Additional Groundwater Investigation Work Plan
Cedar Mill Facility

40580 Cedar Mill Road, Lyons, Oregon

for

DC Walker Enterprises, Inc.
c/o Pioneer Trust Bank
PO Box 2305
Salem, Oregon 97308

August 5, 2024

GeoEngineers
Earth Science + Technology

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File No. 25411-001-01

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Prepared for:

DC Walker Enterprises, Inc.
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PO Box 2305
Salem, Oregon 97308

Attention: Bill Davis

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APPENDICES

1.0 INTRODUCTION

On behalf of DC Walker Enterprises, Inc. (DC Walker), GeoEngineers, Inc. (GeoEngineers) prepared this Additional Groundwater Investigation Work Plan (Work Plan) to address environmental data gaps identified by the Oregon Department of Environmental Quality (DEQ) at the former Cedar Mill facility (Facility), located at 40580 Cedar Mill Road, Lyons, Oregon (Site). The DEQ Environmental Cleanup and Site Information number for the Site is 202. The purpose of the work described herein is to obtain site characterization data necessary to complete the remedial investigation (RI). The investigation proposed herein was requested by DEQ in correspondence dated December 30, 2022.

2.0 SITE DESCRIPTION AND BACKGROUND

2.1. Site Description

The Facility is located at 40580 Cedar Mill Road, Lyons, Oregon. The 14.31-acre Site includes Linn County tax lots 602 and 700, Section 27, Township 9 South, and Range 2 East. The Facility location is shown on Figure 1.

2.1.1. Site Features

The Facility, which is currently not in use, is bounded on the east by Cedar Mill Road, followed by the Freres Lumber Company engineered wood products facility. Agricultural land (pasture) is adjacent to the south, west, and north sides of the Facility. The Albany and Eastern Railroad occupies a right-of-way that crosses through the Site between tax lots 602 and 700. The general layout of the Facility is shown on Figure 2. Topography at the Facility is generally flat.

2.1.2. Former Facility Operations Areas

A former lumber operations area (the “operations area”), approximately 4.3 acres in size, is located at the northeast portion of tax lot 700, as shown on Figure 2. Former log storage areas surround the operations area and comprise most of the remainder of tax lot 700. The former lumber operations area is almost completely covered with asphalt or concrete, although small areas near the former Shop Building and planer chain area are not paved. Two large buildings (Rough Lumber Sawmill and Shop Building) and several smaller buildings (Lunch Room, Barker Building, and Planer Building) remain at the Facility. Two large unused aboveground storage tanks (ASTs), each more than 4,000 gallons, are present north of the Shop Building and three smaller ASTs (less than 1,000 gallons each) are present adjacent to the Shop Building. A concrete containment area surrounds two of the smaller ASTs. No secondary containment structures are present around the larger ASTs.

The historical uses of tax lot 602, northeast of tax lot 700, are unclear. However, aerial photographs dated 1970 and 1988 indicate that tax lot 602 was historically occupied by two structures (an office and a sawdust collection facility). Those structures are no longer present at tax lot 602.

A water supply well (referred to herein as the South Well[1]) was previously present south of the Rough Lumber Sawmill. The South Well was decommissioned in 2013.

2.2. Operations Background

A sawmill operated at the Site beginning in the late 1940s. Wood treatment operations were initiated at the Facility in 1975, using a water-based antifungal agent called Koppers Sapstain #1. Reportedly, Koppers Sapstain #1 contained 20.77 percent tetrachlorophenol (TCP) and 6 percent pentachlorophenol (PCP). Dibenzo-p-dioxins and dibenzofurans (dioxins) were likely present as contaminants or impurities in the TCP and PCP. The wood-treating solution was mixed in the area between the planer chain and green chain areas before being applied to freshly cut lumber in the planer chain and green chain areas. Wood treating chemicals may have migrated in stormwater from the planer chain and green chain areas to ditches south and north of the Facility (see Figure 2). In 1983, a spray-booth was constructed in the Planer Building, and Koppers Sapstain #1 was replaced by a copper-based wood treating solution, called "PQ-8" (RETEC, 1998).

The Rough Lumber Sawmill building burned in 1984 and was rebuilt. The green chain area was paved during rebuilding. Freres Lumber Company purchased the Facility in 1988 and modified the wood treatment operations by replacing the spray booth with an off-site dip tank, which was located east of Cedar Mill Road at another lumber facility that was operated by Freres Lumber Company. The off-site dip tank contained a wood-treating solution called "NP-1" (RETEC, 1998). NP-1 does not contain chlorophenolic compounds according to the manufacturer's safety data sheet. It is unknown whether chlorophenolic compounds were historically used for other wood treatment operations at the Freres Lumber Company facility located east of Cedar Mill Road. Sawmill operations ceased at the Site in approximately 1994.

2.3. Site Setting

2.3.1. Geology

The Site is located on the south side of the North Santiam River valley, on the west slope of the Cascades mountain range. The Site is generally flat, with the exception of a system of ditches that traverses the Site. Soil generally consists of brown silt underlain by a mixture of silt, sand, gravel and cobbles. Unconsolidated to semi-consolidated post-Pleistocene fluvial gravel, sand and silt are widespread near the Site. The fluvial sediments are underlain by the Little Butte Volcanic Series, which is composed of early Oligocene to early Miocene volcanic and pyroclastic rocks.

Sediment at the Site is similar to shallow soil, although the fine-grained fraction is absent from sediment in some locations (e.g., near sample locations SD08-1, SD08-2, SD08-3 and SD09-8). In those locations, sediment is composed of 2- to 12-inch-diameter gravel and cobbles with sand. At other sediment sample locations, sediment consists of 1 to 2 feet of silty sand underlain by cobbles. Surface sediment contains large percentages of organic debris in some locations.

[1] In some historical documents, the South Well is referred to as the "Water Supply Well."

2.3.2. Hydrogeology and Surface Water

Perched groundwater is occasionally present at the Site. A shallow water-bearing unit (informally referred to as the "shallow aquifer") is present between approximately 5 and 14 feet below ground surface (bgs). The shallow and perched intervals may be connected during periods of high groundwater. A deeper water-bearing unit (informally referred to as the "deep aquifer") is present below approximately 60 feet. The deep aquifer is a historical source of drinking, irrigation, and industrial water at the Facility, although groundwater at the Facility is not currently used for any beneficial purposes.

2.4. Oregon Department of Environmental Quality Comments

In a letter dated December 30, 2022, DEQ provided comments on the *Updated Remedial Investigation Report, Cedar Mill Facility (*GeoEngineers, 2022). Among their comments, DEQ concurred with the conclusions in the *Updated Revised Remedial Investigation Report*, which includes updated human health and ecological risk assessments; DEQ stated support for the site-specific human health exposure scenarios evaluated in the report.

DEQ's letter included some questions and comments about dioxins and furans in groundwater. Specifically, DEQ noted that the nature/extent of dioxins and furans in groundwater north of the Site and associated risks to human health remained a data gap.

3.0 PREVIOUS INVESTIGATIONS

Several phases of groundwater monitoring and investigation have been completed at the Site since 1997 and seven monitoring wells (MW97- 1, MW97- 2, MW97- 3, MW97- 4, MW03- 1, MW03- 2, and MW03- 3) were installed between 1997 and 2003. The locations of groundwater monitoring wells are shown on Figure 2. Wells MW97- 1, MW97- 2, MW97- 3, MW97-4, and MW03- 1 are screened in the shallow aquifer and wells MW03- 2 and MW03- 3 are screened in the deep aquifer

One or more dioxin and furan congeners were detected in each of the groundwater monitoring wells during previous groundwater monitoring events. The dioxin and furan data are listed in Appendix A Table A-1. The toxic equivalency (TEQ) concentrations in samples from the shallow groundwater aquifer ranged from 1.0 to 53 picograms per liter (pg/L), while the TEQ concentrations in samples from the deep groundwater aquifer ranged from 1.1 to 65 pg/L. The highest TEQ concentrations were detected in samples from the former Planer Chain area. The most recent groundwater samples collected from the monitoring wells at the Site and analyzed for dioxins and furans were collected in 2008.

In 2017, three groundwater samples were collected from temporary borings at the Site and analyzed for dioxins and furans. One or more dioxin and furan congeners were detected in each of the three 2017 Site groundwater samples. Dioxin and furan data are listed in Appendix A Table A-1. The locations of groundwater samples that were submitted for dioxins analysis are shown on Figure 3. The TEQ concentrations in groundwater samples collected from temporary borings DP-36 GW, DP-37 GW and DP-40 GW ranged from 1.5 to 11.3 pg/L.

The dioxin and furan concentrations in historical groundwater samples collected at the Site are representative of total concentrations in groundwater (i.e., concentrations in the dissolved and solid phases). The total concentrations may be biased high based on concentrations in the solid phase, particularly in samples collected from temporary borings. The sampling approach described in Sections 4 and 5 of this work plan is intended to mitigate the bias that may be caused by solids in groundwater samples.

4.0 SCOPE OF WORK FOR ADDITIONAL GROUNDWATER INVESTIGATION

DEQ has requested additional evaluation of dioxins and furans in groundwater. Specifically, DEQ has requested investigation of: (1) whether dioxins and furans in groundwater have migrated to north of the subject site; and (2) whether ingestion and exposure to dioxins and furans in groundwater is a potential human exposure pathway. This work plan presents the proposed approach for addressing these questions.

This work plan proposes a two-phase approach for evaluating dioxins and furans in groundwater. During the first phase, GeoEngineers will collect and analyze groundwater samples from on-site monitoring wells. The purpose of resampling on-site groundwater monitoring wells is to evaluate current concentrations of dioxins and furans in groundwater. Specialized laboratory methods will be used to distinguish between dioxins and furans that are sorbed to particulates in groundwater (and not mobile) and dioxins and furans that are dissolved in groundwater (and are mobile). The second phase will include collection and analysis of dioxins and furans in groundwater from off-site locations. The second phase will be implemented only if the first phase indicates the potential for significant off-site risk. The scope and details for the second phase of investigation will be presented in a future work plan addendum, if necessary.

4.1. Pre-Field Activities

Pre-field activities include preparation of a site-specific health and safety plan, obtaining Site access, and laboratory coordination. Each of these tasks is described below.

4.1.1. Health and Safety Plan

A site-specific health and safety plan was prepared in accordance with 29 CFR 1910.120.

4.1.2. Access Agreements

Representatives of DC Walker will provide access to the Facility.

If off-site activities are required (e.g., north of tax lot 700 and west of tax lot 602), GeoEngineers will coordinate with the corresponding property owner(s) and DEQ to obtain access agreements. Off-site investigation activities are contingent on obtaining access agreement(s). DEQ assistance may be required to obtain permission to access the adjacent properties.

4.1.3. Laboratory Coordination

GeoEngineers will coordinate with an accredited analytical laboratory prior to the field activities. Coordination will include sampling methods, sample preservation, laboratory processing, and analytical methods. Section 5 presents the proposed laboratory analytical program.

4.2. Field Methods

4.2.1. Collecting Groundwater Samples from On-site Monitoring Wells

- GeoEngineers will inspect the seven groundwater monitoring wells at the Site. Inspection will include observations of the condition of the surface monuments and seals, measurement of total depth, and measurement of depth to groundwater. If the inspection suggests that a well is damaged or compromised, the well will be redeveloped and then re-inspected as described above.
- Wells requiring rehabilitation will be redeveloped via surging and/or overpumping. Surging will be completed by vigorously moving a surge block upward and downward over the entire length of the screened interval. The purpose of the surging is to break up accumulations of fine materials in the bottom of the well casing, so that the accumulated material can be removed from the monitoring well. Surging also forces water back and forth to remove any potential screen blockage or build-up. Overpumping will be completed by placing a submersible pump or other appropriate pump in the well, near the bottom of the well. The well will be pumped aggressively until it is pumped dry or until discharge is clear. The drawdown of the groundwater and an approximate average pumping rate will be noted during and at the completion of the redevelopment.

  A minimum of five well casing volumes of water will be removed from the well during redevelopment. Down-hole equipment (e.g., surge block, pump, cable, water level indicator) will be decontaminated between wells. Water removed during redevelopment and decontamination water will be containerized and handled according to investigation derived waste (IDW) management procedures, as described in Section 4.5.
- Wells will be gauged and groundwater samples will be collected at least 72 hours after redevelopment.
- The groundwater level in each monitoring well will be gauged by measuring the depth of groundwater below the top of the well casing using an electronic water level indicator.
- Groundwater samples will be collected from each of the monitoring wells. The wells will be sampled using low-flow groundwater sampling techniques. Gauging and groundwater sampling will be conducted in accordance with the Low Flow Sampling Standard Operating Procedure (SOP) in Appendix B.
  - Groundwater will be purged and sampled from the monitoring wells using either a peristaltic pump or bladder pump and low-density polyethylene tubing. The sampling equipment will be deployed so that groundwater is collected from the mid-screen in each well and the approximate sample collection depth will be recorded in the field sampling forms.
  - Groundwater will be purged from each well until water quality parameters (e.g., temperature, conductivity, pH, oxidative reduction potential [ORP]) stabilize. The depth to groundwater will be measured throughout the purging process and the pumping rate adjusted to ensure that minimal drawdown occurs during purging and collection of the groundwater samples.
  - A groundwater sample will be collected from each well by pumping groundwater directly into clean, laboratory-supplied containers. To minimize potential variability in the water samples that could occur during sample collection, multiple sample containers for the same well will be filled simultaneously. That is, the bottles will not be filled one at a time. Under this approach, each groundwater sample will be divided into two split samples. It is anticipated that approximately 2 liters will be required for each split sample.
  - The samples will be labeled, stored in an iced cooler, and delivered to the analytical laboratory following chain-of-custody protocols.

4.3. Investigation Derived Waste

IDW, consisting of purge and decontamination water generated during either the redevelopment or groundwater sampling event, will be placed in 55-gallon drums or other suitable containers pending analysis. The analytical data from the IDW drums will be used to establish a waste disposal profile and determine the appropriate disposal facility for the waste.

5.0 LABORATORY ANALYTICAL PROGRAM

Eight groundwater samples, including one field duplicate sample, will be collected and submitted for analysis. The groundwater samples will be submitted to an Oregon Laboratory Accreditation Program (ORELAP) certified laboratory under chain-of-custody protocol for analysis of the following groundwater constituents of interest (COI):

- Total suspended solids (TSS) by U.S. Environmental Protection Agency (EPA) Method 160.2; and
- Dioxins and furans by Method 1613B.

The measured concentrations of dioxins and furans can be biased high due to the presence of dioxins and furans that are sorbed to particulates in the groundwater sample. Generally, the particulate-bound dioxins and furans are not mobile and therefore, are not representative or suitable for evaluating groundwater risks to human health. In an effort to distinguish between total concentrations of dioxins and furans in groundwater (including concentrations sorbed to solids) and dissolved concentrations, the groundwater samples will be processed and analyzed using two distinct methods.

- One of the split samples will be analyzed “as-is.” That is, the sample will be analyzed without any post-field processing. The analytical data from these samples will be used to evaluate current concentrations of dioxins and furans in groundwater relative to historical data.
- The second split sample will be centrifuged by the laboratory prior to analysis. Centrifuging will remove most sediment from the water sample. Analytical data from the centrifuged sample are expected to more accurately represent the dissolved concentrations of dioxins and furans in groundwater.

Laboratory method reporting limit goals are listed in Appendix C.

6.0 DATA EVALUATION

The groundwater data will be compared to the results presented in the *Updated Remedial Investigation Report* (GeoEngineers, 2022) and evaluated against the following risk screening criteria:

- Risk-Based Concentrations (for human receptors); last updated in August 2023.

7.0 REPORTING AND SCHEDULE

The proposed schedule is summarized below.

- Respond to DEQ Comments/Revise Additional Groundwater Investigation Work Plan—within 2 weeks of receipt of comments.
- Implement Data Gap Work Plan. Assessment of the condition of the on-site monitoring wells and collection of the groundwater samples from the on-site monitoring wells will begin within 3 to 4 weeks of work plan approval. The expected duration of field activities is approximately 3 days for sampling on-site monitoring wells. No access agreement negotiations will be needed for the on-site phase of the additional groundwater investigation.
- Laboratory services will be complete within approximately 6 weeks of completion of the field investigation.
- Schedule meeting with DEQ within 2 weeks of receipt of the final laboratory report(s) for the additional on-site groundwater samples to provide DEQ an update on the results of the additional on-site groundwater investigation and discuss the next steps for the project and whether investigation of off-site groundwater is necessary.
- The analytical data will be evaluated against screening levels and incorporated into an amendment to the *Supplemental Remedial Investigation Report.* The draft amendment will be submitted within 6 weeks of completion of the laboratory analyses.

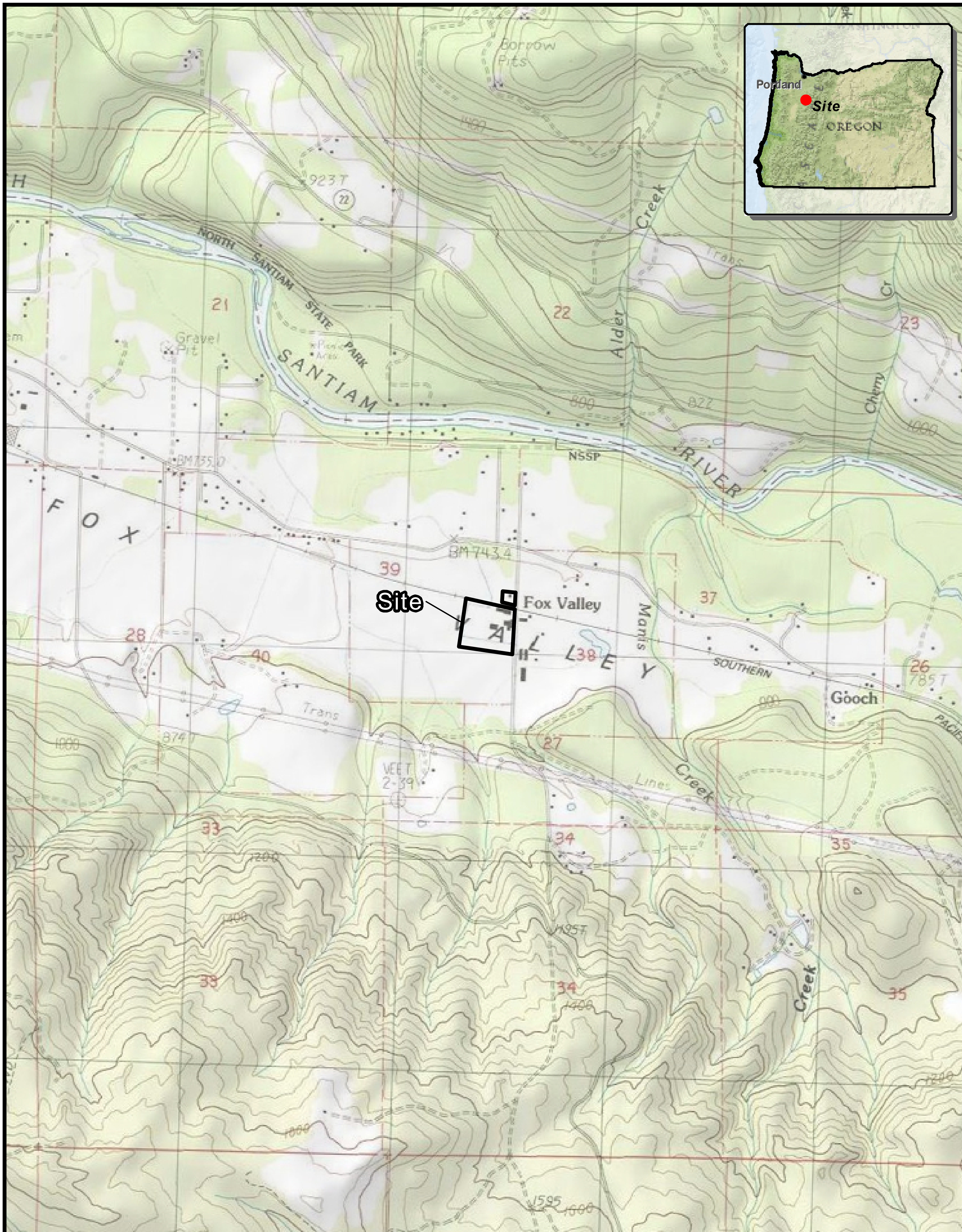
8.0 REFERENCES

Oregon Department of Environmental Quality (DEQ), 2022. *Comments on Cedar Mill Revised RI Report*. December 30, 2022

GeoEngineers, Inc. (Geoengineers), 2022. *Updated Remedial Investigation Report,* Cedar Mill Facility, 40580 Cedar Mill Road, Lyons, Oregon. March 2022.

Remediation Technologies, Inc. (RETEC), 1998. *Phase I Remedial Investigation, Freres Lumber Company*, Lyons, Oregon.

FIGURES



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Site Location

Groundwater Investigation Work Plan

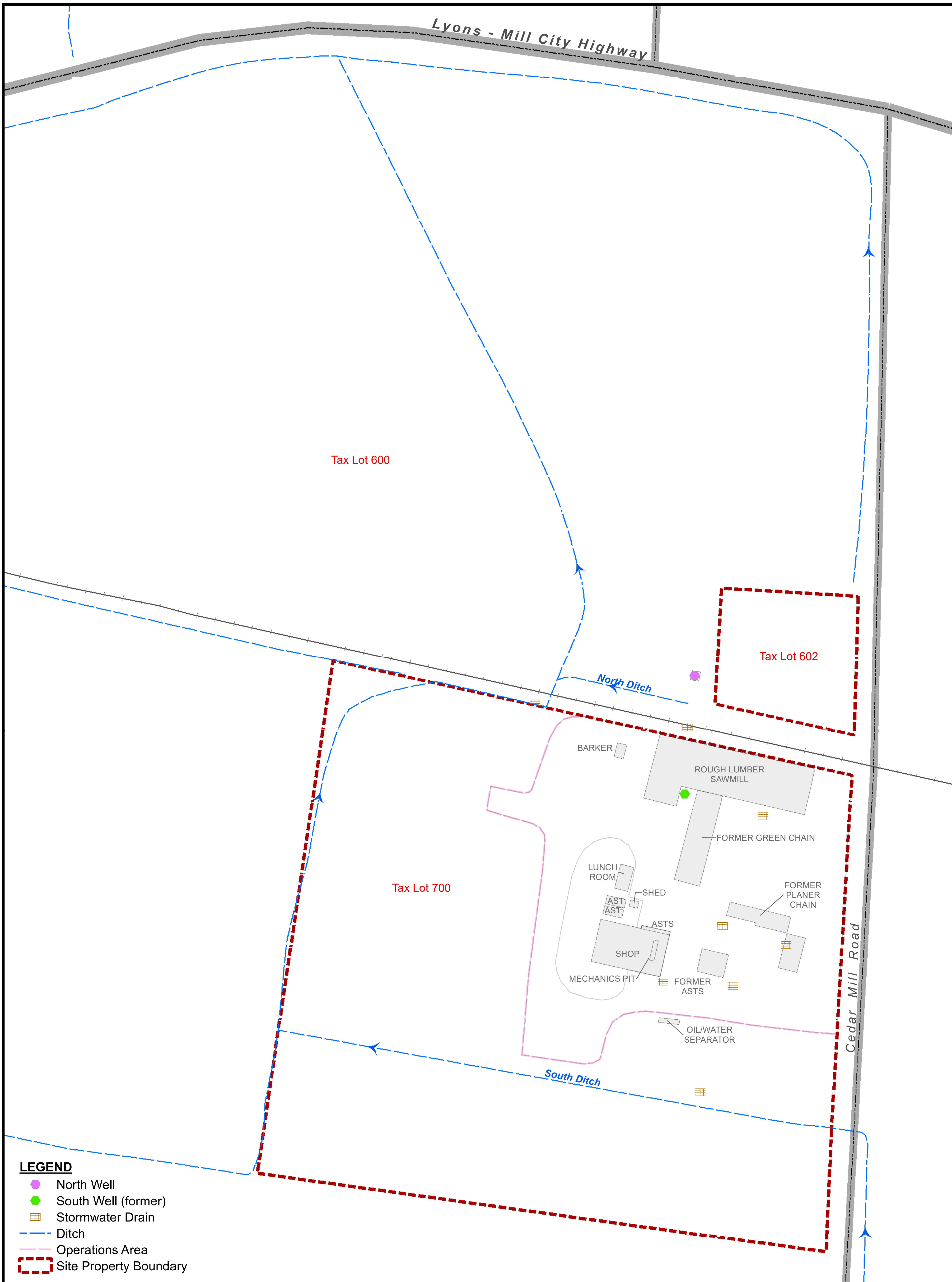
Cedar Mill Facility

Lyons, Oregon

Figure 1

PREPARED BY: E. McCormick | DATE: 7/15/2024

PROJECT: 025411-001-00



Notes:
1. The locations of features shown are approximate.
2. AST = Above ground storage tank.

Sources:
Cascadia Associates; ODOT; National Hydrography Dataset (NHD); Linn County.

Coordinate System:
NAD 83 State Plane Oregon North (US Feet)

N

0 100 200
Feet

Site Plan
Groundwater Investigation Work Plan
Cedar Mill Facility
Lyons, Oregon

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Figure 2

PREPARED BY: E. McCormick | DATE: 7/15/2024 | PROJECT: 025411-001-00

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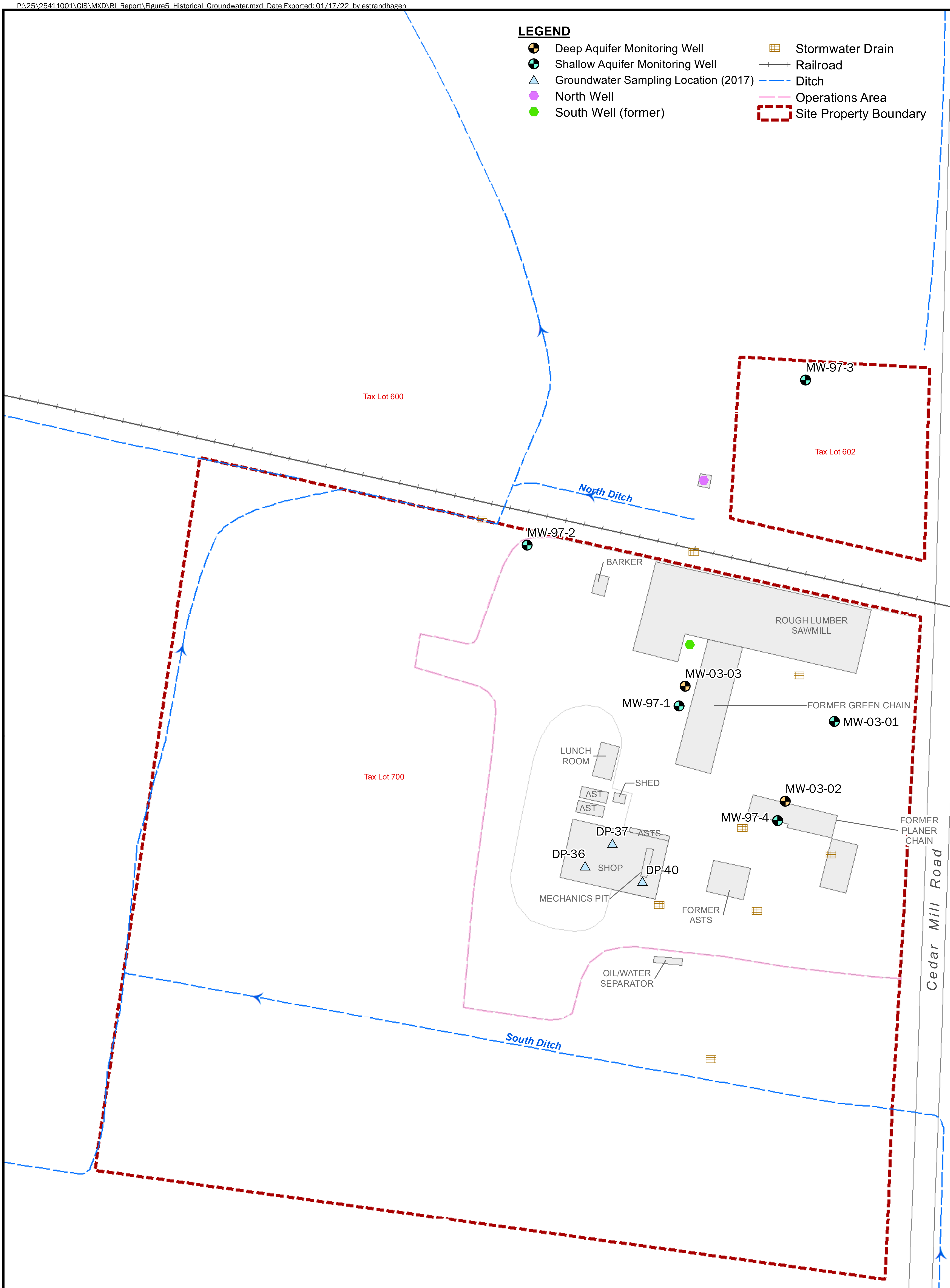

Notes:
1. The locations of features shown are approximate.
2. AST = Above ground storage tank.

Sources:
Cascadia Associates; ODOT; NHD; Linn County; GeoEngineers; RETEC; SRH; ADP.

Coordinate System:
NAD 83 State Plane Oregon North (US Feet)

N

0 100 200
Feet

Monitoring Well Locations

Groundwater Investigation Work Plan

Cedar Mill Facility
Lyons, Oregon

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Figure 3

DATE: 7/15/2024

PROJECT: 025411-001-00

APPENDICES

APPENDIX A
Historical Groundwater Analytical Data

Table A-1

Groundwater Analytical Data - Dioxins and Furans

Cedar Mill Facility

Lyons, Oregon

Sample Location	Sample ID	Sample Date	Dioxin TEQ[1]	Dioxin TEQ[2]	1,2,3,4,6,7,8-HpCDD	1,2,3,4,6,7,8-HpCDF	1,2,3,4,7,8,9-HpCDF	1,2,3,4,7,8-HxCDD	1,2,3,4,7,8-HxCDF	1,2,3,6,7,8-HxCDD	1,2,3,6,7,8-HxCDF	1,2,3,7,8,9-HxCDD	1,2,3,7,8,9-HxCDF	1,2,3,7,8-PeCDD	1,2,3,7,8-PeCDF	2,3,4,6,7,8-HxCDF	2,3,4,7,8-PeCDF	2,3,7,8-TCDD	2,3,7,8-TCDF	OCDD	OCDF
			Concentrations in picograms per liter (pg/L)																		
Monitoring Well Samples																					
MW97-1	MW97-1	10/18/2001	53	3.7	<5.1	<48.1	<48.1	<48.1	<48.1	<48.1	<48.1	<48.1	<48.1	<48.1	<48.1	<48.1	<48.1	3.7 J	<9.6	31.9 J	<96.2
	MW97-1	7/23/2002	3.5	0.014	<4	<2.1	<3.7	<2.3	<1.7	<2.3	<1.6	<2.3	<2.4	<2.2	<1.6	<1.6	<1.5	<2.6	<2.1	46 J	<4.9
	MW97-1	1/16/2003	7.1	2.0	88.5	<18.1	<5.7	<3.7	<2.7	10.6 J	<2.5	<3.7	<3.6	<3.8	<2.2	<2.8	<2.5	<3.2	<2.3	377 B	28.2 J
	MW97-1	5/12/2008	1.4	0.39	14.6	<2.92	<0.611	<0.525	<0.517	1.33	<0.554	<0.56	<0.542	<0.545	<0.583	<0.535	<1.84	<0.549	1.01	59.3	3.46
	MW97-1	10/31/2008	1.1	0.47	5.32	<1.18	<0.666	<0.522	<0.488	<0.559	<0.511	<0.544	<0.506	<0.511	<0.581	<0.514	0.844	<0.583	1.54	24.6	<1.03
MW97-2	MW97-2	1/16/2003	5.2	0.00	<7	<3.7	<5.5	<3.7	<2.6	<4	<2.6	<3.7	<3.5	<3.8	<2.4	<2.8	<2.5	<3.2	<2.5	<34.4	<7.7
	MW97-2	5/12/2008	1.2	0.12	2.94	<0.615	<0.598	<0.55	<0.512	<0.597	<0.549	<0.587	<0.537	<0.54	<0.574	<0.53	<2.03	<0.583	0.921	11.2	<1.06
	MW97-2	10/31/2008	1.0	0.41	2.04	<0.58	<0.57	<0.513	<0.557	<0.55	<0.583	<0.535	<0.577	<0.572	<0.538	<0.587	0.963	<0.574	1.01	6.6	<1.07
MW97-3	MW97-3	1/16/2003	5.2	0.00	<6.2	<3.5	<4.8	<3.4	<2.5	<3.7	<2.4	<3.4	<3.4	<3.8	<2.1	<2.6	<2.6	<3.2	<2.5	<9.9	<7.2
	MW97-3	5/12/2008	1.2	0.100	1.07	<0.542	<0.609	<0.524	<0.526	<0.569	<0.564	<0.559	<0.552	<0.545	<0.598	<0.544	<2.13	<0.559	0.883	3.94	<1.06
	MW97-3	11/11/2008	1.2	0.41	4.57	<0.554	<0.624	<0.509	<0.57	<0.546	<0.597	<0.531	<0.591	<0.545	<0.514	<0.601	0.891	<0.566	0.928	26.3	<1.15
MW97-4	MW97-4	10/18/2001	65	20	810	88.2	<48.1	<48.1	7.9 J	67.3	6.8 J	<48.1	<48.1	<48.1	<48.1	12.3 J	<48.1	<9.6	<9.6	6,650	61.6 J
	MW97-4	7/23/2002	7.0	3.6	82.5	11.6 J	<3.6	<2.2	7.2 J	12.9 J	<1.5	6.1 J	<2.3	<2.2	<1.7	<4.2	<1.4	<2.8	<2.2	347	<5
	MW97-4	1/16/2003	11.6	4.9	227	19.7 J B	<7.1	<5.2	<3.6	21.1 J	<3.4	<5.1	<4.7	<4.9	<3.1	<3.8	<3.3	<4.5	<3.2	1,500	<10
	MW97-4	5/12/2008	7.9	7.3	163	13	<0.593	<0.497	1.69	22.8	2.69	2.16	<0.563	<0.552	1.65	2.66	4.89	<0.533	5.71	1,170	5.84
	MW97-4	11/11/2008	52	51	1,790	131	<2.57	2.28	8.9	138	<10.2	9.94	<0.615	2.83	7.38	15	15.9	<0.574	28.8	16,000	50.3
	MW97-4 Duplicate	11/11/2008	51	51	1,760	<128	2.97	2.07	8.8	137	8.49	10.0	0.764	2.75	7.67	12.8	16.0	<0.599	31.5	15,800	54.6
MW03-1	MW03-1	1/16/2003	2.4	0.72	3.6 J	<1.4	<1.8	<1.2	1.9	<1.3	<0.7	<1.2	1.8	<1	1.9	2.4	<2.5	<0.9	<2.2	67.5 JB	<2.6
	MW03-1	5/12/2008	1.1	0.097	1.66	<0.492	<0.59	<0.538	<0.552	<0.585	<0.592	<0.574	<0.579	<0.543	<0.598	<0.571	<1.62	<0.585	0.801	4.97	<1.07
	MW03-1	10/31/2008	1.4	0.16	3.19	<0.885	<0.56	<0.495	<0.495	<0.53	<0.519	<0.516	<0.514	<0.555	<0.53	<0.522	1.57	<0.581	1.22	30.5	<1.04
MW03-2	MW03-2	1/16/2003	4.3	0.011	<9.7	<3	<4.5	<3	<1.9	<3.1	<1.9	<2.9	<2.8	<3.1	<2	<2.1	<2.1	<2.6	<2	35.8 JB	<6.7
	MW03-2	5/12/2008	1.4	0.36	4.6	<0.878	<0.559	0.679	<0.521	1.48	<0.558	<0.542	<0.546	<0.547	<0.573	<0.539	<2.06	<0.532	0.961	22	<1.07
	MW03-2	10/31/2008	3.8	3.3	53.4	<4.28	<0.578	1.07	<0.565	7.35	<0.591	2.25	<0.585	1.2	<0.599	<0.595	1.03	<0.6	1.32	327	3.74
MW03-3	MW03-3	1/16/2003	3.4	0.0058	<3.8	<2.1	<3	<2.1	<1.6	<2.4	<1.5	<2.2	<2.1	<2.5	<1.5	<1.6	<1.6	<2.2	<1.7	19.3 JB	<4.1
	MW03-3	5/12/2008	1.2	0.17	4.47	<0.909	<0.584	<0.506	<0.55	<0.554	<0.589	<0.54	<0.576	<0.565	<0.567	<0.569	<1.86	<0.562	1.18	27.1	<1.18
	MW03-3	11/19/2008	1.1	0.35	2.72	<0.618	<0.691	<0.544	<0.593	<0.583	<0.621	<0.567	<0.615	<0.597	<0.602	<0.625	0.782	<0.546	0.855	17.1	<1.29
Data Gap Investigation Samples																					
DP-36	DP-36 GW	5/9/2017	1.5	0.170	11.2 EM	2.29 EM	<1.26	<1.65	<0.688	<1.69	<0.689	<1.82	<1.09	<1.13	<0.957	<0.754	<0.882	<0.348	<0.515	129	3.55
DP-37	DP-37 GW	5/9/2017	11.3	9.5	496	45.5	<2.53	<2.04	2.24 EM	19.2 J	1.97 J	2.88 EM	<1.36	<1.81	<1.6	2.66 J	<1.57	<0.746	<1.09	4,750	37.5 J
DP-40	DP-40 GW	5/9/2017	2.9	1.54	110	10.6 J	<1.96	<2.34	<1.05	<2.45	<1.1	<2.61	<1.78	<0.735	<0.764	<1.17	<0.77	<0.347	<0.417	1260	9.32 J
Supply Well Samples [3]																					
South Well	South Well	11/13/2001	40	38	1,380 J	<1.7 J	<2.3 J	<6.3 J	<5.3 J	60.1 J	4.6 J	60.4 J	<3.8 J	4.9 J	<4.1 J	<6.6 J	<5.8 J	3.9 J	<9.5	10,810 J	<59.6
	South Well	7/23/2002	4.8	1.01	80.3	<2.2	<3.3	<1.5	<2.3	<2.4	<1.5	<2.4	<2.3	<2.5	<1.6	<1.6	<1.5	<2.9	<2	798	<4.8
	South Well	11/19/2008	10.7	7.7	263	<73.6	2.9	4.52	1.51	13.5	<21.8	11.7	<0.575	1.8	<0.876	3.25	1.3	<0.513	0.995	2,050	115
Risk-Based Concentrations for Groundwater																					
Ingestion and Inhalation from Tapwater																					
Residential			0.091	0.091		--	--	--	--	--	--	--	--	--	--	--	--	0.091	--	--	--
Occupational			0.42	0.42		--	--	--	--	--	--	--	--	--	--	--	--	0.42	--	--	--
Groundwater in Excavation																					
Construction and Excavation Worker			450	450	--	--	--	--	--	--	--	--	--	--	--	--	--	450	--	--	--

Please see notes at end of table.

Table A-1

Groundwater Analytical Data - Dioxins and Furans

Cedar Mill Facility

Lyons, Oregon

Sample Location	Sample ID	Sample Date	Total HpCDD	Total HpCDF	Total HxCDD	Total HxCDF	Total PeCDD	Total PeCDF	Total TCDD	Total TCDF
			Concentrations in picograms per liter (pg/L)							
Monitoring Well Samples										
MW97-1	MW97-1	10/18/2001	**5.1 J**	<48.1	<48.1	**2.5**	<48.1	**5.2**	**3.7**	<9.6
	MW97-1	7/23/2002	- -	- -	- -	- -	- -	- -	- -	- -
	MW97-1	1/16/2003	**88.5**	**22.6**	**30.8**	**13.4**	<3.8	<11.5	<3.2	<2.3
	MW97-1	5/12/2008	**27.8**	**5.48**	**13.2**	**11.3**	<5.95	**11**	**3.45**	**6.02**
	MW97-1	10/31/2008	**10.1**	**1.76**	**3.62**	**4.4**	<2.84	**6.91**	**3.27**	**6.03**
MW97-2	MW97-2	1/16/2003	<7	<4.4	<3.8	<2.8	<3.8	<2.5	<3.2	<2.5
	MW97-2	5/12/2008	**5.92**	**1.94**	**1.51**	**2.5**	<1.08	**3.46**	**3.29**	**5.64**
	MW97-2	10/31/2008	**3.41**	**1.24**	<0.541	**1.09**	<0.572	**2.17**	**1.48**	**1.59**
MW97-3	MW97-3	1/16/2003	<6.2	<4	<3.5	<2.7	<3.8	<2.3	<3.3	<2.5
	MW97-3	5/12/2008	**1.88**	<0.574	**0.828**	<0.546	**0.615**	<2.18	**0.6**	**0.883**
	MW97-3	11/11/2008	**7.59**	<0.793	<0.531	**0.75**	<0.545	**0.91**	<0.566	**2.4**
MW97-4	MW97-4	10/18/2001	**1,440**	**260**	**195**	**332**	<48.1	**95.9**	<9.6	**15.9 J**
	MW97-4	7/23/2002	- -	- -	- -	- -	- -	- -	- -	- -
	MW97-4	1/16/2003	**398**	**19.7**	**70.6**	**56**	<4.9	<15.5	<4.5	<3.2
	MW97-4	5/12/2008	**286**	**42.6**	**237**	**101**	**15.5**	**106**	**7.88**	**20.1**
	MW97-4	11/11/2008	**3,190**	**384**	**387**	**606**	**11.6**	**619**	**4.5**	**118**
	MW97-4 (Duplicate)	11/11/2008	**3,140**	**253**	**365**	**555**	**13.4**	**530**	**4.78**	**139**
MW03-1	MW03-1	1/16/2003	**3.6**	<1.6	<3.2	**6.2**	<1	**1.9**	<0.9	<2.2
	MW03-1	5/12/2008	2.58	<0.566	<1.56	<0.573	<0.709	<1.65	<0.899	**3.31**
	MW03-1	10/31/2008	**3.19**	<0.885	<0.516	<0.512	<0.555	**2.23**	<0.986	**2.3**
MW03-2	MW03-2	1/16/2003	<21.9	<3.6	<3	<2.1	<3.1	<2	<2.6	<2
	MW03-2	5/12/2008	**9.63**	<1.01	**57.2**	**1.45**	**35.4**	**2.05**	**7.19**	**3.84**
	MW03-2	10/31/2008	**121**	**6.03**	**42.4**	**9.67**	**2.64**	**13.6**	**<0.6**	**3.74**
MW03-3	MW03-3	1/16/2003	<3.8	<2.5	<2.3	<1.7	<2.5	<1.5	<2.2	<1.7
	MW03-3	5/12/2008	**9.27**	<1.09	<1.38	<0.571	<0.565	<1.84	<0.933	**2.5**
	MW03-3	11/19/2008	**5.02**	<0.653	<0.567	<0.613	<0.597	**1.61**	<0.546	**2.38**
Data Gap Investigation Samples										
DP-36	DP-36 GW	5/9/2017	**11.8** J	**2.29** EM	**2.06** J	<0.796	<1.13	**1.84** EM	<0.348	<0.515
DP-37	DP-37 GW	5/9/2017	**935**	**124**	**154**	**99**	**45.7**	**68.8**	**9.2**	**19.4**
DP-40	DP-40 GW	5/9/2017	**203**	**32**	**31.3**	**11.7**	<0.735	**4.9**	<0.347	<0.417
Supply Well Samples										
South Well	South Well	11/13/2001	- -	<1.9 J	**487 J**	**85.5 J**	**4.9 J**	**7.2 J**	**3.9 J**	**11.9 J**
	South Well	7/23/2002	- -	- -	- -	- -	- -	- -	- -	- -
	South Well	11/19/2008	**478**	**92.8**	**85.3**	**92.4**	**4.36**	**26.1**	<0.513	**3.25**
Risk-Based Concentrations for Groundwater										
Ingestion and Inhalation from Tapwater										
Residential			--	--	--	--	--	--	--	--
Occupational			--	--	--	--	--	--	--	--
Groundwater in Excavation										
Construction and Excavation Worker			--	--	--	--	--	--	--	--

Please see notes at end of table.

Notes:

Risk-Based Decision Making for the Remediation of Contaminated Sites, DEQ, 2003; updated August 2023.

TEQ = Toxicity Equivalence Quotient, Based on toxicity equivalence factors (TEFs) presented by World Health Organization (2005)

DEQ = Oregon Department of Environmental Quality

pg/L = picograms per liter

-- = Not analyzed or not applicable

< = Analyte was not detected at a concentration greater than the listed method detection limit

J = Analyte detected at a concentration between the method detection limit and the laboratory reporting limit

EM = Estimated maximum possible concentration

Bold indicates that the compound was detected above the laboratory method detection limit.

Shading indicates concentration exceeds occupational screening criterion.

Analyses by U.S. Environmental Protection Agency Method 1613B

[1]TEQ calculated by summing TEF adjusted concentrations (calculated by multiplying the detected concentration [or 1/2 the DL for non-detects] by the TEF).

[2]TEQ calculated by summing TEF adjusted concentrations (calculated by multiplying the detected concentration [or 0 for non-detects] by the TEF).

[3]South Well screened in the deep aquifer; samples not included in shallow groundwater screening

APPENDIX B
Standard Operating Procedures (SOPs)

LOW-FLOW GROUNDWATER PURGING/SAMPLING PROCEDURES

Groundwater samples will be obtained using low-flow/low-turbidity sampling techniques to minimize the suspension of sediment in groundwater samples. Low-flow (minimal drawdown) sampling utilizes an in-line water quality measurement device (e.g. flow-through cell) to establish the stabilization over time for several parameters (e.g. pH, specific conductance, salinity, temperature redox, dissolved oxygen and turbidity) on a well-specific basis. Data on pumping rate, drawdown, and volume required for parameter stabilization can be used as a guide for conducting subsequent sampling activities.

This method assumes the water within the screened interval is not stagnant, and a small change to the natural flow rate in the screened interval will result in samples with particulates and colloidal material representative of groundwater.

General Considerations

The major concern when conducting low-flow sampling is that the device gives consistent results and minimal disturbance of the sample across a range of low-flow rates (i.e. < 0.5 L/min). Pumping rates that cause minimal to no drawdown in one well could easily cause "significant" drawdown in another well finished in a less transmissive formation. The pump should not cause undue pressure or temperature changes or physical disturbance on the water sample over a reasonable sampling range. Consistency in operation is critical to meet accuracy and precision goals.

Prior to sampling, all sampling devices and monitoring equipment should be calibrated according to manufacture's recommendations. The water quality parameter instrument will be calibrated at the beginning of and once during each sampling day and whenever appropriate, in accordance with the equipment manufacturer's specifications. Calibration of pH should be performed with at least two buffers which bracket the expected range. Two buffers (either pH-4 and pH-7, or pH-7 and pH-10, whichever most closely bracket the anticipated range of groundwater conditions) will be used for instrument calibration for pH. Dissolved oxygen calibration must be corrected for local barometric pressure readings and elevation.

Pump Type

A variety of sampling devices are available for low-flow purging and sampling and include peristaltic pumps, bladder pumps, electrical submersible pumps, and gas-driven pumps. Use of a “low” flow (e.g. 0.1-0.5 L/min) pump is acceptable for purging and sampling all types of analytes. All pumps have some limitation and these should be investigated with respect to application at a particular site.

Pump Installation

Dedicated sampling devices (left in the well) capable of pumping and sampling are preferred over any other type of device. Any portable sampling device should be slowly and carefully lowered to the middle of the screened interval or slightly above the middle (e.g. 1-1.5 m below the top of a 3 m screen). This is to minimize excessive mixing of the stagnant water in the casing above the screen with the screened interval zone water, and to minimize resuspension of solids which will have collected at the bottom of the well. The key is to minimize disturbance of water and solids in the well casing.

The pump should be preset in the screen interval at least 24 hours before the sampling event. The dedicated downhole pump and tubing will be left in each well casing for use during subsequent monitoring events. The well casing plug and monument cover lid will be secured after each sampling event.

Monitoring of Water Level and Water Quality Indicator Parameters

Well depth should be obtained from the well logs. Measuring to the bottom of the well casing will cause resuspension of settled solids from the formation and require longer purging times for turbidity equilibration. Check water level periodically to monitor drawdown in the well as a guide to flow rate adjustment. The goal is minimal drawdown (<0.1 m) during purging. This goal may be difficult to achieve under some circumstances due to geologic heterogeneities within the screened interval, and may require adjustment based on site-specific conditions and personal experience. Wells that recharge very slowly may be purged dry once, allowed to recharge, and then sampled as soon as sufficient water is available. In this case, at least two sets of parameter readings of field water quality should be taken, one initially and one after recharge.

In-line water quality indicator parameters should be continuously monitored during purging. The water quality indicator parameters monitored can include pH, redox potential, temperature, salinity, conductivity, dissolved oxygen (DO) and turbidity. The last three parameters are often most sensitive (conductivity, dissolved oxygen (DO) and turbidity). Pumping rate, drawdown, and the time or volume required to obtain stabilization of parameter readings can be used as a future guide to purge the well. Measurements should be taken every three to five minutes if the above suggested rates are used (0.1-0.5 L/min). Stabilization is achieved after all parameters have stabilized for three successive readings. In lieu of measuring all five parameters a minimum subset would include pH, conductivity, and turbidity or DO. Three successive readings should be within ± 0.1 for pH, ± 3% for conductivity, ± 10 mv for redox potential, and ± 10% for turbidity and DO. Dissolved oxygen and turbidity usually require the longest time for stabilization. A Horiba U-22 water quality measuring system (with flow-through-cell) will be used to monitor the water quality parameters during purging. The stabilized field measurements will be documented in the field log book, and then groundwater samples will be obtained.

Sampling and Documentation

The sampler will wear clean gloves appropriate for the chemicals of concern while collecting the sample. Samples will be collected directly in laboratory-prepared bottles from the sampling device.

Each sampling episode or day should generally begin with the well having the least suspected concentrations of target compounds. Successive wells should generally be sampled in sequence of increasing suspected concentration.

Upon parameter stabilization, sampling can be initiated. If an in-line device is used to monitor water quality parameters, it should be disconnected or bypassed during sample collection. Sampling flow rate may remain at established purge rate or may be adjusted slightly to minimize aeration, bubble formation, turbulent filling of sample bottles or loss of volatiles due to extended residence time in tubing. Flow rates less than 0.5 L/min are appropriate. The same device should be used for sampling as was used for purging. Water samples should be collected directly in sample containers from the pump tubing. The samples will be obtained by flowing water directly from the tubing into sample containers provided by the analytical laboratory. The samples will be free of bubbles and headspace will not be present in the containers. VOC vials shall be filled by pouring the sample down the sides of the container with as little turbulence as possible. Vials shall be filled completely and immediately capped leaving no airspace in the vial. The vial shall then be capped, turned upside down, and tapped to check for air bubbles. If an air bubble is trapped in the vial, and exceeds the size of a pea, the sample shall be discarded and a new sample collected; the remaining sample is not to be topped off. Each sample container will be securely capped, labeled, and placed in a cooler with ice immediately upon collection.

The usual practices for documenting the sampling event should be used for low-flow purging and sampling techniques. This should include, at a minimum: information on the conduct of purging operations (flow-rate, drawdown, water-quality parameter values, volumes extracted and times for measurements), field instrument calibration data, water sampling forms and chain of custody forms.

The following information will be recorded in the field notes:

- Sample I.D.
- Duplicate I.D., if applicable
- Date and time sampled
- Name of sample collector
- Well designation (State well numbering system for water supply wells, and unique sequential number for other wells)
- Owner's name, or other common designation for water supply wells
- Well diameter
- Depth to water on day sampled
- Casing volume on day sampled
- Method of purging (bailing, pumping, etc.)
- Amount of water purged
- Extraordinary circumstances (if any)
- Results of instrument calibration/standardization and field measurements (temperature, pH, specific electrical conductance) and observed relative turbidity
- Depth from which sample was obtained
- Number and type of sample container(s)
- Purging pump intake depth
- Times and volumes corresponding to water quality measurement
- Purge rate

Purge water will be stored in labeled 55-gallon drums for subsequent characterization.

APPENDIX C
Laboratory Method Limits

Table C-1

Groundwater Analytical Program - Quantitation Limits and Regulatory Criteria Groundwater Investigation Work Plan

Cedar Mill Facility

Lyons, Oregon

Parameter	Laboratory	Method	Risk Based Concentrations for Groundwater			Achievable Laboratory MDLs	Laboratory MRLs	Units
			Ingestion and Inhalation of Tapwater		Groundwater in Excavation			
			Residential	Occupational	Construction and Excavation Worker			
Dioxin/Furans								
2,3,7,8 TCDD	CFA or Apex	EPA 1613B	0.091	0.42	450	1.0	10	pg/L
1,2,3,7,8 PeCDD						5.0	50.0	pg/L
1,2,3,4,7,8 HxCDD						5.0	50.0	pg/L
1,2,3,6,7,8 HxCDD						5.0	50.0	pg/L
1,2,3,7,8,9 HxCDD						5.0	50.0	pg/L
1,2,3,4,6,7,8 HpCDD						5.0	50.0	pg/L
OCDD						10	100	pg/L
2,3,7,8 TCDF						1.0	10.0	pg/L
1,2,3,7,8 PeCDF						5.0	50.0	pg/L
2,3,4,7,8 PeCDF						5.0	50.0	pg/L
1,2,3,4,7,8 HxCDF						5.0	50.0	pg/L
1,2,3,6,7,8 HxCDF						5.0	50.0	pg/L
2,3,4,6,7,8 HxCDF						5.0	50.0	pg/L
1,2,3,7,8,9 HxCDF						5.0	50.0	pg/L
1,2,3,4,6,7,8 HpCDF						5.0	50.0	pg/L
1,2,3,4,7,8,9 HpCDF						5.0	50.0	pg/L
OCDF						5.0	50.0	pg/L
TEQ[1,2]			0.091	0.42	450	10	100	pg/L

Notes:

Risk-Based Decision Making for the Remediation of Contaminated Sites, DEQ, 2003; updated August 2023.

TEQ = Toxicity Equivalence Quotient, Based on toxicity equivalence factors (TEFs) presented by World Health Organization (2005)

DEQ = Oregon Department of Environmental Quality

EPA = U.S. Environmental Protection Agency

pg/L = picograms per liter

-- = Not analyzed or not applicable

Analyses by U.S. Environmental Protection Agency Method 1613B

[1]TEQ calculated by summing TEF adjusted concentrations (calculated by multiplying the detected concentration [or 1/2 the DL for non-detects] by the TEF).

[2]TEQ calculated by summing TEF adjusted concentrations (calculated by multiplying the detected concentration [or 0 for non-detects] by the TEF).

MDL = method detection limit

QL = quantification limit

MRL = method reporting limit

MDLs, MRLs, and QLs were provided by the laboratory. These are presented for informational purposes only. Data review/validation will be based most current precision and accuracy limits in effect at the time of analysis.

GeoEngineers