0.01									
Volatile Organic Compounds																													
1,1,1-Trichloroethane (TCA)	µg/L	0.5	U	0.5	U	0.12	U															0.5	U	0.5	U	0.5	U	0.12	U
1,1-Dichloroethane (1,1-DCA)	µg/L	0.5	U	0.5	U	0.11	U															0.1	J	0.18	J	0.19	J	0.17	J
1,1-Dichloroethene (1,1-DCE)	µg/L	0.5	U	0.5	UJ	0.13	U															0.5	U	0.5	U	0.5	U	0.13	U
1,2,4-Trimethylbenzene	µg/L	2	U	2	U	0.15	UJ															2	U	2	U	2	U	0.15	UJ
1,3-Dichlorobenzene	µg/L	0.5	U	0.5	U	0.11	U															0.5	U	0.5	U	0.5	U	0.11	U
1,4-Dichlorobenzene	µg/L	0.5	U	0.5	U	0.12	U															0.5	U	0.5	U	0.5	U	0.12	U
2-Butanone (MEK)	µg/L	20	U	20	U	2	U															20	U	20	U	20	U	2	U
Acetone	µg/L	20	U	20	U	4.1	U															20	U	20	U	20	U	4.1	U
Benzene	µg/L	0.5	U	0.5	U	0.14	U															0.5	U	0.5	U	0.5	U	0.14	U
Carbon Dioxide	µg/L							49,100	J	29,000		27,300		30,800		27,500		26,000		26,000									
Carbon Disulfide	µg/L	0.5	U	0.5	U	0.16	U															0.5	U	0.5	U	0.5	U	0.16	U
Chlorobenzene	µg/L	0.5	U	0.5	U	0.14	U															0.5	U	0.5	U	0.5	U	0.14	U
Chloroform	µg/L	0.5	U	0.5	U	0.14	U															0.5	U	0.5	U	0.5	U	0.14	U
cis-1,2-Dichloroethene	µg/L	0.5	U	0.5	U	0.12	U	0.15	UJ	0.15	U	0.15	U	0.15	U	0.1	U	0.1	U	0.1	U	0.19	J	0.13	J	0.5	U	0.14	J
Ethylbenzene	µg/L	0.5	U	0.5	U	0.13	U															0.5	U	0.5	U	0.5	U	0.13	U
Isopropylbenzene	µg/L	2	U	2	U	0.11	U															2	U	2	U	2	U	0.11	U
Methane	µg/L							2,640	J	1,220		22.5	J	22.5	J	0.25	U	2.4		3.6									
m,p-Xylenes	µg/L	0.5	U	0.5	U	0.22	U															0.5	U	0.5	U	0.5	U	0.36	J
Naphthalene	µg/L	2	U	2	U	0.29	U															2	U	2	U	2	U	0.29	U
n-Butylbenzene	µg/L	2	U	2	U	0.23	UJ															2	U	2	U	2	U	0.23	UJ
n-Propylbenzene	µg/L	2	U	2	U	0.098	U															2	U	2	U	2	U	0.098	U
o-Xylene	µg/L	0.5	U	0.5	U	0.11	U															0.5	U	0.5	U	0.5	U	0.17	J
sec-Butylbenzene	µg/L	2	U	2	U	0.13	U															2	U	2	U	2	U	0.13	U
Tetrachloroethene (PCE)	µg/L	0.5	U	0.5	U	0.13	U	0.0191	J	0.0177	J	0.005	U	0.0139	J	0.1	U	0.1	U	0.1	U	0.24		0.33	J	0.51		0.41	J
Toluene	µg/L	0.5	U	0.5	U	0.26	J															0.22	J	0.5	U	0.5	U	0.37	J
trans-1,2-Dichloroethene	µg/L	0.5	U	0.5	U	0.15	U															0.5	U	0.5	U	0.5	U	0.15	U
Trichloroethene (TCE)	µg/L	0.5	U	0.5	U	0.14	U	0.15	UJ	0.15	U	0.15	U	0.15	U	0.1	U	0.1	U	0.1	U	0.19	J	0.21	J	0.5	J	0.24	J
Vinyl Chloride	µg/L	0.5	U	0.5	UJ	0.22	U	0.0197	J	0.0113	J	0.008	U	0.008	U	0.02	U	0.02	U	0.02	U	0.5	U	0.5	U	0.5	U	0.22	U

Notes:

D = Dilution
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-- = Not Established

°C = degrees Celsius
mg/L = milligrams per Liter
mV = millivolts
uS/cm = microsiemens per centimeter
ug/L = micrograms per Liter
NTU = Nephelometric Turbidity Units

Table 3
Analytical Groundwater Sampling Results
for Port of Portland Wells
Northwest Pipe Company, Portland, Oregon

Location ID		T4S1MW-11	T4S1MW-11	T4S1MW-11	T4S1MW-11	T4S1MW-12	T4S1MW-13	T4S1MW-14	T4S1MW-14	T4S1MW-14	T4S1MW-14	T4S1MW-15	T4S1MW-16	T4S1MW-16	T4S1MW-16	T4S1MW-16
Sample Date		04/19/04	09/01/04	02/08/05	05/10/05	04/19/04	04/16/04	04/16/04	08/31/04	02/08/05	05/10/05	04/16/04	04/19/04	08/27/04	02/10/05	05/10/05
Analyte	**Units**															
Field Parameters																
Temperature	(°C)															
pH																
Conductivity	(µS/cm)															
Dissolved Oxygen	mg/L															
Oxidation Reduction Potential	mV															
Turbidity	NTU															
Conventional Parameters																
Chloride	mg/L															
Nitrate-N	mg/L															
Sulfate	mg/L															
Total Organic Carbon	mg/L															
Metals, Dissolved																
Iron	mg/L															
Ferrous Iron	mg/L															
Volatile Organic Compounds																
1,1,1-Trichloroethane (TCA)	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane (1,1-DCA)	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethene (1,1-DCE)	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U
1,2,4-Trimethylbenzene	µg/L	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.2 J	2 U	2 U	2 U	2 U	2 U
1,3-Dichlorobenzene	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.4	0.5 U	0.5 U	0.5 U
1,4-Dichlorobenzene	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.12 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Butanone (MEK)	µg/L	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Acetone	µg/L	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Benzene	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Carbon Dioxide	µg/L															
Carbon Disulfide	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	0.21 J	0.5 U	0.5 U	0.5 U	0.5 U	0.19 J	0.5 U	0.5 U	0.5 U	1.7	0.5 U
Chlorobenzene	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroform	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.75	4.4	3.1
cis-1,2-Dichloroethene	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Ethylbenzene	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Isopropylbenzene	µg/L	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Methane	µg/L															
m,p-Xylenes	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.34 J	0.5 U	0.5 U	0.5 U	0.5 U	0.36 J
Naphthalene	µg/L	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
n-Butylbenzene	µg/L	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
n-Propylbenzene	µg/L	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
o-Xylene	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.14 J	0.5 U	0.5 U	0.5 U	0.5 U	0.15 J
sec-Butylbenzene	µg/L	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Tetrachloroethene (PCE)	µg/L	0.39 U	0.5 U	0.5 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Toluene	µg/L	0.2 J	0.5 U	0.5 U	0.5 U	0.5 U	0.13 J	0.16 J	0.5 U	0.11 U	0.31 J	0.13 J	0.9	0.5 U	0.5 U	0.5
trans-1,2-Dichloroethene	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene (TCE)	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Vinyl Chloride	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U

Notes:

D = Dilution

J = Estimated value.

U = The analyte was analyzed for, but not detected.

-- = Not Established

°C = degrees Celsius

mg/L = milligrams per Liter

mV = millivolts

uS/cm = microsiemens per centimeter

ug/L = micrograms per Liter

NTU = Nephelometric Turbidity Units

Table 3
Analytical Groundwater Sampling Results
for Port of Portland Wells
Northwest Pipe Company, Portland, Oregon

Location ID		T4S1MW-17		T4S1MW-17		T4S1MW-17		T4S1MW-17		T4S1MW-18		T4S1MW-18		T4S1MW-18		T4S1MW-18		T4S1MW-19		T4S1MW-19		T4S1MW-19		T4S1MW-20		T4S1MW-20		T4S1MW-20	
Sample Date		04/20/04		09/02/04		02/01/05		05/04/05		04/21/04		09/01/04		02/01/05		05/06/05		09/15/04		02/09/05		05/09/05		09/02/04		02/10/05		05/11/05	
Analyte	**Units**																												
Field Parameters																													
Temperature	(°C)																												
pH																													
Conductivity	(µS/cm)																												
Dissolved Oxygen	mg/L																												
Oxidation Reduction Potential	mV																												
Turbidity	NTU																												
Conventional Parameters																													
Chloride	mg/L																												
Nitrate-N	mg/L																												
Sulfate	mg/L																												
Total Organic Carbon	mg/L																												
Metals, Dissolved																													
Iron	mg/L																												
Ferrous Iron	mg/L																												
Volatile Organic Compounds																													
1,1,1-Trichloroethane (TCA)	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
1,1-Dichloroethane (1,1-DCA)	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
1,1-Dichloroethene (1,1-DCE)	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	UJ	0.5	U
1,2,4-Trimethylbenzene	µg/L	2	U	2	U	2	U	2	UJ	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U
1,3-Dichlorobenzene	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
1,4-Dichlorobenzene	µg/L	0.5	U	0.5	U	0.5	U	0.12	J	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
2-Butanone (MEK)	µg/L	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Acetone	µg/L	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Benzene	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Carbon Dioxide	µg/L																												
Carbon Disulfide	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Chlorobenzene	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Chloroform	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
cis-1,2-Dichloroethene	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Ethylbenzene	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Isopropylbenzene	µg/L	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U
Methane	µg/L																												
m,p-Xylenes	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Naphthalene	µg/L	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	UJ	2	U	2	U	2	U	2	U	2	U	2	U
n-Butylbenzene	µg/L	2	U	2	U	2	U	2	UJ	2	U	2	U	2	U	2	U	2	U	2	U	2	UJ	2	U	2	U	2	U
n-Propylbenzene	µg/L	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U
o-Xylene	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
sec-Butylbenzene	µg/L	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U
Tetrachloroethene (PCE)	µg/L	0.5	U	0.5	U	0.21	J	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Toluene	µg/L	0.36	J	0.5	U	1.3		0.5	U	0.1	J	0.5	U	1.3		0.14	J	0.5	U	0.5	U	0.25	J	0.5	U	0.19	J	0.13	J
trans-1,2-Dichloroethene	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Trichloroethene (TCE)	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Vinyl Chloride	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	UJ	0.5	U	0.5	U	0.5	UJ	0.5	U

Notes:

D = Dilution
J = Estimated value.
U = The analyte was analyzed for, but not detected.
-- = Not Established

°C = degrees Celsius
mg/L = milligrams per Liter
mV = millivolts
uS/cm = microsiemens per centimeter
ug/L = micrograms per Liter
NTU = Nephelometric Turbidity Units

Table 3
Analytical Groundwater Sampling Results
for Port of Portland Wells
Northwest Pipe Company, Portland, Oregon

Location ID		T4S1MW-21		T4S1MW-21		T4S1MW-21		T4S1MW-22		T4S1MW-22		T4S1MW-22		T4S1MW-22		T4S1MW-22		T4S1MW-22		T4S1MW-22		T4S1MW-22		T4S1MW-22		T4S1MW-23	
Sample Date		09/02/04		02/10/05		05/11/05		09/02/04		02/04/05		05/06/05		10/25/16		02/01/17		04/27/17		07/26/17		12/06/18		05/08/19		10/08/19		09/02/04	
Analyte	**Units**																												
Field Parameters																													
Temperature	(°C)													15.7		14.4		15.0		16.0		15.0		15.8		12.4			
pH														6.4		6.4		6.4		6.3		6.5		6.2		6.2			
Conductivity	(µS/cm)													217		255		232		242		281		651		321			
Dissolved Oxygen	mg/L													0.3		0.3		1.2		0.9		0.6		1.1		0.3			
Oxidation Reduction Potential	mV													97		132		169		117		149		123		42			
Turbidity	NTU													4.0		1.2		1.4		0.7		0.3		1.2		1.0			
Conventional Parameters																													
Chloride	mg/L													2.8	J	4.56		3.38		4.78		6.1		7.9		7.3			
Nitrate-N	mg/L													0.095	J	0.039		0.92		0.36		0.02	U	0.11	J	0.02	U		
Sulfate	mg/L													5.49	J	8.9		10		7.9		15		11		16			
Total Organic Carbon	mg/L													1.19	J	1.09		1.18		1.15		1.3		1.2		1.6			
Metals, Dissolved																													
Iron	mg/L													0.01	U	0.01	U	0.01	U	0.01	U								
Ferrous Iron	mg/L																					0		0.05		0.01			
Volatile Organic Compounds																													
1,1,1-Trichloroethane (TCA)	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U															0.5	U
1,1-Dichloroethane (1,1-DCA)	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U															0.5	U
1,1-Dichloroethene (1,1-DCE)	µg/L	0.5	U	0.5	UJ	0.5	U	0.4	J	0.63		1.1																0.5	U
1,2,4-Trimethylbenzene	µg/L	2	U	2	U	2	U	2	U	2	U	2	U															2	U
1,3-Dichlorobenzene	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U															0.5	U
1,4-Dichlorobenzene	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U															0.5	U
2-Butanone (MEK)	µg/L	20	U	20	U	20	U	20	U	20	U	20	U															20	U
Acetone	µg/L	20	U	20	U	20	U	20	U	20	U	20	U															20	U
Benzene	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U															0.5	U
Carbon Dioxide	µg/L													48,400	J	84,500		49,100		60,000		50,000		85,000		60,000			
Carbon Disulfide	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U															0.5	U
Chlorobenzene	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U															0.5	U
Chloroform	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U															0.5	U
cis-1,2-Dichloroethene	µg/L	0.5	U	0.5	U	0.5	U	23		36		49		2.77	J	5.36		2.11		3.78		5.8		7.5		7.4		16	
Ethylbenzene	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U															0.5	U
Isopropylbenzene	µg/L	2	U	2	U	2	U	2	U	2	U	2	U															2	U
Methane	µg/L													15.9	J	33.4		6.05	U	15.4	J	160		41		16			
m,p-Xylenes	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U															0.5	U
Naphthalene	µg/L	2	U	2	U	2	U	2	U	2	UJ	2	UJ															2	U
n-Butylbenzene	µg/L	2	U	2	U	2	U	2	U	2	U	2	U															2	U
n-Propylbenzene	µg/L	2	U	2	U	2	U	2	U	2	U	2	U															2	U
o-Xylene	µg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U															0.5	U
sec-Butylbenzene	µg/L	2	U	2	U	2	U	2	U	2	U	2	U															2	U
Tetrachloroethene (PCE)	µg/L	0.5	U	0.5	U	0.5	U	12		27		34		1.46	J	1.28		1.43		1.71		1.4		1.8		1.3		8	
Toluene	µg/L	0.5	U	0.5	U	0.15	J	0.5	U	0.5	U	0.11	J															0.5	U
trans-1,2-Dichloroethene	µg/L	0.5	U	0.5	U	0.5	U	0.59		0.88		1.2																0.5	U
Trichloroethene (TCE)	µg/L	0.5	U	0.5	U	0.5	U	36		64		83	D	4.6	J	4.29		3.56		3		4.6		4.4		3.4		6.2	
Vinyl Chloride	µg/L	0.5	U	0.5	UJ	0.5	U	0.23	J	0.97		0.88		0.0499	J	0.106		0.022		0.0638		0.076	J	0.33		0.18		0.48	J

Notes:

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J = Estimated value.

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-- = Not Established

°C = degrees Celsius

mg/L = milligrams per Liter

mV = millivolts

uS/cm = microsiemens per centimeter

ug/L = micrograms per Liter

NTU = Nephelometric Turbidity Units

Table 3
Analytical Groundwater Sampling Results
for Port of Portland Wells
Northwest Pipe Company, Portland, Oregon

Location ID		T4S1MW-23		T4S1MW-23		T4S1MW-23		T4S1MW-23		T4S1MW-23		T4S1MW-23		T4S1MW-23		T4S1MW-23		T4S1MW-24		T4S1MW-24		T4S1MW-24	
Sample Date		02/04/05		05/06/05		10/25/16		02/01/17		04/27/17		07/26/17		12/06/18		05/09/19		10/08/19		09/01/04		02/03/05		05/06/05	
Analyte	**Units**																								
Field Parameters																									
Temperature	(°C)					15.1		14.2		14.9		18.0		13.8		14.6		12.0							
pH						6.5		6.5		6.5		6.6		6.7		6.4		6.3							
Conductivity	(µS/cm)					165		177		161		165		182		438		202							
Dissolved Oxygen	mg/L					0.9		1.3		1.1		1.5		1.1		1.3		1.8							
Oxidation Reduction Potential	mV					39		51		92		61		80		101		33							
Turbidity	NTU					1.2		1.4		1.9		0.6		1.0		1.5		1.0							
Conventional Parameters																									
Chloride	mg/L					3.92	J	4.24		3.36		4.07		3.6		13		8.5							
Nitrate-N	mg/L					0.27	J	0.58		0.42		0.36		0.42		0.48	U	0.4							
Sulfate	mg/L					7.67	J	8.74		7.76		4.83		10		8.3		6.6							
Total Organic Carbon	mg/L					0.65	J	0.68		0.78		1.18		0.79	J	0.67		0.78							
Metals, Dissolved																									
Iron	mg/L					0.221		0.185		0.0545	J	0.11													
Ferrous Iron	mg/L													0.02		0.08		0.05							
Volatile Organic Compounds																									
1,1,1-Trichloroethane (TCA)	µg/L	0.5	U	0.5	U															0.5	U	0.5	U	0.5	U
1,1-Dichloroethane (1,1-DCA)	µg/L	0.5	U	0.5	U															0.5	U	0.5	U	0.5	U
1,1-Dichloroethene (1,1-DCE)	µg/L	0.5	U	0.5	U															0.5	U	0.5	U	0.5	U
1,2,4-Trimethylbenzene	µg/L	2	U	2	U															2	U	2	U	2	U
1,3-Dichlorobenzene	µg/L	0.21	J	0.5	U															0.5	U	0.5	U	0.5	U
1,4-Dichlorobenzene	µg/L	0.5	U	0.5	U															0.5	U	0.5	U	0.5	U
2-Butanone (MEK)	µg/L	20	U	20	U															20	U	20	U	20	U
Acetone	µg/L	20	U	20	U															20	U	20	U	20	U
Benzene	µg/L	0.5	U	0.5	U															0.5	U	0.5	U	0.5	U
Carbon Dioxide	µg/L					52,900	J	26,900		20,400		27,500		26,000		36,000		28,000							
Carbon Disulfide	µg/L	0.5	U	0.5	U															0.5	U	0.5	U	0.5	U
Chlorobenzene	µg/L	0.5	U	0.5	U															0.5	U	0.5	U	0.5	U
Chloroform	µg/L	0.5	U	0.5	U															0.5	U	0.5	U	0.5	U
cis-1,2-Dichloroethene	µg/L	0.86		4.1		0.7	J	0.65		0.42	J	0.15	U	1.4		0.34		0.58		0.5	U	0.5	U	0.5	U
Ethylbenzene	µg/L	0.5	U	0.5	U															0.5	U	0.5	U	0.5	U
Isopropylbenzene	µg/L	2	U	2	U															2	U	2	U	2	U
Methane	µg/L					5.07	J	37.9		7.12	J	19.6	J	68		16		67							
m,p-Xylenes	µg/L	0.5	U	0.5	U															0.5	U	0.25	J	0.5	U
Naphthalene	µg/L	2	UJ	2	UJ															2	U	2	UJ	2	UJ
n-Butylbenzene	µg/L	2	U	2	U															2	U	2	U	2	U
n-Propylbenzene	µg/L	2	U	2	U															2	U	2	U	2	U
o-Xylene	µg/L	0.5	U	0.5	U															0.5	U	0.12	J	0.5	U
sec-Butylbenzene	µg/L	2	U	2	U															2	U	2	U	2	U
Tetrachloroethene (PCE)	µg/L	5.3		7.8		1.59	J	0.937		1.07		1.21		1.8		1.9		1.6		0.5	U	0.5	U	0.5	U
Toluene	µg/L	0.16	J	0.5	U															0.5	U	0.61		0.13	J
trans-1,2-Dichloroethene	µg/L	0.5	U	0.5	U															0.5	U	0.5	U	0.5	U
Trichloroethene (TCE)	µg/L	1.2		2.2		0.15	UJ	0.41	J	0.39	J	0.29	J	0.61		0.5		0.4		0.5	U	0.5	U	0.5	U
Vinyl Chloride	µg/L	0.5	U	0.5	U	0.008	UJ	0.0188	J	0.008	U	0.008	U	0.023	J	0.02	U	0.02	U	0.5	U	0.5	U	0.5	U

Notes:

D = Dilution

J = Estimated value.

U = The analyte was analyzed for, but not detected.

-- = Not Established

°C = degrees Celsius

mg/L = milligrams per Liter

mV = millivolts

uS/cm = microsiemens per centimeter

ug/L = micrograms per Liter

NTU = Nephelometric Turbidity Units

Appendix B
Sampling and Analysis Plan

Northwest Pipe Company
Portland Plant
ECSI No. 138

Sampling and Analysis Plan

Final

April 2022

Northwest Pipe Company

Northwest Pipe Company
Portland Plant
ECSI No. 138

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Document History and Status

Revision	Date	Description	By	Review	Approved

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Figure

2-1 Proposed MNA Monitoring Well Network

Attachment

1 Field Sampling Form

Acronyms and Abbreviations

µg/L	microgram(s) per liter
°C	degree(s) Celsius
A	annually
bgs	below ground surface
CUL	cleanup level
DEQ	Department of Environmental Quality
EPA	U.S. Environmental Protection Agency
H_2SO_4	sulfuric acid
HCl	hydrochloric acid
HDPE	high-density polyethylene
MDL	method detection limit
mL	milliliter(s)
LCS	laboratory control sample
MNA	monitored natural attenuation
MRL	method reporting limit
NAD83	North American Datum 1983
NTU	nephelometric turbidity unit
PTFE	polytetrafluoroethylene
PVC	polyvinyl chloride
Q	quarterly
QA	quality assurance
QC	quality control
ROD	Record of Decision
SA	semiannually
SAP	sampling and analysis plan
VOA	volatile organic analysis
VOC	volatile organic compound

1. Introduction

This sampling and analysis plan (SAP) details field and laboratory procedures that will be used to implement the long-term monitored natural attenuation (MNA) performance groundwater monitoring. This SAP is submitted as an appendix (Appendix B) to the MNA Evaluation Work Plan (MNA Work Plan) and describes the procedures recommended for obtaining, preparing, documenting, preserving, and shipping groundwater quality samples collected at the site. This SAP establishes quality assurance (QA)/quality control (QC) requirements for sample acquisition and handling. The objective of the SAP is to optimize the accuracy and precision of collected data through effective and controlled field measurements, sampling, and laboratory analysis. Procedures meeting those criteria will allow for accurate evaluation of data.

2. Monitoring Well Installation

Three new monitoring wells were installed at the Site in March 2022, per DEQ email approval January 26, 2022. These wells were sited based on DEQ and EPA's requested locations in response to the passive soil gas sampling performed in March 2021 described in the technical memorandum, *Passive Soil Gas Investigation Results and Proposed Well Locations* (Jacobs 2021). As requested, monitoring well MW-10 is located between PSG12 and PSG13 and downgradient of T4S1MW-23, MW-11 is located near PSG16 and downgradient of MW-03, and MW-12 is located east of PSG19 in the vicinity of the historical Gatton Creek channel and downgradient of T4S1MW-22. Following consultation with the Port of Portland, MW-12 was moved slightly north of the location proposed by DEQ and EPA to stay north of the current silt fence and provide sufficient clearance from the two railroad lines in that area while still meeting the objectives stated by DEQ and EPA. The locations of the new wells are shown on Figure 2-1.

2.1 Well Construction

The new monitoring wells were drilled and constructed consistent with *Groundwater Monitoring Well Drilling, Construction, and Decommissioning* (DEQ 1992). New wells are flush-mounted with a locking cap and constructed of 2-inch-diameter polyvinyl chloride (PVC) piping and screened across the thickness of the aquifer. Wells were constructed with10-slot screen with 10x20 Colorado silica sand pack and a bentonite seal. Well construction details are summarized in Table 2-1 and were reported to the Oregon Department of Environmental Quality (DEQ) and the Oregon Water Resources Department following completion.

Table 2-1. New Well Construction Details

Well Name	Hydrologic Unit	Coordinates (NAD83 State Plane)		Screened Interval (feet bgs)		Well Construction	Total Depth (feet bgs)
		Northing (feet)	Easting (feet)	Screen Top	Screen Bottom		
MW-10	Shallow aquifer	7620334.01	715196.95	9.0	29.0	2-inch Sch 40 PVC	29
MW-11	Shallow aquifer	7620715.29	715182.10	15.0	35.0	2-inch Sch 40 PVC	35
MW-12	Shallow aquifer	7621011.80	715214.92	15.0	30.0	2-inch Sch 40 PVC	30

Notes:
Coordinates are estimated and will be confirmed upon completion of the well survey. bgs = below ground surface
Coordinate System: North American Datum 1983 (NAD83) State Plane Oregon North (U.S. feet)

2.2 Monitoring Well Development

The annular seal was allowed to cure for at least 24 hours prior to the development of each new monitoring well. Well development consisted of a combination of surging and purging the well to remove fines from the well bottom, sand filter pack, and well, and promote hydraulic communication with the aquifer. During pumping and between pumping cycles, the pump was raised and lowered along the well screen to promote surging and flow reversal across different portions of the well screen. Water levels in the well undergoing development were periodically measured using an electronic water-level indicator. Well development was considered complete when the visible clarity of the water ceased to improve with continued development efforts.

After the combination of more aggressive surging and pumping was concluded, the pump was operated at an approximate constant rate, and a multi-parameter meter was used to measure pH, specific conductance, and turbidity in the pump discharge until three successive measurements, each made at least 5 minutes after the previous measurement, met the stabilization criteria noted for the parameters presented in Section 6.2. Well development equipment was decontaminated before and after use. Well development water and any silt removed from the wells was stored in steel drums transported to a designated staging area on the Northwest Pipe Company (Northwest Pipe) facility and managed as described in Section 9.

2.3 Surveying

Upon completion of the new monitoring well installation, existing and new monitoring wells will be surveyed by a licensed surveyor to a vertical precision of 0.01 foot.

3. Long-term MNA Performance Groundwater Monitoring Network

The construction information for the monitoring wells selected for the MNA program are summarized in Table 3-1. Figure 2-1 shows the proposed MNA monitoring well network and the groundwater flow direction.

Table 3-1. Well Construction Details for MNA Program

Well	Coordinates		Screened Interval (feet bgs)		Total Depth (feet bgs)	Well Use in MNA Network
	Northing (feet)	Easting (feet)	Screen Top	Screen Bottom		
MW-01	7621115.44	715674.70	14	24	25	Analytical and Water Level
MW-02	7620821.90	715683.93	10.5	20.5	22	Analytical and Water Level
MW-03	7620850.03	715487.66	14.5	24.5	26	Analytical and Water Level
MW-04	7621087.85	715497.29	16.5	26.5	27	Analytical and Water Level

Table 3-1. Well Construction Details for MNA Program

Well	Coordinates		Screened Interval (feet bgs)		Total Depth (feet bgs)	Well Use in MNA Network
	Northing (feet)	Easting (feet)	Screen Top	Screen Bottom		
MW-05	7621060.97	715816.63	17.5	27.5	28	Analytical and Water Level
MW-06	7621020.40	715649.12	18.5	28.5	29	Analytical and Water Level
MW-10[a]	7620334.01	715196.95	9.0	29.0	29	Analytical and Water Level
MW-11[a]	7620715.29	715182.10	15.0	35.0	35	Analytical and Water Level
MW-12[a]	7621011.80	715214.92	15.0	30.0	30	Analytical and Water Level
T4S1MW-02S	7621214.97	714998.33	20	30	30	Water Level Only
T4S1MW-03S	7620492.60	714732.19	20	30	30	Analytical and Water Level
T4S1MW-09	7620519.44	714609.19	20	30	30	Analytical and Water Level
T4S1MW-10	7620514.97	714448.17	10	20	20	Water Level Only
T4S1MW-22	7621091.96	715327.08	13	23	30	Analytical and Water Level
T4S1MW-23	7620347.24	715358.39	15	25	30	Analytical and Water Level
T4S1MW-25	7620880.20	714518.94	10	20	20	Water Level Only

Notes:
[a] Coordinates are estimated and will be confirmed upon completion of the well survey.
Coordinate System: North American Datum 1983 (NAD83) State Plane Oregon North (U.S. feet)

4. Groundwater Monitoring Frequency

The groundwater monitoring frequency for water quality samples and groundwater levels are presented in Sections 4.1 and 4.2.

4.1 Water Quality Sampling Schedule

In accordance with U.S. Environmental Protection Agency (EPA) guidance, quarterly monitoring will be conducted for the three new monitoring wells after installation in order to establish baseline conditions, observe seasonal trends, respond to recharge, and estimate attenuation rates for key contaminants (EPA 2004). Quarterly monitoring for several years provides baseline data to determine trends at new monitoring points and tests key hypotheses of the conceptual site model (EPA 2004). It is assumed that

groundwater data from the new wells will show the same stability in trends as the other site wells, which have been monitored for many years. Therefore, 2 years of quarterly monitoring will be performed for the new wells, while the existing wells continue to be sampled on a semiannual basis, which will then transition to annual monitoring for all wells. The proposed monitoring schedule is presented in Table 4-1.

Table 4-1. Sampling Frequency by Well

Well	Year 1	Year 2	Year 3	Year 4	Year 5+
MW-01	SA	SA	A	A	A
MW-02	SA	SA	A	A	A
MW-03	SA	SA	A	A	A
MW-04	SA	SA	A	A	A
MW-05	SA	SA	A	A	A
MW-06	SA	SA	A	A	A
MW-10	Q	Q	A	A	A
MW-11	Q	Q	A	A	A
MW-12	Q	Q	A	A	A
T4S1MW-03S	SA	SA	A	A	A
T4S1MW-09	SA	SA	A	A	A
T4S1MW-22	SA	SA	A	A	A
T4S1MW-23	SA	SA	A	A	A

Notes:
Q = quarterly
SA = semiannually
A = annually

Further reduction of the groundwater sampling frequency may be recommended in the future based on groundwater sampling data.

4.2 Groundwater Elevation Measurements

Prior to sampling, the depth to groundwater will be measured in each of the wells to be sampled, as well as other accessible monitoring wells on the Port's property, prior to initiating purging and sampling activities. Wells included in the groundwater elevation data set are included in Table 3-1. An electronic water-level indicator with an audible alarm and a cable marked in 0.01-foot increments will be used for the measurements. Before use, and between wells, the wetted portion of the water-level indicator tip will be decontaminated using a distilled water rinse. If the wells are sealed with an airtight cap, 20 to 30 minutes will be provided to allow pressure to equilibrate after the cap is released and before water levels are measured. Measurements will be repeated until consecutive readings are within 0.01 foot. Willamette River stage data concurrent with the measurement event will be noted from the United States Geological Survey river gauge at the Morrison Bridge (gage number 14211720) and reported along with groundwater level data.

5. Sampling Procedure

This section describes the sampling procedures for long-term MNA performance groundwater monitoring.

5.1 Well Inspection and Maintenance

At the start of each groundwater sampling event, field personnel will identify and evaluate the condition of Site-related monitoring wells. Personnel will also assess the integrity of the well completion (e.g., condition of the well pad and well caps) and identify any maintenance issues. Observations will be documented on the individual monitoring well sampling forms. The maintenance issue will either be corrected by field personnel or an Oregon-licensed drilling subcontractor. Maintenance needed on wells owned by the Port of Portland will be reported to the Port facility staff through the appropriate channels.

5.2 Groundwater Sample Collection and Analysis

Groundwater samples will be collected using low-flow (also known as low-stress) sampling techniques (EPA 2017). Purging and sampling will be conducted using a peristaltic pump with new disposable polytetrafluoroethylene (PTFE) (Teflon) tubing or PTFE-lined polyethylene tubing and new disposable silicone head tubing at each well (EPA 1998). EPA considers the use of a peristaltic pump to conduct groundwater sampling as acceptable for meeting the objectives of this study. According to EPA Guidance on low stress purging and sampling procedures, adjustable rate, peristaltic pumps (suction) are to be used with caution when collecting samples for VOCs and dissolved gas (e.g., methane, carbon dioxide, etc.) analyses (EPA 2017). To minimize the loss of VOCs and dissolved gases during sampling, the following measures will be implemented:

- Tubing lengths will be minimized by using short tubing runs.
- The pump tubing will be completely full of groundwater prior to sample collection to prevent aeration as the groundwater flows through the tubing.
- Minimal turbulence will be maintained while filling sample containers.

The peristaltic pump will be powered by either a car battery or generator. Should a generator be used, it will be located downwind of sampling activities at sufficient distance, and gloves will be changed following any contact with the generator to prevent sample contamination. To further reduce the potential for cross-contamination, wells will be purged and sampled in order of expected lowest to highest concentrations of VOCs.

Prior to beginning purging at a well, the static, pre-purging water level will be measured with a water-level indicator and recorded. The pump intake will be set within the middle of the screened interval, and the drawdown will be kept as low as reasonably possible (target of 0.33 foot) using flow rates in the range of 0.1 to 0.3 liter per minute. Purge water will be directed into 5-gallon buckets with fitted lids, which will be emptied into one or more 55-gallon-labeled steel drums with lids. The initial measurements of pH, specific conductance, dissolved oxygen, turbidity, oxidation reduction potential, and temperature of the purge water will be observed and recorded in the field logbook or sampling log for the well. Subsequent readings will be noted after removal of approximately 1 well casing volume, and then at a frequency of approximately every 5 minutes until water quality parameters have stabilized, which is defined as three successive measurements within the target criteria listed in Table 5-1.

Water quality parameters will be measured in-line using a YSI 556 multiparameter water quality meter (or similar) with a flow-through cell to monitor pH, oxidation-reduction potential, specific conductance,

dissolved oxygen, and temperature. A separate turbidity meter, HACH 2100Q (or similar), will be used to record turbidity readings prior to the inlet of the flow-through cell. Field meters will be calibrated following the manufacturer's specifications at the start of each day of sampling. The results of this calibration will be noted in the field notebook.

Table 5-1. Stabilization Criteria for Water Quality Parameters

Parameter	Target Stabilization Criteria
pH	+/- 0.1 pH units
Specific Conductance	+/- 3% microSiemens per centimeter
Oxidation-reduction Potential	+/- 10 millivolts
Turbidity	+/- 10% NTUs (when turbidity is greater than 10 NTUs)
Dissolved Oxygen	+/- 0.3 milligrams per liter

Notes:
NTU = nephelometric turbidity unit

After the field parameters have stabilized during purging, the in-line flow cell will be disconnected and the well will be sampled. The elapsed time between stabilization of field parameters and the beginning of sampling will be as short as reasonably possible to minimize potential changes in water quality after field parameter values have been documented. Samples will be placed in laboratory-provided containers previously prepared with the appropriate preservative, if necessary, by the analytical laboratory. Field personnel will replace nitrile gloves with new ones prior to sample collection and change gloves between sample locations to reduce the potential for cross-contamination. The pumping rate used for sample collection will be approximately 0.1 to 0.3 liter per minute. Sample collection will be done at the same flow rate used during purging, when possible, to preserve the equilibrium condition represented by stabilized parameters measured during purging.

For wells to be analyzed for both VOCs and geochemical parameters, VOC samples will be collected first. VOC vials will be filled in such a way as to minimize the volatilization of VOCs and dilution or loss of laboratory-provided sample preservative. The pumped water will be directed to run down the inside wall of the sample bottle to minimize splashing, bottles will not be overfilled, and no air bubbles or headspace will remain in vials upon completion of filling.

Samples for iron analysis will be field-filtered using a new, disposable 0.45-micron in-line filter to remove artificial turbidity, if any, that could bias sample results. The other sample containers listed in Table 5-1 will be filled in accordance with the sample handling procedures listed in Section 7.

6. Sampling Parameters

Samples will be submitted to the selected laboratory for analysis. The laboratory will be requested to provide results using standard turnaround time. The sample containers, preservative requirements, and maximum holding times for individual analyses are shown in Table 6-1. The selected laboratory will be certified under the National Environmental Laboratory Accreditation Program as well as the Oregon Environmental Laboratory Accreditation Program.

Portland Harbor Record of Decision (ROD) cleanup levels (CULs) included in Table 6-1 for use as screening values are from Table 17 of the Portland Harbor ROD (EPA 2017). Values were selected from Remedial Action Objectives 4 and 8 associated with migration of contaminated groundwater. Values reflect changes

from Errata for Portland Harbor ROD (EPA 2018) and Errata #2 for Portland Harbor ROD (EPA 2020). Despite selecting the analytical method with the lowest method reporting limit (MRL), the MRL for vinyl chloride is still above the ROD CUL. However, the method detection limit (MDL) is below the ROD CUL. The MDL is the minimum measured concentration of a substance that can be reported with 99 percent confidence that the measured concentration is distinguishable from method blank results. Results below the MRL but above the MDL will be "J" flagged, indicating they are estimated. These results will provide a reliable indication of whether vinyl chloride is present at concentrations above the ROD CULs.

Table 6-1. Sample Containers, Holding Times, and Analytical Methods

Analysis	Method	Container Size	Container Type	Preservative	Holding Time	ROD CULs[a] (µg/L)	MDL (µg/L)	MRL (µg/L)
Trichloroethene	SW8260SIM	(3) 40-mL VOA vials	Glass VOA vials	HCl, ≤6°C	14 days	0.6	0.011	0.2
cis-1,2-Dichloroethene						70	0.032	0.2
Vinyl Chloride						0.022	0.014	0.1
Tetrachloroethene						0.24	0.019	0.2
Ferrous Iron	Field-measured	NA	NA	NA	NA	--	10	100
Chloride	E300.0	(1) 250-mL	HDPE	None, ≤6°C	28 days	--	430	1,500
Sulfate					28 days	--	800	1,500
Nitrate-N					48 hours	--	30	200
Total Organic Carbon	SM5310	(1) 250-mL	HDPE	H2SO4, ≤6°C	28 days	--	50	100
Methane	RSK175	(3) 40-mL VOA vials	Glass VOA vials	None, ≤6°C	7 days	--	0.078	1
Carbon Dioxide	Field-measured or RSK175	NA	NA	NA	NA	--	39.8	100

[a] ROD concentrations are from Table 17 of the Portland Harbor ROD (EPA 2017). Values were selected from Remedial Action Objectives 4 and 8, which are associated with migration of contaminated groundwater. Values reflect changes from Errata for Portland Harbor ROD (EPA 2018) and Errata #2 for Portland Harbor ROD (EPA 2020).

Notes:
-- = not applicable
°C = degree(s) Celsius
µg/L = microgram(s) per liter
H_2SO_4 = sulfuric acid
HCl = hydrochloric acid
HDPE = high-density polyethylene
mL = milliliter
NA = not applicable
VOA = volatile organic analysis

7. Sample Handling and Quality Assurance

The selected laboratory will provide the required sample containers. The analytical laboratory will add preservatives, as needed, prior to shipping the sample containers to the field. The laboratory, upon receipt of the samples, will verify the adequacy of preservation and will add additional preservative, if necessary.

Trip blanks will be analyzed for VOCs and included at a rate of one per sample cooler containing samples for VOC analysis. Because disposable sample equipment will be used, no equipment blank is necessary. One blind sample duplicate (labeled MW-100) will be analyzed for each sample event.

Sample preservation efforts will commence at the time of sample collection and will continue until analyses are performed. After filling, sample containers will be placed promptly in an insulated cooler with ice to maintain sample temperature at or below 6°C. The ice will be double bagged in plastic storage bags. Coolers will be kept out of direct sunlight. The temperature of the samples will be documented upon receipt at the laboratory.

A chain-of-custody form will be completed for each sampling event. The original copy will be provided to the laboratory with the sample shipping cooler, and a copy will be retained in the field documentation files. The coolers containing the samples will be sealed with a custody seal any time the coolers are not in a sampling team member's possession or view before shipping. The custody seals will be signed and dated by a sampling team member.

Samples will be hand-delivered or shipped by an overnight express carrier for delivery to the analytical laboratory. Samples will be shipped for laboratory receipt and analyses within the holding times specified in Table 6-1.

7.1 Field Instrument Decontamination

The wetted portion of any instruments which have come into contact with groundwater will be decontaminated with an Alconox wash and distilled water rinse between monitoring sites, including the water level indicator, in order to minimize the potential of cross contamination between monitoring wells. At the end of each monitoring day, each instrument will be washed with Alconox solution and thoroughly rinsed with distilled water.

7.2 Field Documentation

Standard field information (typically weather conditions, personnel onsite, equipment calibration, sample information and location, and field observations), any deviations from the work plan, and the reason for deviations will be recorded daily in a field logbook. In addition, general observations of samples and field parameter measurements will be documented in the field logbook and/or the groundwater sampling worksheets.

Sample labels will be filled out using waterproof ink. At a minimum, each label will contain the following information:

- Sample identification code (i.e., MW06-122021-0)
  - Well ID and sample date (MMDDYY)
- Date and time of sample collection
- Sampler's signature or initials

7.3 Chain-of-Custody Record

A chain-of-custody form will accompany each sample. The laboratory will provide the chain of custody form. In preparing samples for transport, a chain-of-custody form will be completed with the following information:

- Name and phone number of destination laboratory
- Laboratory contract number

- Name of sample collectors
- Name of person recording the chain of custody
- Name of contact person
- Site location and sample matrix type
- Unique identification for each sample and associated date and time of collection
- Parameters to be analyzed
- Sample transport instructions if required

The sampler will sign the chain of custody over to the laboratory personnel when samples are retrieved. If samples are to be shipped, the chain-of-custody form will be placed inside the cooler and custody seals placed on the coolers.

7.4 Field Monitoring Instrument Calibration

Calibration of test sensors for field parameters will be performed twice each day of sample collection, according to procedures recommended by the field instrument vendors. The first calibration will be completed at the start of the day, and the second calibration will be completed mid-day. Most calibration creep occurs during morning hours when atmospheric warming is greatest. Where required during sampling, maintenance and any associated re-calibration will also be performed.

Records will be kept of any equipment calibration and maintenance performed between sampling events. This will include records of equipment function problems, calibration and maintenance procedures, and dates.

8. Laboratory Quality Assurance/Quality Control

All laboratory QA/QC procedures are documented by the laboratory and implemented routinely as a condition of its contract. The procedures are based on the EPA Contract Laboratory Program, ASTM International, and the Association of Official Analytical Chemists. Analytical QC will be performed at a minimum frequency of 10 percent (i.e., one complement of relevant QC tests for every nine field samples analyzed). QC results (e.g., percent recovery or relative percent difference) will be provided to Northwest Pipe along with field sample results. The results will be used by Northwest Pipe and the laboratory as a measure of performance and as an indicator of potential sources of cross-contamination. Routine QC control charts will be maintained and made available to Northwest Pipe upon request.

8.1 Laboratory Record-keeping

A laboratory logbook of all analyses performed for Northwest Pipe will be maintained a minimum of 3 years to document the sample processing steps, including the following:

- Sample preparation technique (e.g., dilution or extraction)
- Analytical instruments
- Analytical methods
- Experimental conditions

Reporting of analytical results will include the following:

- Sampling site and media
- Dates and times of sampling
- Date of receipt of sample by laboratory
- Date of sample analysis
- Laboratory sample identification number

- Analytical methods
- Measured concentrations
- MDLs
- MRLs
- Practical quantitation limits
- Analytical qualifier where applicable

8.2 Data Validation

Laboratory analytical data acquired during this investigation will be validated by the Jacobs Project Chemist. EPA Stage 2A data validation will be conducted on 100 percent of the laboratory data using laboratory-derived QA/QC limits.

The following items will be reviewed during validation:

- Documentation identifies the laboratory receiving and conducting analyses and includes documentation for all samples submitted by the project or requester for analyses.
- Requested analytical methods were performed and the analysis dates are present.
- Requested target analytes and units are reported.
- Sampling dates and times, date and time of laboratory receipt of samples, and sample conditions upon receipt at the laboratory (including preservation, pH, and temperature) are documented.
- Method dates for handling, preparation, cleanup, and analysis are present, as appropriate.
- Sample-related QC data and QC acceptance criteria (e.g., method blanks, surrogate recoveries, laboratory control sample [LCS] recoveries, duplicate analyses, matrix spike/matrix spike duplicate recoveries) are provided and linked to the reported field samples.
- Requested spike analytes or compounds (e.g., surrogate or LCS spikes) have been added, as appropriate.
- Sample holding times (from sampling date to preparation and preparation to analysis) are evaluated.
- Frequency of QC samples is checked for appropriateness (e.g., 1 LCS for every 20 samples in a preparation batch).

9. Investigation-Derived Waste Management

Purge water and any suspended silt from well development, sampling activities, and equipment decontamination water will be contained, labeled, and temporarily stored in a designated location at the Northwest Pipe facility. Drums will be labeled and covered with lids. The drums will be disposed of by Northwest Pipe through a commercial wastewater treatment service as part of its routine waste management procedures. Tubing, gloves, and other solid waste will be managed by Northwest Pipe as solid waste along with other site solid waste.

10. Health and Safety

Site activities will be conducted according to the site health and safety plan, consistent with 29 *Code of Federal Regulations* 1910, which calls for modified Level D personal protective equipment to be worn during sampling activities (safety glasses with side shields, steel-toed boots, disposable nitrile gloves, and safety vests).

11. References

Jacobs Engineering Group, Inc. (Jacobs). 2021. *Passive Soil Gas Investigation Results and Proposed Well Locations Memorandum*. August.

Oregon Department of Environmental Quality (DEQ). 1992. *Groundwater Monitoring Well Drilling, Construction, and Decommissioning*. DEQ Guidance Document. August 24.

U.S. Environmental Protection Agency (EPA). 1998. *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water.* EPA/600/R-98-128. September.

U.S. Environmental Protection Agency (EPA). 2004. *Performance Monitoring of MNA Remedies for VOCs in Ground Water*. Office of Research and Development. EPA/600/R-04/027. April.

U.S. Environmental Protection Agency (EPA). 2017. *Record of Decision, Portland Harbor Superfund Site. Portland, Oregon*. U.S. EPA Region 10, Seattle, Washington. January.

U.S. Environmental Protection Agency (EPA). 2018. Errata for Portland Harbor Superfund Site Record of Decision, Version 1.0. April 3.

U.S. Environmental Protection Agency (EPA). 2020. Errata #2 for Portland Harbor Superfund Site Record of Decision ROD Table 17. January 14.

Figure

LEGEND

Proposed MNA Monitoring Network

- Groundwater Quality Monitoring Well
- Monitoring Well for Water Level Monitoring Only
- New Groundwater Quality Monitoring Well
- Soil Gas Investigation Location
- General Groundwater Flow Direction
- Northwest Pipe Facility Boundary

1897 Surface Water Features

- Historical Waterbody
- Historical Marsh/Mudflat
- Historical Gatton Creek[1]

Note:
[1]The depicted location of historical Gatton Creek is based on its mapped location shown by the U.S. Geological Survey in its 1897 topographic map of the area. However, the historical creek channel may have shifted to the east or west over time, as is common for stream channels, before it was buried by fill placed in the area in the early 1940s.

N

0 75 150 300
Feet

Figure 2-1. Proposed MNA Monitoring Well Network
Northwest Pipe Company
Portland, Oregon

Jacobs

\\PDXFPP01\PROJ\NORTHWESTPIPECOMPANY\485880PORTHARBSUP\GIS\MAPFILES\2021\MNA WORK PLAN\FIGURE4-1_MNAWELLNETWORK_122221.MXD GGEE 4/14/2022 3:40:02 PM

Attachment 1
Field Sampling Form

JACOBS WELL SAMPLING FIELD LOG

Date:

Project #: NWP22003.A.CS.EV.03 **Well I.D.:**

Field Team:

Total Depth (ft) (-) DTW (ft) (X gal\ft) = Well Casing Volume (gal.) =

Field Conditions:

Decontamination: Alconox wash, DI wash

PURGE INFORMATION

	Purge Method:	Transient peristaltic pump with | | new or | | dedicated polyethylene/teflon-lined tubing
	Purge Method :	Dedicated submersible pump with | | new or | | dedicated polyethylene tubing
	Purge Method:	Dedicated Hydrostar pump with | | new or | | dedicated polyethylene tubing

Depth to bottom of sample tubing (ft): Purge water disposal:

Comments/Exceptions to SAP:

	Purge Volume (gallons)	Specific Conduct. (µS/cm)	Temp. (°C)	pH	ORP (mV)	Dissolved Oxygen (mg/L)	Turbidity (NTUs)	Flow Rate (gpm)	DTW (ft)	* Clarity/ Color/Remarks
Target Stabilization Criteria	**-**	**+/- 3%**	**-**	**+/- 0.1**	**+/- 10**	**+/- 0.3**	**+/- 10 if > 10 NTU**	**0.03 - 0.08**	**-**	
Time										
:										
:										
:										
:										
:										
:										
:										
:										
:										
:										
:	Start Sampling									
:	End Sampling									

* **VC** = Very cloudy **Cl** = Cloudy **SC** = Slightly Cloudy **VSC** = Very Slightly Cloudy **AC** = Almost Clear **C** = Clear

Laboratory Analytical Program - Semiannual Sampling

Groundwater Sampling

Project #: NWP22003.A.CS.EV.03

DATE: **Time:** **:** **Well ID:**

Sample I.D.	Number of Sample Containers (Circled)			Volume	Type	Pres.	Shipping Date	Analytical Method
	Equip-ment	Dupli-cate	Parent Sample					
Organic Constituents								
TCE, cis 1,2-DCE, PCE, VC	3	3	3	40 mL	Glass	HCl		EPA 8260C, no headspace
Metals								
Dissolved Ferrous Iron	Field measurement Only							HACH DR890- Ferrous Iron
Natural Attenuation Monitoring Constituents								
Nitrate, Sulfate, Chloride	1	1	1	250 mL	Poly	None		Nitrate (300), Sulfate & Chloride (300.0_28D)
TOC	1	1	1	250 mL	Glass	H2S04		SM5310
Carbon Dioxide	Field measurement Only							HACH CO2 Test Kit
Methane	3	3	3	40 mL	Glass	HCl		RSK 175, no headspace
Duplicate ID	Time:							

Comments: